DA51 Lab Session 1: Creating a Blockchain

Description:

This lab session guides us through creating a basic blockchain using MultiChain, a platform for private blockchains. We will learn how to install MultiChain, create a blockchain, and obtain information about it using the command line. We will also test blockchain operability by creating a transaction and checking balances across nodes.

Question 6:

```
PS C:\Users\jules> multichain-util create myChain

MultiChain 2.3.3 Utilities (latest protocol 20013)

Blockchain parameter set was successfully generated.
You can edit it in C:\Users\jules\AppData\Roaming\MultiChain\myChain\params.dat before running multichaind for the first time.

To generate blockchain please run "multichaind myChain -daemon".
```

Question 9:

The ‘multichaind myChain -daemon’ command start and mine the first block called the **genesis block**. This node is accessible through the address: myChain@172.23.144.1:9259. This link is made with the name of the chain, the local Ip address of my computer and the port that the node is listening on. In this case, this Ip come from the ethernet adapter for WSL. So, the previous command tells me that I can connect the node with this link also myChain@172.23.36.20:9259

```
PS C:\Users\jules> multichaind myChain -daemon

MultiChain 2.3.3 Daemon (Community Edition, latest protocol 20013)

Looking for genesis block...
Genesis block found

Other nodes can connect to this node using:
multichaind myChain@172.23.144.1:5779

This host has multiple IP addresses, so from some networks:
multichaind myChain@172.23.36.20:5779

Listening for API requests on port 5778 (local only - see rpcallowip setting)

Node ready.
```

Question 13:

When I try to connect to the blockchain for the first time, the blockchain reject it because in the configuration file ‘anyone-can-connect’ is set to ‘false’.

Command:

```
jules@TABLET-TQGU8LI5:~$ multichaind myChain@172.23.144.1:6837

MultiChain 2.3.3 Daemon (Community Edition, latest protocol 20013)

Retrieving blockchain parameters from the seed node 172.23.144.1:6837 ...
Blockchain successfully initialized.

Please ask blockchain admin or user having activate permission to let you connect and/or transact:
multichain-cli myChain grant 1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs connect
multichain-cli myChain grant 1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs connect,send,receive
```

Question 15:

As feedback, I get the json inserted in configuration file and a unique ID which represent this action.

```
PS C:\Users\jules> multichain-cli myChain grant 1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs connect,send,receive
{"method":"grant","params":["1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs","connect,send,receive"],"id":"72508621-1726057947","chain_name":"myChain"}

ecdbf4247ac28722b895119f7911fe673f39128a5b4a8422e8ded35815a9d220
```

Question 17:

At this point of the lab, I create the first node using –deamon parameter and I connect two other nodes using WSL and -datadir option.

Question 18 – 30:

Command feedback:

- multichain-cli myChain getinfo

  Get the general information of the blockchain like node version, the port, etc. and the software used to run the chain like the version and the edition

```
PS C:\Users\jules> multichain-cli myChain getinfo
{"method":"getinfo","params":[],"id":"71604968-1726064516","chain_name":"myChain"}

{
    "version" : "2.3.3",
    "nodeversion" : 20303901,
    "edition" : "Community",
    "protocolversion" : 20013,
    "chainname" : "myChain",
    "description" : "MultiChain myChain",
    "protocol" : "multichain",
    "port" : 5779,
    "setupblocks" : 60,
    "nodeaddress" : "myChain@172.23.144.1:5779",
    "burnaddress" : "1XXXXXXWkXXXXXXXMJXXXXXXbqXXXXXXY23Ai8",
    "incomingpaused" : false,
    "miningpaused" : false,
    "offchainpaused" : false,
    "walletversion" : 60000,
    "balance" : 0,
    "walletdbversion" : 3,
    "reindex" : false,
    "blocks" : 24,
    "chainrewards" : 0,
    "streams" : 1,
    "timeoffset" : 0,
    "connections" : 3,
    "proxy" : "",
    "difficulty" : 5.960464477753906e-8,
    "testnet" : false,
    "keypoololdest" : 1726064440,
    "keypoolsize" : 2,
    "paytxfee" : 0,
    "relayfee" : 0,
    "errors" : ""
}
```

- multichain-cli myChain help

  Get a list of all command available on a chain

```
PS C:\Users\jules> multichain-cli myChain help
{"method":"help","params":[],"id":"46214789-1726064517","chain_name":"myChain"}

== Blockchain ==
addlibraryupdate "library-identifier" "update-name" "javascript-code"
addlibraryupdatefrom "from-address" "library-identifier" "update-name" "javascript-code"
getassetinfo "asset-identifier" ( verbose )
getbestblockhash
getblock "hash"|height ( verbose )
getblockchaininfo
getblockcount
getblockhash index
getchaintips
getdifficulty
getfiltercode "filter-identifier"
getlastblockinfo ( skip )
getlibrarycode "library-identifier" ( "update-name" )
getmempoolinfo
getrawmempool ( verbose )
getstreaminfo "stream-identifier" ( verbose )
gettokeninfo "asset-identifier" "token-identifier" ( verbose )
gettxout "txid" n ( includemempool )
gettxoutsetinfo
getvariablehistory "variable-identifier" ( verbose count start )
getvariableinfo "variable-identifier" ( verbose )
getvariablevalue "variable-identifier"
listassetissues "asset-identifier" ( verbose count start )
listassets ( asset-identifier(s) verbose count start )
listblocks block-set-identifier ( verbose )
listlibraries ( library-identifier(s) verbose )
listminers ( verbose )
listpermissions ( "permission(s)" address(es) verbose )
liststreamfilters ( filter-identifier(s) verbose )
liststreams ( stream-identifier(s) verbose count start )
listtxfilters ( filter-identifier(s) verbose )
listupgrades (upgrade-identifier(s))
listvariables ( variable-identifier(s) verbose count start )
runstreamfilter "filter-identifier" ( "tx-hex"|"txid" vout )
runtxfilter "filter-identifier" ( "tx-hex"|"txid" )
setvariablevalue "variable-identifier" ( value )
setvariablevaluefrom "from-address" "variable-identifier" ( value )
testlibrary ( "library-identifier"  "update-name" "javascript-code")
teststreamfilter restrictions "javascript-code" ( "tx-hex"|"txid" vout )
testtxfilter restrictions "javascript-code" ( "tx-hex"|"txid" )
verifychain ( checklevel numblocks )
verifypermission "address" "permission"
```

- multichain-cli myChain getblockchainparams

Get the content of the configuration file param.dat

```
PS C:\Users\jules> multichain-cli myChain getblockchainparams
{"method":"getblockchainparams","params":[],"id":"20827356-1726064518","chain_name":"myChain"}

{
    "chain-protocol" : "multichain",
    "chain-description" : "MultiChain myChain",
    "root-stream-name" : "root",
    "root-stream-open" : true,
    "chain-is-testnet" : false,
    "target-block-time" : 15,
    "maximum-block-size" : 8388608,
    "maximum-chunk-size" : 1048576,
    "maximum-chunk-count" : 1024,
    "default-network-port" : 5779,
    "default-rpc-port" : 5778,
    "anyone-can-connect" : false,
    "anyone-can-send" : false,
    "anyone-can-receive" : false,
    "anyone-can-receive-empty" : true,
    "anyone-can-create" : false,
    "anyone-can-issue" : false,
    "anyone-can-mine" : false,
    "anyone-can-activate" : false,
    "anyone-can-admin" : false,
    "support-miner-precheck" : true,
    "allow-arbitrary-outputs" : false,
    "allow-p2sh-outputs" : true,
    "allow-multisig-outputs" : true,
    "setup-first-blocks" : 60,
    "mining-diversity" : 0.3,
    "admin-consensus-upgrade" : 0.5,
    "admin-consensus-txfilter" : 0.5,
    "admin-consensus-admin" : 0.5,
    "admin-consensus-activate" : 0.5,
    "admin-consensus-mine" : 0.5,
    "admin-consensus-create" : 0,
    "admin-consensus-issue" : 0,
    "lock-admin-mine-rounds" : 10,
    "mining-requires-peers" : true,
    "mine-empty-rounds" : 10,
    "mining-turnover" : 0.5,
    "first-block-reward" : -1,
    "initial-block-reward" : 0,
    "reward-halving-interval" : 52560000,
    "reward-spendable-delay" : 1,
    "minimum-per-output" : 0,
    "maximum-per-output" : 100000000000000,
    "minimum-offchain-fee" : 0,
    "minimum-relay-fee" : 0,
    "native-currency-multiple" : 100000000,
    "skip-pow-check" : false,
```

- multichain-cli myChain listpermissions

Get all the permissions granted with the address

```
PS C:\Users\jules> multichain-cli myChain listpermissions
{"method":"listpermissions","params":[],"id":"85442670-1726064519","chain_name":"myChain"}

[
    {
        "address" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "for" : null,
        "type" : "mine",
        "startblock" : 0,
        "endblock" : 4294967295
    },
    {
        "address" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "for" : null,
        "type" : "admin",
        "startblock" : 0,
        "endblock" : 4294967295
    },
    {
        "address" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "for" : null,
        "type" : "activate",
        "startblock" : 0,
        "endblock" : 4294967295
    },
    {
        "address" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "for" : null,
        "type" : "connect",
        "startblock" : 0,
        "endblock" : 4294967295
    },
    {
        "address" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "for" : null,
        "type" : "send",
        "startblock" : 0,
        "endblock" : 4294967295
    },
    {
        "address" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "for" : null,
        "type" : "receive",
        "startblock" : 0,
        "endblock" : 4294967295
    },
    {
        "address" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "for" : null,
        "type" : "issue",
```

- multichain-cli myChain getaddresses

Get the addresses of the node, in this case the first folder created/the first node (genesis)

```
PS C:\Users\jules> multichain-cli myChain getaddresses
{"method":"getaddresses","params":[],"id":"85442670-1726064519","chain_name":"myChain"}

[
    "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
    "1EX2UKX7nwgmaAXAWkjaYiSEtV7FDKP8MZ2J3M"
]
```

- multichaind -datadir=~/.multichainother -port=7730 -rpcport=7729 myChain –daemon

Connect to the first node from the second node

```
PS C:\Users\jules> multichaind -datadir="C:\dev\multi" -port=7730 -rpcport=7729 myChain -daemon

MultiChain 2.3.3 Daemon (Community Edition, latest protocol 20013)

Other nodes can connect to this node using:
multichaind myChain@172.23.144.1:7730

This host has multiple IP addresses, so from some networks:
multichaind myChain@172.23.36.20:7730

Listening for API requests on port 7729 (local only - see rpcallowip setting)

Node ready.
```

- multichain-cli -datadir=~/.multichainother -port=7730 -rpcport=7729 myChain getinfo

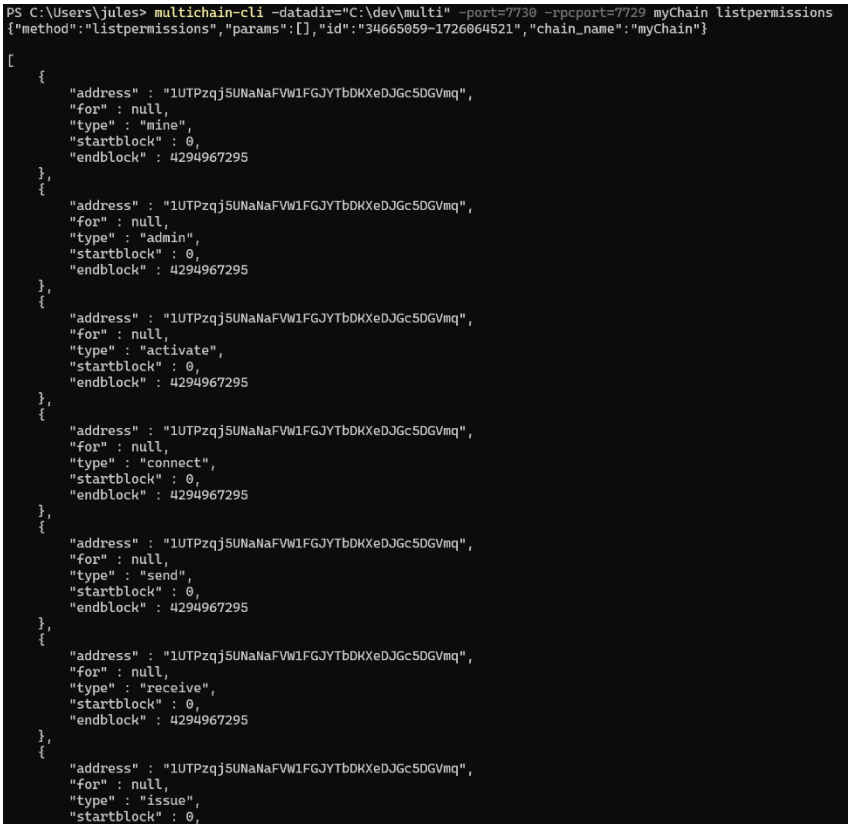
Get the general information of the blockchain like node version, the port, etc. and the software used to run the chain like the version and the edition. This gives the same information regardless of the node

```
PS C:\Users\jules> multichain-cli -datadir="C:\dev\multi" -port=7730 -rpcport=7729 myChain getinfo
{"method":"getinfo","params":[],"id":"60052491-1726064520","chain_name":"myChain"}

{
    "version" : "2.3.3",
    "nodeversion" : 20303901,
    "edition" : "Community",
    "protocolversion" : 20013,
    "chainname" : "myChain",
    "description" : "MultiChain myChain",
    "protocol" : "multichain",
    "port" : 7730,
    "setupblocks" : 60,
    "nodeaddress" : "myChain@172.23.144.1:7730",
    "burnaddress" : "1XXXXXXWkXXXXXXXMJXXXXXXbqXXXXXXY23Ai8",
    "incomingpaused" : false,
    "miningpaused" : false,
    "offchainpaused" : false,
    "walletversion" : 60000,
    "balance" : 0,
    "walletdbversion" : 3,
    "reindex" : false,
    "blocks" : 24,
    "chainrewards" : 0,
    "streams" : 1,
    "timeoffset" : 0,
    "connections" : 2,
    "proxy" : "",
    "difficulty" : 5.96046447753906e-8,
    "testnet" : false,
    "keypoololdest" : 1726064404,
    "keypoolsize" : 2,
    "paytxfee" : 0,
    "relayfee" : 0,
    "errors" : ""
}
```

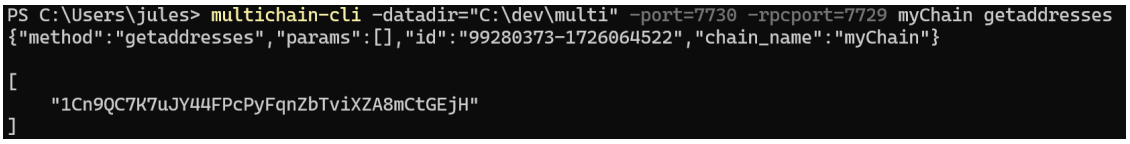
- multichain-cli -datadir=~/.multichainother -port=7730 -rpcport=7729 myChain listpermissions

Get all the permissions granted with the address



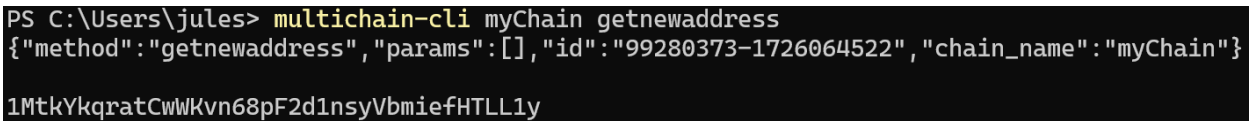
- multichain-cli -datadir=~/.multichainother -port=7730 -rpcport=7729 myChain getaddresses

Get the addresses of the node, in this case the second node.



- multichain-cli myChain getnewaddress

Create a new address for the first node



- multichain-cli myChain getaddresses

Get the addresses of the node

- multichain-cli myChain getpeerinfo

Get the information of the peer that are connected to the current node like the address and the Ip

```
PS C:\Users\jules> multichain-cli myChain getpeerinfo
{"method":"getpeerinfo","params":[],"id":"48502761-1726064524","chain_name":"myChain"}

[
    {
        "id" : 5,
        "addr" : "172.23.36.20:7730",
        "addrlocal" : "172.23.36.20:52826",
        "services" : "0000000000000001",
        "lastsend" : 1726064521,
        "lastrecv" : 1726064521,
        "bytessent" : 7413,
        "bytesrecv" : 6596,
        "conntime" : 1726064416,
        "pingtime" : 0.078624,
        "version" : 70002,
        "subver" : "/MultiChain:0.2.0.13/",
        "handshakelocal" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "handshake" : "1Cn9QC7K7uJY44FPcPyFqnZbTviXZA8mCtGEjH",
        "inbound" : false,
        "encrypted" : false,
        "startingheight" : 0,
        "banscore" : 0,
        "synced_headers" : 16,
        "synced_blocks" : -1,
        "inflight" : [
        ],
        "whitelisted" : false
    },
    {
        "id" : 6,
        "addr" : "172.23.144.1:52828",
        "addrlocal" : "172.23.144.1:5779",
        "services" : "0000000000000001",
        "lastsend" : 1726064521,
        "lastrecv" : 1726064518,
        "bytessent" : 2441,
        "bytesrecv" : 2131,
        "conntime" : 1726064417,
        "pingtime" : 0.076615,
        "version" : 70002,
        "subver" : "/MultiChain:0.2.0.13/",
        "handshakelocal" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "handshake" : "1Cn9QC7K7uJY44FPcPyFqnZbTviXZA8mCtGEjH",
        "inbound" : true,
        "encrypted" : false,
        "startingheight" : 18,
        "banscore" : 0,
        "synced_headers" : 18,
        "synced_blocks" : 18,
        "inflight" : [
```

- multichain-cli -datadir=~/.multichainother -port=7730 -rpcport=7729 myChain getpeerinfo

Get the information of the peer that are connected to the current node like the address and the Ip

```
PS C:\Users\jules> multichain-cli -datadir="C:\dev\multi" -port=7730 -rpcport=7729 myChain getpeerinfo
{"method":"getpeerinfo","params":[],"id":"48502761-1726064524","chain_name":"myChain"}

[
    {
        "id" : 3,
        "addr" : "172.23.36.20:52826",
        "addrlocal" : "172.23.36.20:7730",
        "services" : "0000000000000001",
        "lastsend" : 1726064521,
        "lastrecv" : 1726064521,
        "bytessent" : 6596,
        "bytesrecv" : 7413,
        "conntime" : 1726064416,
        "pingtime" : 0.030448,
        "version" : 70002,
        "subver" : "/MultiChain:0.2.0.13/",
        "handshakelocal" : "1Cn9QC7K7uJY44FPcPyFqnZbTviXZA8mCtGEjH",
        "handshake" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "inbound" : true,
        "encrypted" : false,
        "startingheight" : 18,
        "banscore" : 0,
        "synced_headers" : 25,
        "synced_blocks" : 25,
        "inflight" : [
        ],
        "whitelisted" : false
    },
    {
        "id" : 4,
        "addr" : "172.23.144.1:5779",
        "addrlocal" : "172.23.144.1:52828",
        "services" : "0000000000000001",
        "lastsend" : 1726064518,
        "lastrecv" : 1726064521,
        "bytessent" : 2131,
        "bytesrecv" : 2441,
        "conntime" : 1726064417,
        "pingtime" : 0.030761,
        "version" : 70002,
        "subver" : "/MultiChain:0.2.0.13/",
        "handshakelocal" : "1Cn9QC7K7uJY44FPcPyFqnZbTviXZA8mCtGEjH",
        "handshake" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "inbound" : false,
        "encrypted" : false,
        "startingheight" : 18,
        "banscore" : 0,
        "synced_headers" : 25,
        "synced_blocks" : 25,
        "inflight" : [
        ],
        "whitelisted" : false
```

Question 33:

The command ‘multichain-cli myChain listpermissions issue’ get a list of all node that can issue new asset on the blockchain. In this case, only the first address can issue new asset.

```
PS C:\Users\jules> multichain-cli myChain listpermissions issue
{"method":"listpermissions","params":["issue"],"id":"90117496-1726065281","chain_name":"myChain"}

[
    {
        "address" : "1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq",
        "for" : null,
        "type" : "issue",
        "startblock" : 0,
        "endblock" : 4294967295
    }
]
```

Question 35:

multichain-cli myChain issue 1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq myCryptoMoney 500 0.01

This command will create 500 units of a new asset called “MyCryptoMoney” on the blockchain and send them to the address specified. The smallest possible unit that can be transferred is 0.01 of these assets.

```
PS C:\Users\jules> multichain-cli myChain issue 1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq myCryptoMoney 500 0.01
{"method":"issue","params":["1UTPzqj5UNaNaFVW1FGJYTbDKXeDJGc5DGVmq","myCryptoMoney",500,0.01],"id":"48376415-1726065350","chain_name":"myChain"}

5e5d0e51d4757ffdd2889062487e3be1bcc45afc1d1586def968b18705557fd3
```

Question 38:

The first command gives the same result because the command gives the list of assets that is in the blockchain. But the second command give a different result because it gives the balances of each asset in the current node.

Question 39:

multichain-cli myChain sendasset 1QRPoZWj7uNhQwEvmV6ggcAPnjV5dSDtuMbizA myCryptoMoney 50

Question 40:

multichain-cli myChain gettotalbalances

Question 41:

WSL: multichain-cli myChain gettotalbalances

Windows second node: multichain-cli -datadir=~/.multichainother -port=7730 -rpcport=7729 myChain gettotalbalances

Question 42:

First step: give enough units to system 2 and 3:

On System 1:

First command:

multichain-cli myChain sendasset 1QRPoZWj7uNhQwEvmV6ggcAPnjV5dSDtuMbizA myCryptoMoney 130

Result:

```
PS C:\Users\jules> multichain-cli myChain sendasset 1QRPoZWj7uNhQwEvmV6ggcAPnjV5dSDtuMbizA myCryptoMoney 130
{"method":"sendasset","params":["1QRPoZWj7uNhQwEvmV6ggcAPnjV5dSDtuMbizA","myCryptoMoney",130],"id":"53103427-1726062964","chain_name":"myChain"}

1c8cdcdddbb9b01027126a56e6eebddf1c676dea5e9ea032a3e7c13cdbe0c35c
```

Second command:

multichain-cli myChain sendasset 1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs myCryptoMoney 30

Result:

```
PS C:\Users\jules> multichain-cli myChain sendasset 1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs myCryptoMoney 30
{"method":"sendasset","params":["1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs","myCryptoMoney",30],"id":"34574419-1726062986","chain_name":"myChain"}

09e14a0c3c3ba523c8fc8d6b99fdb37c8cfaa5f6f9c503fc00bda7fd66711e5d
```

Second step: Send 30 units from system 3 to system 1:

On System 2:

Command:

multichain-cli myChain sendasset 1UmZXcJNn8zKBK9QYpvdzrBWLbsywqjEu8Zaix myCryptoMoney 30

Result:

```
jules@TABLET-TQGU8LI5:~$ multichain-cli myChain sendasset 1UmZXcJNn8zKBK9QYpvdzrBWLbsywqjEu8Zaix myCryptoMoney 30
{"method":"sendasset","params":["1UmZXcJNn8zKBK9QYpvdzrBWLbsywqjEu8Zaix","myCryptoMoney",30],"id":"37559618-1726062993","chain_name":"myChain"}

9a2182e3266de39c3a9191987ba216831ce4510425e7d7b0afadb6c82e215478
```

Third step: Send 130 units from system 2 to system 3:

Command:

multichain-cli -datadir="C:\dev\multi" -port=7730 -rpcport=7729 myChain@172.23.144.1:6837 sendasset 1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs myCryptoMoney 130

Result:

```
PS C:\Users\jules> multichain-cli -datadir="C:\dev\multi" -port=7730 -rpcport=7729 myChain@172.23.144.1:6837 sendasset 1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs myCryptoMoney 130
{"method":"sendasset","params":["1R7jfy6PVqmJXVe679L5Lyf4jdAimCG6Jy1Cxs","myCryptoMoney",130],"id":"82476271-1726063959","chain_name":"myChain"}

a4156284c80a993f5b9295bd59de14dca8f65ac525db183ae7dd9f3d2b490640
```

Conclusion:

To conclude, a blockchain was created using multichain-util and connected to using the address myChain@172.23.144.1:9259. The blockchain was configured to allow only the first address to issue new assets. Assets were transferred between nodes, demonstrating the functionality of the blockchain.