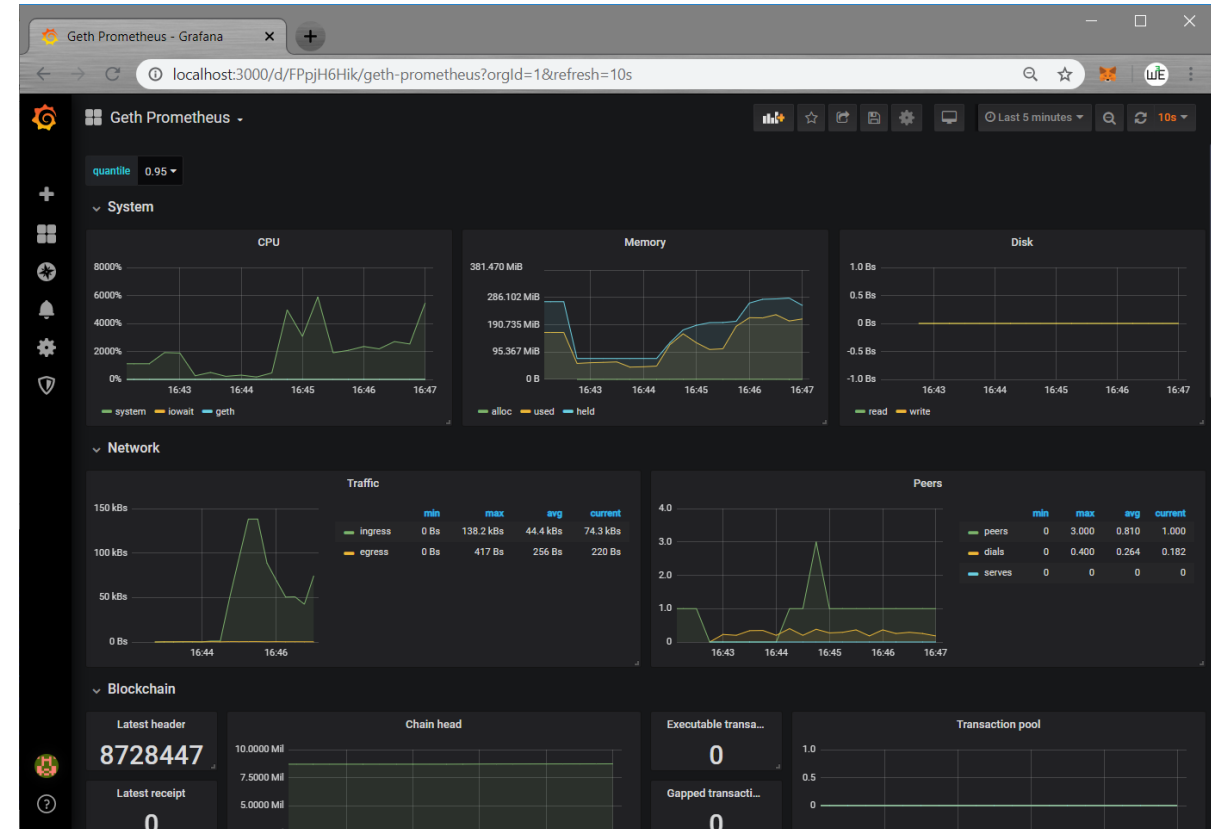
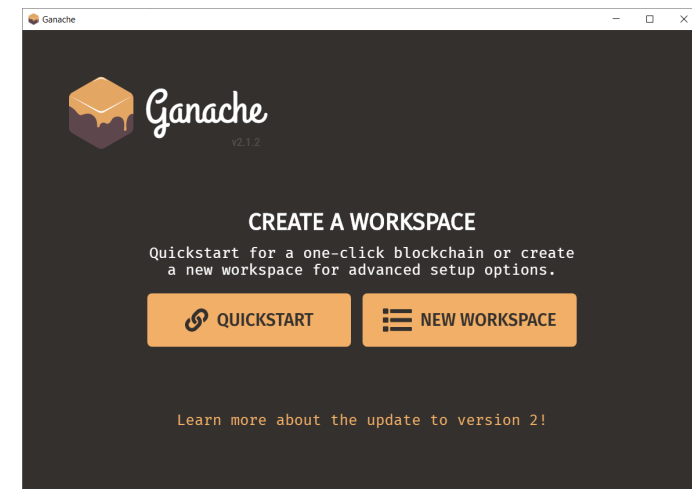


# PD-4.0 Nodes & RPC interface

- PD-4.1 Run a local Node (Ganache)
- PD-4.2 Access local nodes via Metamask
- PD-4.3 Geth (via Grid)
- PD-4.4 Management of nodes
- PD-4.5 RPC functions
- PD-4.6 Tools to access RPC interface
- PD-4.7 Web interface for RPC
- PD-4.8 Test networks
- PD-4.9 Infura account



# PD-4.1.1 Install Ganache



<https://www.trufflesuite.com/ganache>

<https://github.com/trufflesuite/ganache/releases>

<https://www.trufflesuite.com/docs/ganache/quickstart>

[http://web3examples.com/ethereum/install/Install\\_ganache\\_Windows\\_Use\\_HTTPS.html](http://web3examples.com/ethereum/install/Install_ganache_Windows_Use_HTTPS.html)

# PD-4.1.1 Ganache – fixed seed

Ganache

WORKSPACE SERVER **ACCOUNTS & KEYS** CHAIN ADVANCED ABOUT

CANCEL RESTART

⚠ Restarting the Quickstart workspace resets the blockchain. All transactions and contract states will be reset.

### ACCOUNTS & KEYS

ACCOUNT DEFAULT BALANCE

The starting balance for accounts, in Ether.

TOTAL ACCOUNTS TO GENERATE

Total number of Accounts to create and pre-fund.

AUTOGENERATE HD MNEMONIC

Turn on to automatically generate a new mnemonic and account addresses on each run.

Enter the Mnemonic you wish to use.

note: this mnemonic is not secure; don't use it on a public blockchain.

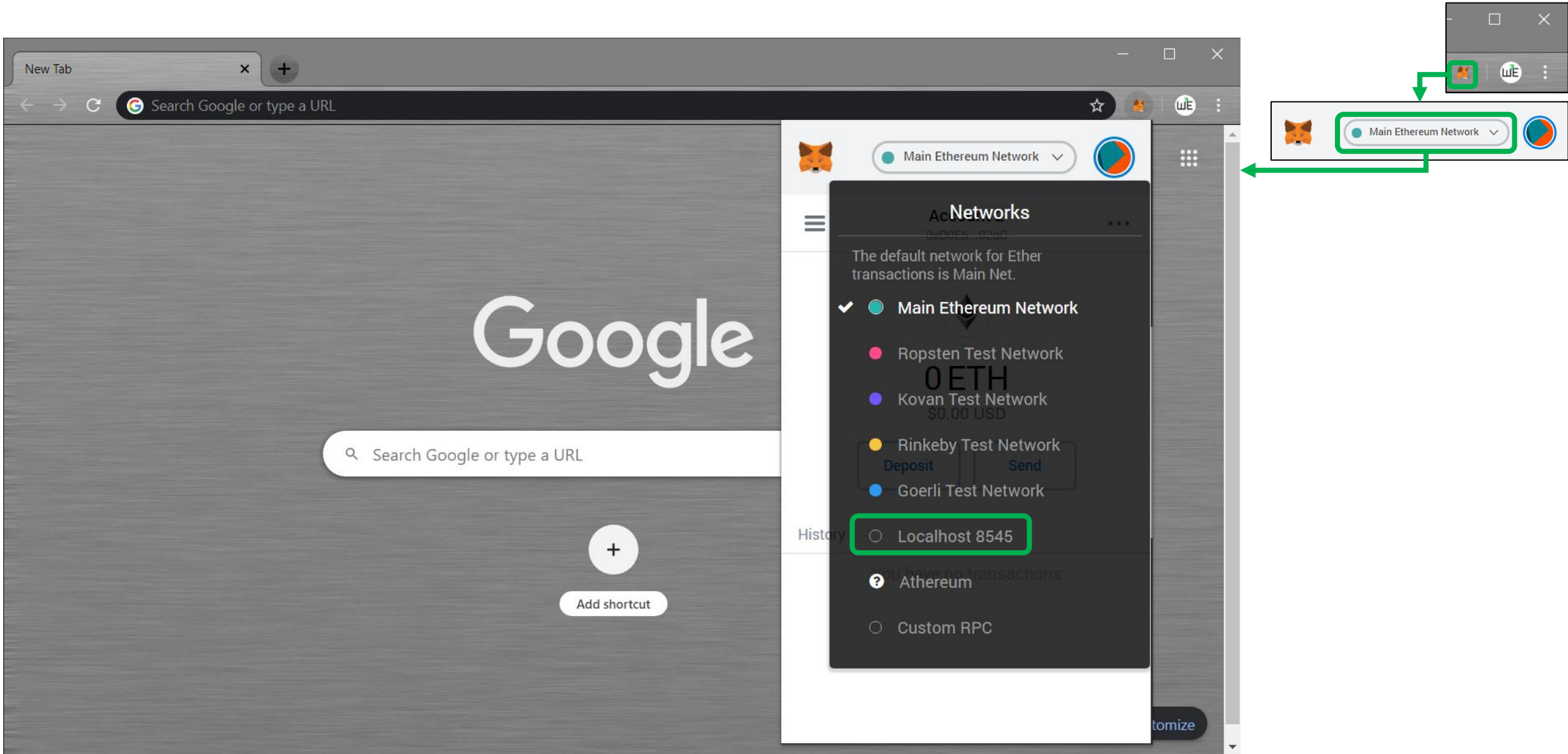
LOCK ACCOUNTS

If enabled, accounts will be locked on startup.

WORKSPACE SERVER **ACCOUNTS & KEYS** CHAIN ADVANCED ABOUT

spend vital trip member scheme buzz liquid normal supreme soft device cereal

# PD-4.1.2 Ganache and MetaMask



# PD-4.1.2 Ganache and MetaMask

**ACCOUNT INFORMATION**


**ACCOUNT ADDRESS**  
0x6B5bB8441DD079F8Da87FF48F74F3A4F08bf417B

**PRIVATE KEY**  
4f8801870ed9311f0f4a371c7b2d50c3fe45dfcbf0caf85dba3c48baed68be2f


Do not use this private key on a public blockchain; use it for development purposes only!

**DONE**

NUMBERS OR TX HASHES

**SAVE** **SWITCH** 

**PATH**  
4'/60'/0'/0'/account\_index

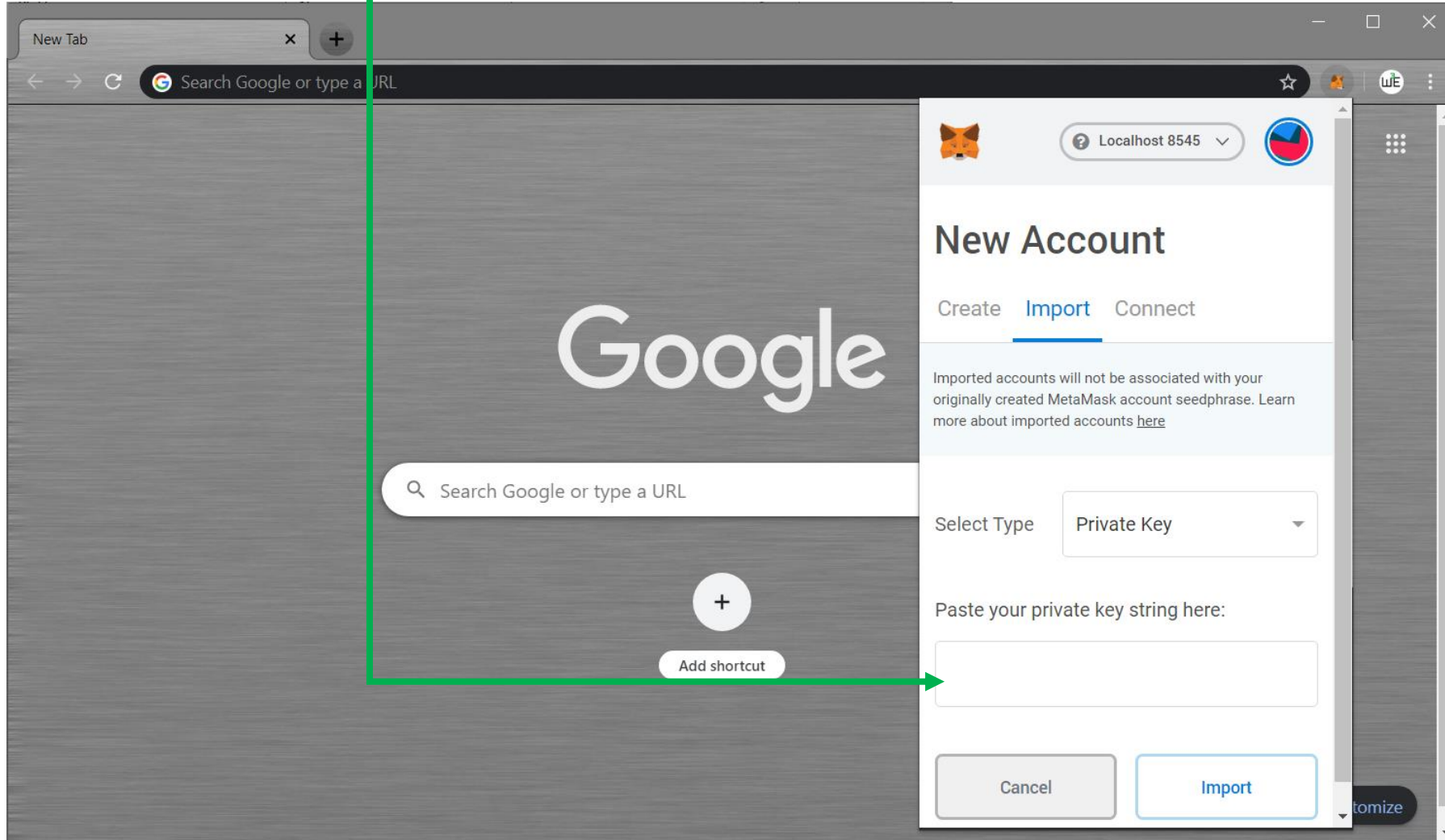
TX COUNT	INDEX	
0	0	



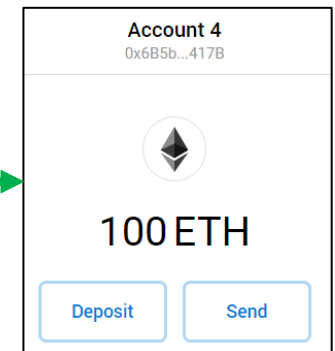
4f8801870ed9311f0f4a371c7b2d50c3fe45dfcbf0caf85dba3c48baed68be2f

# PD-4.1.2 Ganache and MetaMask

4f8801870ed9311f0f4a371c7b2d50c3fe45dfcbf0caf85dba3c48baed68be2f



Import Account

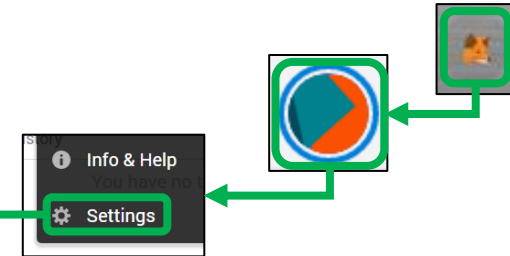
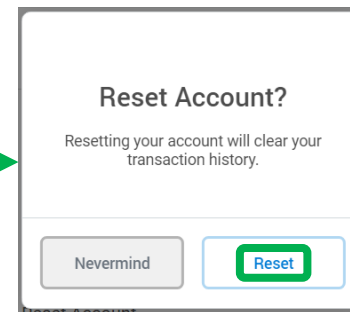
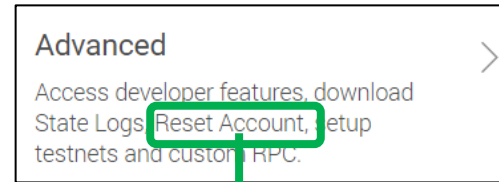
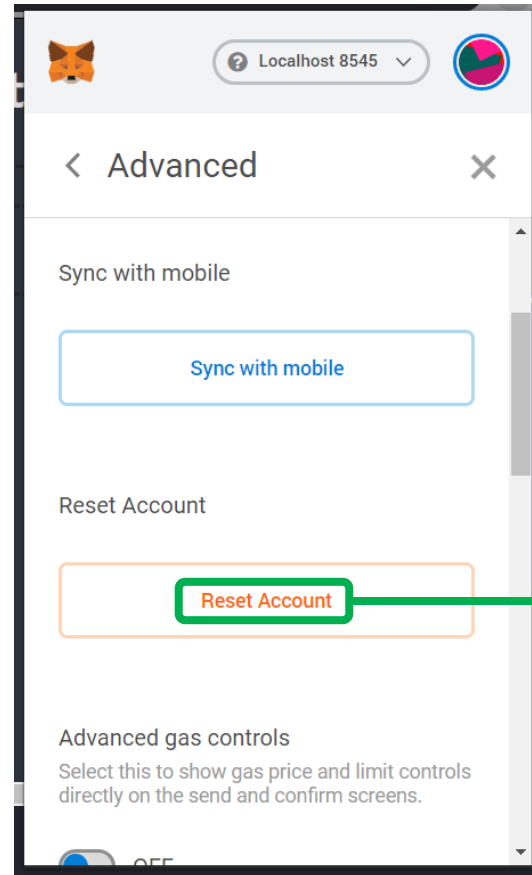
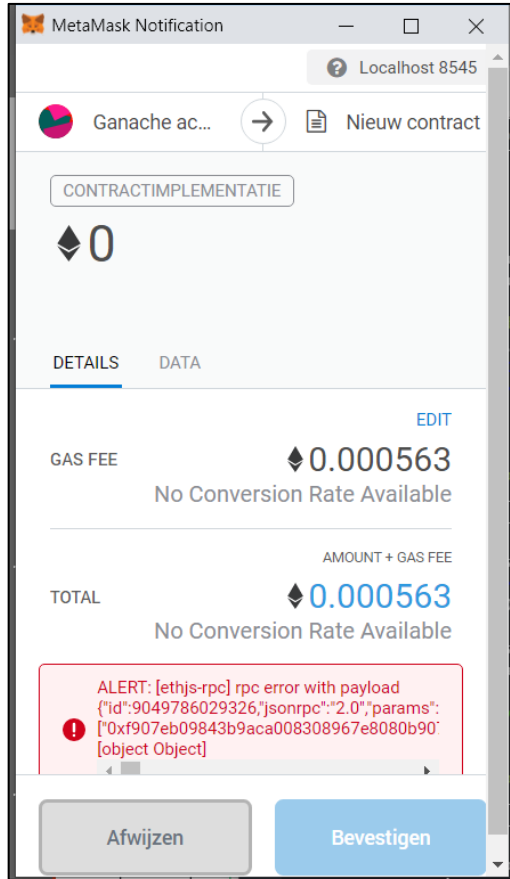


# PD-4.1.3 Ganache and Play Editor

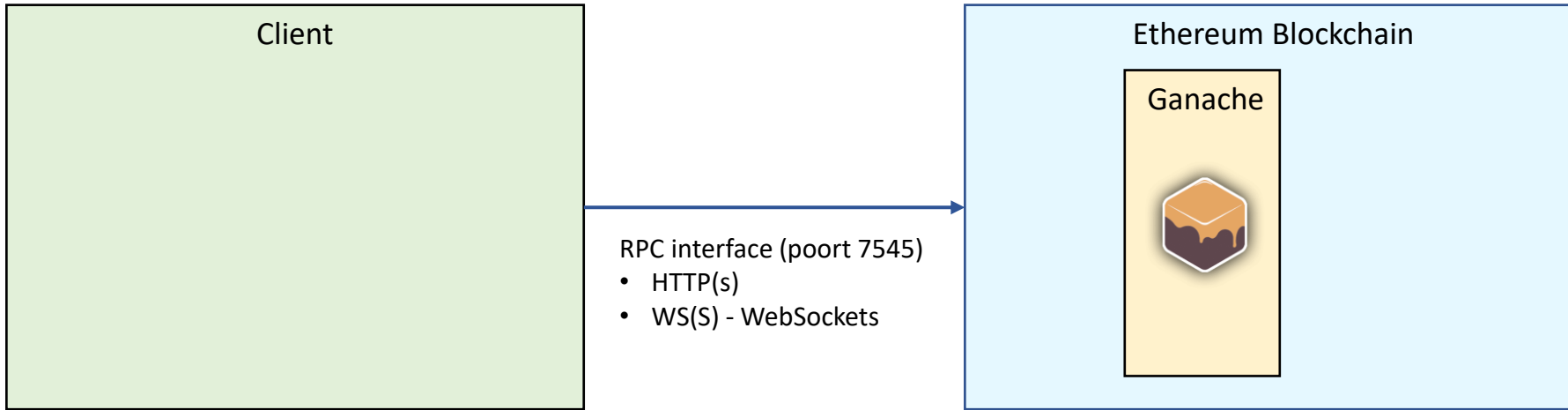
# PD-4.1.4 Ganache and Remix



# PD-4.1.5 Troubleshoot metamask and Ganache



# PD-4.2.1 RPC to Ganache



<https://github.com/ethereum/wiki/wiki/JSON-RPC>

<https://github.com/ethereum/wiki/wiki/JSON-RPC#json-rpc-support>

# PD-4.2.1 RPC to Ganache

Name	Function
web3_clientVersion	Current client version.

## Windows

```
set request=web3_clientVersion
set body={"jsonrpc":"2.0","method":"%request%","params":[],"id":67}
curl -H "Content-Type: application/json" -g --data "%body:"=""%" http://localhost:7545
```

## Linux

```
export request=web3_clientVersion
export body=' {"jsonrpc":"2.0","method":"$request","params":[],"id":67} '
curl -H "Content-Type: application/json" -g --data $body http://localhost:7545
```

## Result

```
{"id":67,"jsonrpc":"2.0","result":"EthereumJS TestRPC/v2.8.0/ethereum-js"}
```

<https://curl.haxx.se/download.html>

[https://github.com/ethereum/wiki/wiki/JSON-RPC#web3\\_clientversion](https://github.com/ethereum/wiki/wiki/JSON-RPC#web3_clientversion)

[https://github.com/web3examples/ethereum/blob/master/rpc/web3\\_clientVersion\\_port\\_7545.cmd](https://github.com/web3examples/ethereum/blob/master/rpc/web3_clientVersion_port_7545.cmd)

# PD-4.2.1 Ganache - RPC eth\_accounts

## Windows

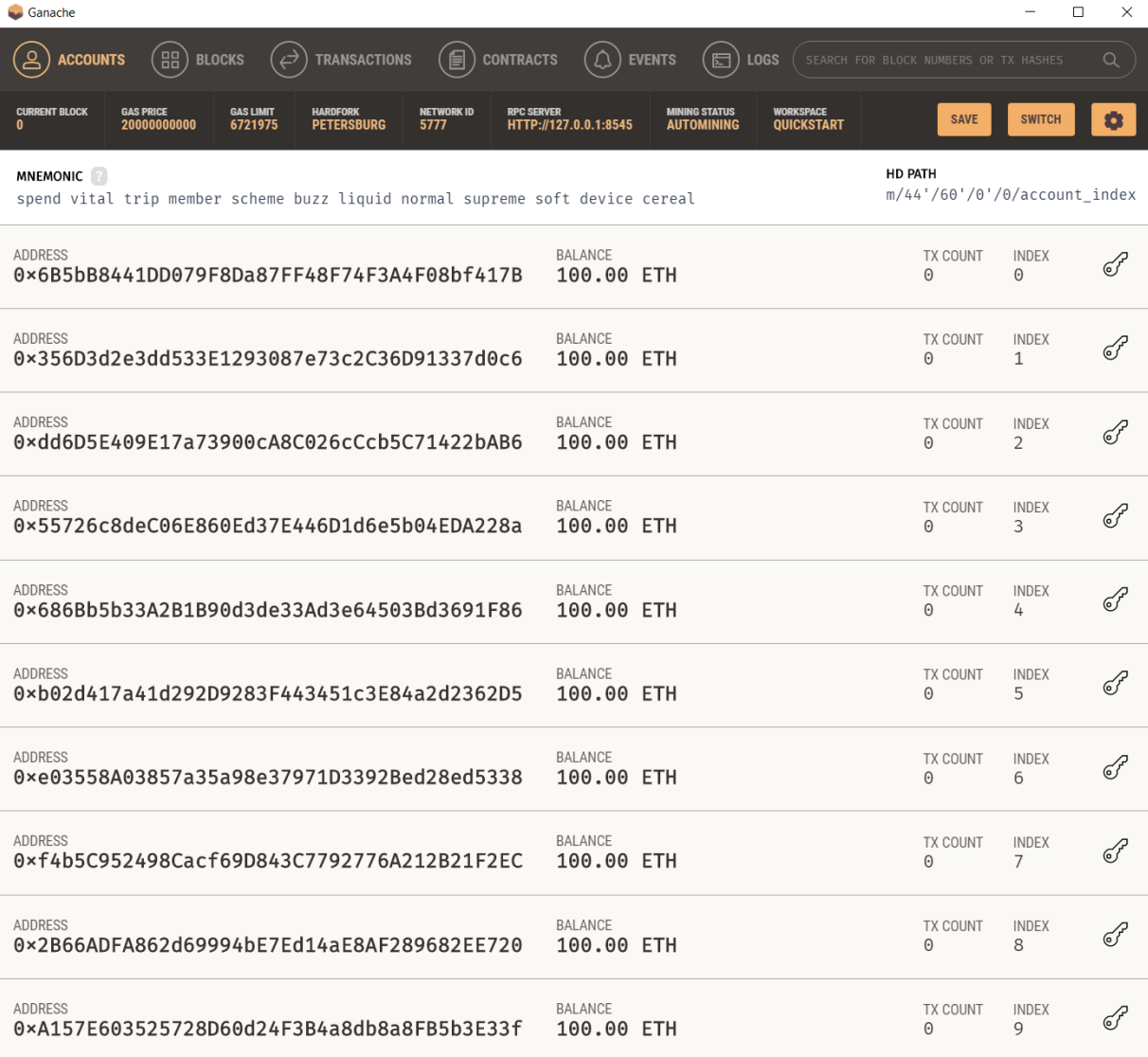
```
curl -d '{"method":"","eth_accounts":""}'  
http://localhost:7545
```

## Linux

```
curl -d '{"method":"eth_accounts"}' http://localhost:7545
```

## Result

```
{"result": [  
  "0x6b5bb8441dd079f8da87ff48f74f3a4f08bf417b",  
  "0x356d3d2e3dd533e1293087e73c2c36d91337d0c6",  
  "0xdd6d5e409e17a73900ca8c026cccb5c71422bab6",  
  "0x55726c8dec06e860ed37e446d1d6e5b04eda228a",  
  "0x686bb5b33a2b1b90d3de33ad3e64503bd3691f86",  
  "0xb02d417a41d292d9283f443451c3e84a2d2362d5",  
  "0xe03558a03857a35a98e37971d3392bed28ed5338",  
  "0xf4b5c952498cacf69d843c7792776a212b21f2ec",  
  "0x2b66adfa862d69994be7ed14ae8af289682ee720",  
  "0xa157e603525728d60d24f3b4a8db8a8fb5b3e33f"  
]}
```



ADDRESS	BALANCE	TX COUNT	INDEX
0x6B5bB8441DD079F8Da87FF48F74F3A4F08bf417B	100.00 ETH	0	0
0x356D3d2e3dd533E1293087e73c2C36D91337d0c6	100.00 ETH	0	1
0xdd6D5E409E17a73900ca8C026cCcb5C71422bab6	100.00 ETH	0	2
0x55726c8deC06E860Ed37E446D1d6e5b04EDA228a	100.00 ETH	0	3
0x686Bb5b33A2B1B90d3de33Ad3e64503Bd3691F86	100.00 ETH	0	4
0xb02d417a41d292D9283F443451c3E84a2d2362D5	100.00 ETH	0	5
0xe03558A03857a35a98e37971D3392Bed28ed5338	100.00 ETH	0	6
0xf4b5C952498Cacf69D843C7792776A212B21F2EC	100.00 ETH	0	7
0x2B66ADFA862d69994be7Ed14aE8AF289682EE720	100.00 ETH	0	8
0xA157E603525728D60d24F3B4a8db8a8FB5b3E33f	100.00 ETH	0	9

[https://github.com/web3examples/ethereum/blob/master/rpc/eth\\_accounts\\_ganache.cmd](https://github.com/web3examples/ethereum/blob/master/rpc/eth_accounts_ganache.cmd)

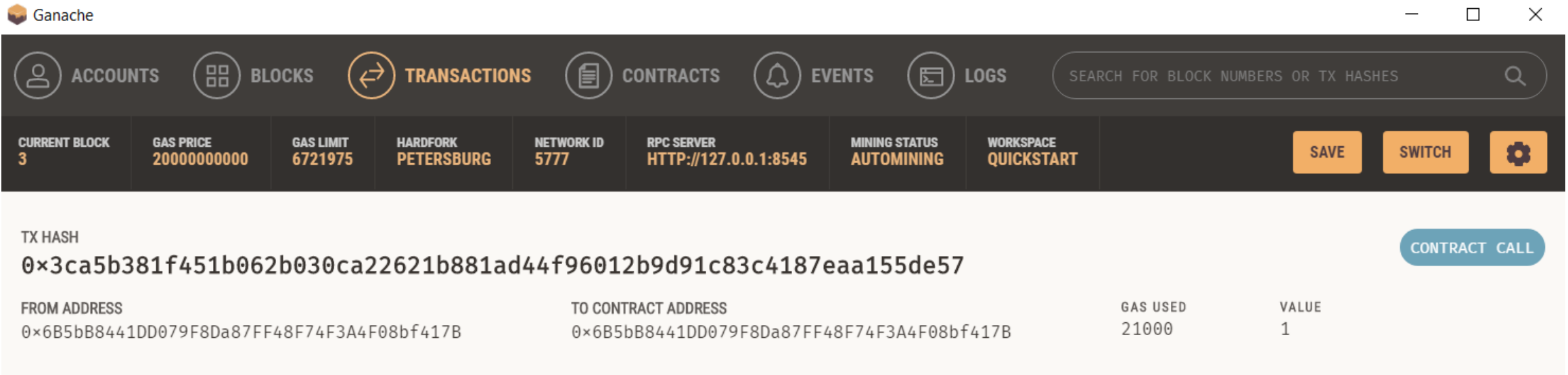
# PD-4.2.1 Ganache - eth\_sendTransaction

## Windows:

```
set address=0x6B5bB8441DD079F8Da87FF48F74F3A4F08bf417B
set params={ "from": "%address%", "to": "%address%", "value": "0x1" }
set body= {"jsonrpc":"2.0","method":"eth_sendTransaction","params":[%params%],"id":1}
curl -H "Content-Type: application/json" -g --data "%body:"="%" http://localhost:7545
```

## Result:

```
{"id":1,"jsonrpc":"2.0","result":"0x3ca5b381f451b062b030ca22621b881ad44f96012b9d91c83c4187eaa155de57"}
```



The screenshot shows the Ganache web interface. At the top, there are navigation tabs: ACCOUNTS, BLOCKS, TRANSACTIONS (highlighted), CONTRACTS, EVENTS, and LOGS. A search bar is on the right. Below the tabs is a status bar with various metrics: CURRENT BLOCK 3, GAS PRICE 20000000000, GAS LIMIT 6721975, HARDFORK PETERSBURG, NETWORK ID 5777, RPC SERVER HTTP://127.0.0.1:8545, MINING STATUS AUTOMINING, and WORKSPACE QUICKSTART. There are buttons for SAVE, SWITCH, and a settings gear. The main content area displays a transaction hash: 0x3ca5b381f451b062b030ca22621b881ad44f96012b9d91c83c4187eaa155de57, with a CONTRACT CALL button. Below the hash, transaction details are shown in a table:

FROM ADDRESS	TO CONTRACT ADDRESS	GAS USED	VALUE
0x6B5bB8441DD079F8Da87FF48F74F3A4F08bf417B	0x6B5bB8441DD079F8Da87FF48F74F3A4F08bf417B	21000	1

# PD-4.2.2 wscurl subscribe ganache

## Start:

```
wscurl ws://localhost:7545
```

## Paste: (without <enter>)

```
{"id": 1, "method": "web3_clientVersion"}
```

## Output:

```
{"id":1,"result":"EthereumJS TestRPC/v2.8.0/ethereum-js"}
```

<https://www.npmjs.com/package/wscurl>

<https://www.npmjs.com/package/wscat>

[http://web3examples.com/ethereum/demo/Use\\_ganache\\_cli\\_Windows\\_WS.html](http://web3examples.com/ethereum/demo/Use_ganache_cli_Windows_WS.html)

# PD-4.2.2 wscurl subscribe ganache

## Start:

```
wscurl ws://localhost:7545
```

## Paste: (without <enter>)

```
{"id": 1, "method": "eth_subscribe", "params": ["newHeads"]}
```

## Output:

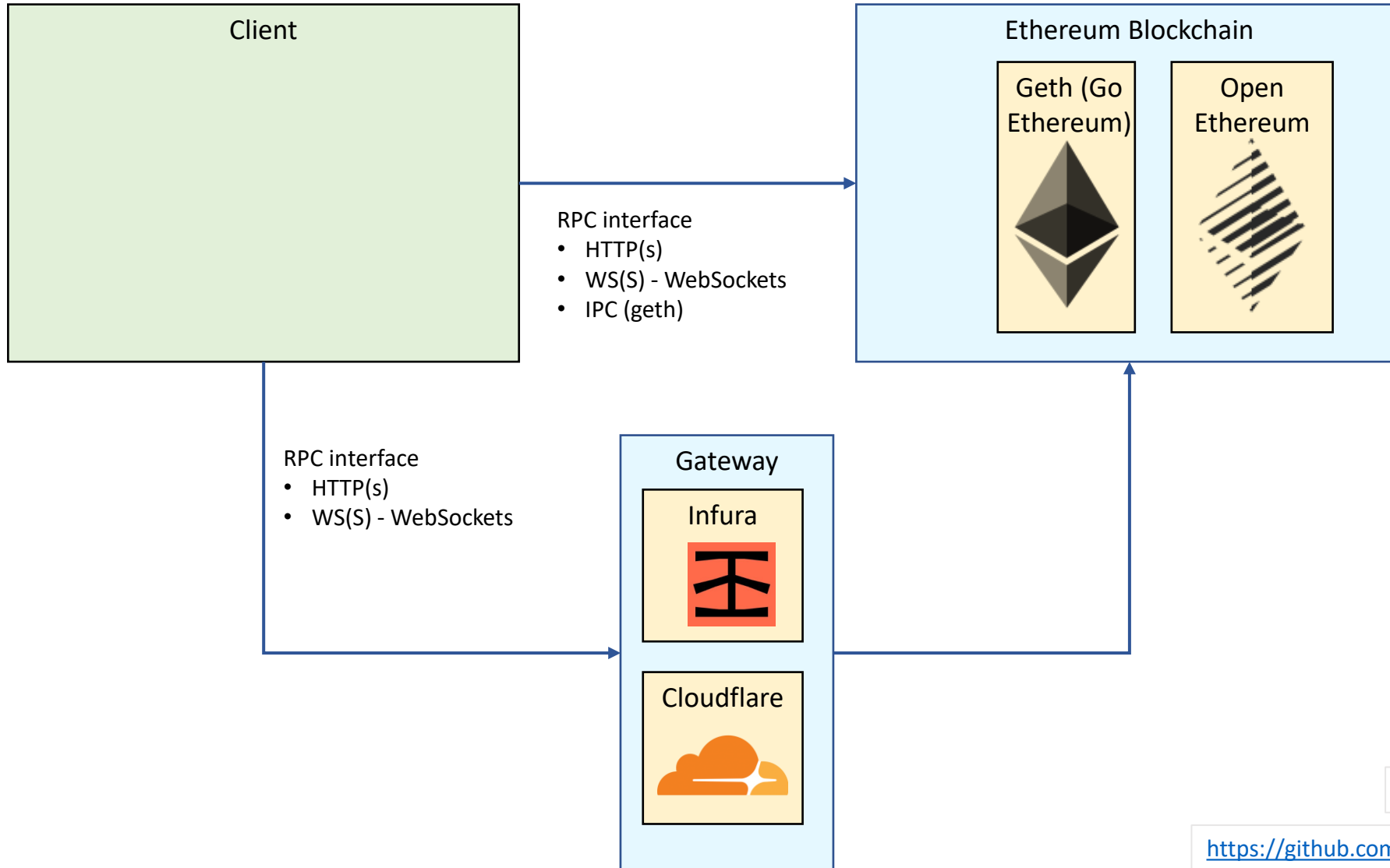
```
{"id":1,"result":"0x7"}
{"jsonrpc": "2.0",
 "method": "eth_subscription",
 "params":
 { "subscription": "0x7",
  "result":
  { "hash": "0x27d8a20ec365c8a91d3f8919731a87c472c1c570e9199a4c65857281964b6938",
    "parentHash": "0x399173ef5ac8fa65c8ca7466d5830bdfc4ef92a85d76cf1072a24fd9e608069e",
    "sha3Uncles": "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
    "miner": "0x0000000000000000000000000000000000000000",
    "stateRoot": "0xf20e4654c8b521ad84a67164b7a27c699292a8e73a19bd08abc6c35a52d192bc",
    "transactionsRoot": "0x7570cbff644607a1bd7b7bb559fed522a8931cc1366c00b2640cc85df2d36173",
    "receiptsRoot": "0x056b23fbba480696b65fe5a59b8f2148a1299103c4f57df839233af2cf4ca2d2",
    "logsBloom": "0x00000.....",
    "difficulty": "0x0",
    "number": "0xa",
    "gasLimit": "0x6691b7",
    "gasUsed": "0x5208",
    "nonce": "0x0000000000000000",
    "mixHash": "0x0000000000000000000000000000000000000000000000000000000000000000",
    "timestamp": "0x5fb3b463",
    "extraData": "0x"
  }
 }
}
```

<https://www.npmjs.com/package/wscurl>

<https://www.npmjs.com/package/wscat>

[http://web3examples.com/ethereum/demo/Use\\_ganache\\_cli\\_Windows\\_WS\\_Subscriptions.html](http://web3examples.com/ethereum/demo/Use_ganache_cli_Windows_WS_Subscriptions.html)

# PD-4.2.3 RPC Interface

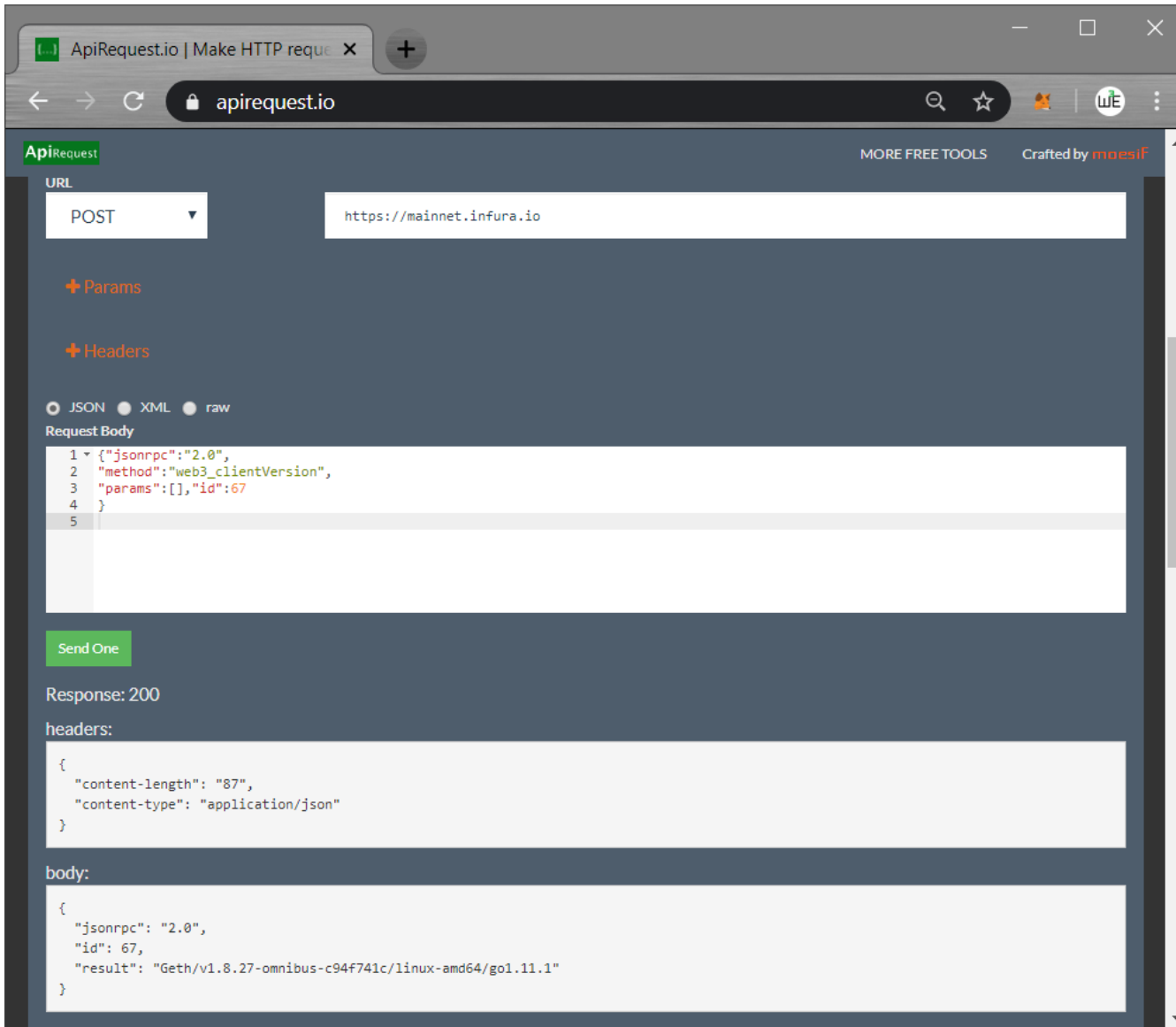


<https://github.com/ethereum/wiki/wiki/JSON-RPC>

<https://github.com/ethereum/wiki/wiki/JSON-RPC#json-rpc-support>



# PD-4.2.3 Call RPC Functions via web interface



The screenshot shows the ApiRequest.io interface with the following details:

- URL:** POST `https://mainnet.infura.io`
- Request Body (JSON):**

```
1 { "jsonrpc": "2.0",  
2   "method": "web3_clientVersion",  
3   "params": [], "id": 67  
4 }  
5
```
- Response:** 200
- headers:**

```
{  
  "content-length": "87",  
  "content-type": "application/json"  
}
```
- body:**

```
{  
  "jsonrpc": "2.0",  
  "id": 67,  
  "result": "Geth/v1.8.27-omnibus-c94f741c/linux-amd64/go1.11.1"  
}
```

`http://localhost:7545`

`eth_blockNumber`

## Input parameters:

POST

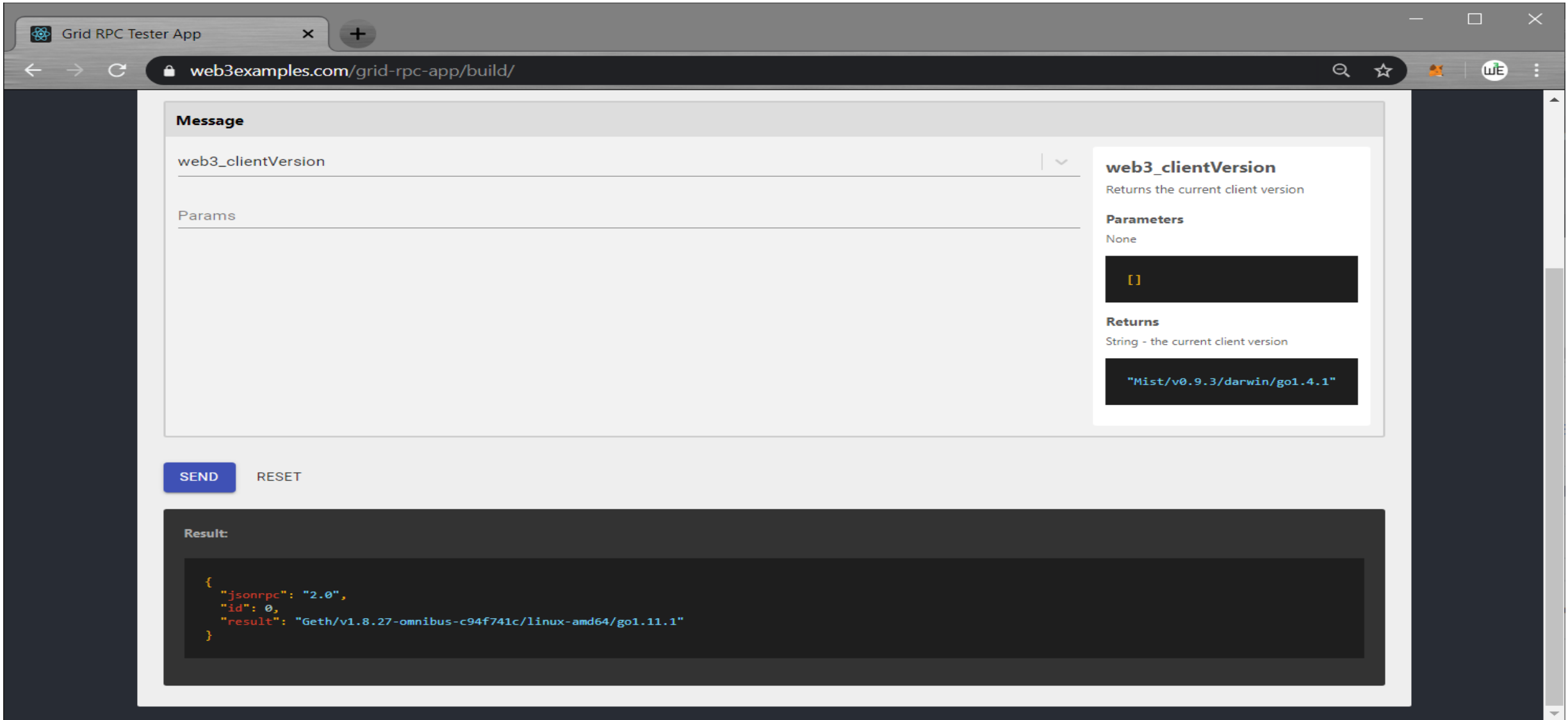
<https://cloudflare-eth.com>

```
{"jsonrpc": "2.0",  
 "method": "web3_clientVersion",  
 "params": [], "id": 67  
}
```

<https://www.apirequest.io/>

[http://web3examples.com/ethereum/demo/Check\\_contract\\_balance\\_via\\_RPC\\_online.html](http://web3examples.com/ethereum/demo/Check_contract_balance_via_RPC_online.html)

# PD-4.2.3 Grid RPC Tester - web3\_clientVersion



Grid RPC Tester App

web3examples.com/grid-rpc-app/build/

**Message**

web3\_clientVersion

Params

**SEND** **RESET**

**Result:**

```
{
  "jsonrpc": "2.0",
  "id": 0,
  "result": "Geth/v1.8.27-omnibus-c94f741c/linux-amd64/go1.11.1"
}
```

**web3\_clientVersion**  
Returns the current client version

**Parameters**  
None

**Returns**  
String - the current client version

"Mist/v0.9.3/darwin/go1.4.1"

# PD-4.2.3 Grid RPC Tester - eth\_getBalance

The screenshot displays the Grid RPC Tester App interface. The browser address bar shows the URL `web3examples.com/grid-rpc-app/build/`. The main content area is titled "Message" and contains the following information:

**Message**

eth\_getBalance

Params

```
["0xEA9a7c7cD8d4Dc3acc6f0AaEc1506C8D6041a1c5","latest"]
```

**eth\_getBalance**

Returns the balance of the account of a given address

**Parameters**

DATA, 20 Bytes - address to check for balance  
QUANTITY|TAG - integer block number, or the string "latest", "earliest", or "pending"

```
[  
  "0xc9477007dda54cF92009BFF0dE90c06F603a09f",  
  "latest"  
]
```

**Returns**

QUANTITY - integer of the current balance in wei

```
"0x0234c8a3397aab58"
```

SEND RESET

**Result:**

```
{  
  "jsonrpc": "2.0",  
  "id": 0,  
  "result": "0x35dbb74014cc1"  
}
```

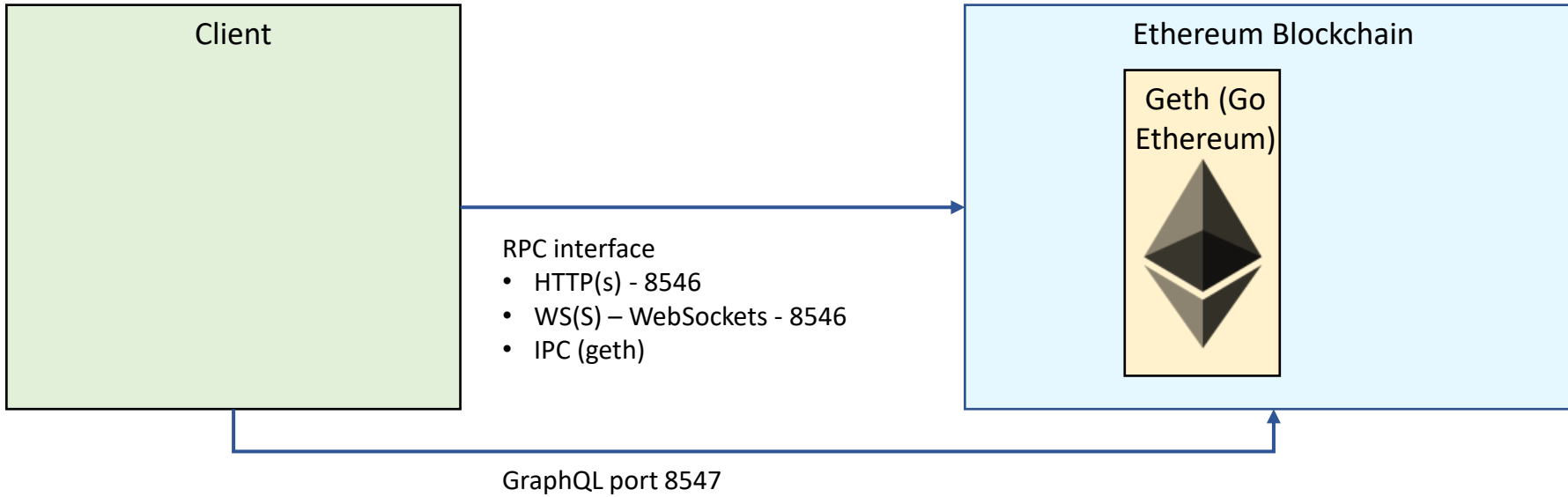
# PD-4.2.3 Web interface eth\_blockNumber

```
1 <body>
2 Get current Ethereum blocknumber<br>
3 Compare to <a href="https://etherscan.io/blocks" target="_blank">Etherscan</a>
4 <pre id="log" style="width:100%;height:200px"></pre>
5 <script>
6 function log(logstr) {
7   document.getElementById("log").innerHTML += logstr + "\n";
8 }
9 async function f() {
10   const request = JSON.stringify({"jsonrpc": "2.0", "method": "eth_blockNumber", "params": [], "id": 67});
11   log(`Sending ${request}`);
12   const rawResponse = await fetch('https://mainnet.infura.io', {
13     method: 'POST',
14     headers: {
15       'Accept': 'application/json',
16       'Content-Type': 'application/json'
17     },
18     body: request
19   });
20   const content = await rawResponse.json();
21   log(`Received ${JSON.stringify(content)}`);
22   log(`Current blocknumber = ${parseInt(content.result)}`);
23 }
24 f();
25 </script>
26 </body>
```

# PD-4.2.5 Web interface eth\_subscribe (websockets)

```
1 <body>
2 Get latest Ethereum blocknumbers via websockets<br>
3 Compare to <a href="https://etherscan.io/blocks" target="_blank">Etherscan</a>
4 <pre id="log" style="width:100%;height:200px"></pre>
5 <script>
6 function log(logstr) {
7   document.getElementById("log").innerHTML += logstr + "\n";
8 }
9 const server = "wss://mainnet.infura.io/ws";
10 log(`Opening connection to ${server}`);
11 var socket = new WebSocket(server);
12 socket.onopen = function(event) {
13   const request = JSON.stringify({"id": 1, "method": "eth_subscribe", "params": ["newHeads"]});
14   log(`Connection opened, sending: ${request}`);
15   socket.send(request);
16 };
17 socket.onmessage = async function(event) {
18   log(`Received ${event.data}`);
19   var data = JSON.parse(event.data);
20   log(`Current blocknumber = ${parseInt(data.params.result.number)}`);
21 }
22 socket.onerror = function(error) {
23   log(`[error] ${error.message}`);
24 };
25 </script>
26 </body>
```

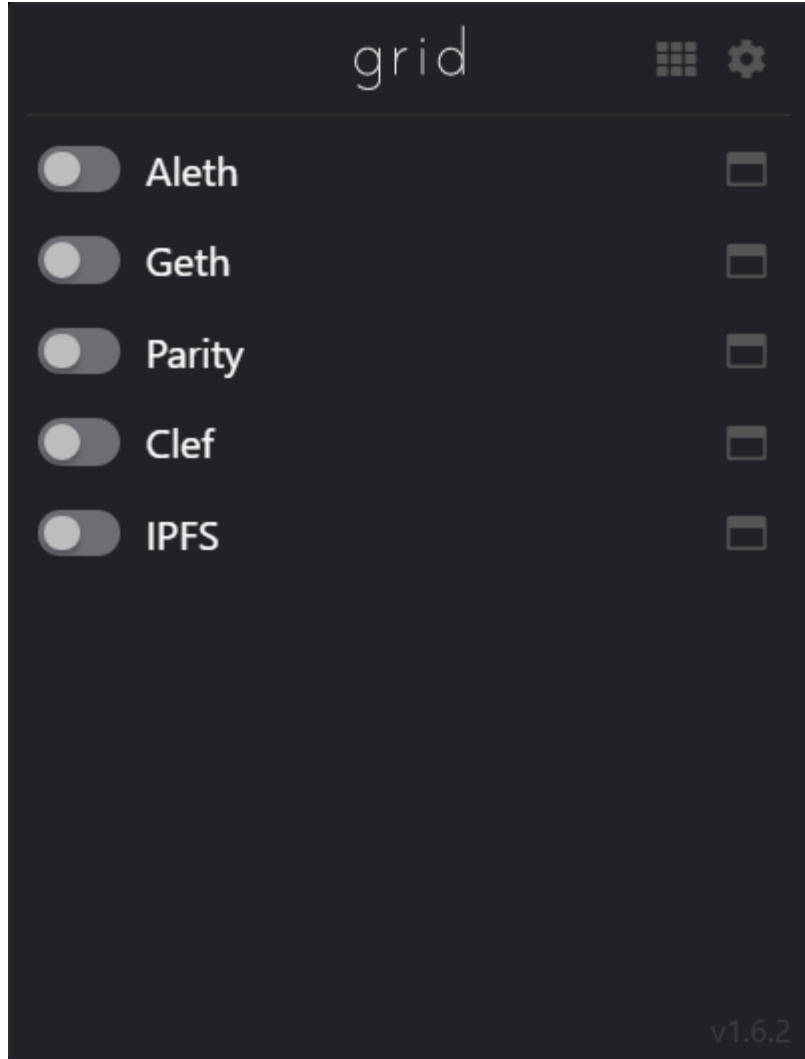
# PD-4.3 RPC Interface Geth (via Grid)



<https://github.com/ethereum/wiki/wiki/JSON-RPC>

<https://github.com/ethereum/wiki/wiki/JSON-RPC#json-rpc-support>

# PD-4.3 Ethereum - Grid



# PD-4.3 Grid - Geth

Ethereum Grid

CLIENT

- Geth
- Parity
- Aleth
- SIGNER
- Clef
- STORAGE
- IPFS

## Geth ●

STOPPED

ABOUT    VERSION    **SETTINGS**    TERMINAL    METADATA

Network: Main

Sync Mode: **Light**

Data Directory: C:\Users\gerar\AppData\Roaming\Ethereum

Keystore Directory: C:\Users\gerar\AppData\Roaming\Ethereum\key:

Enable Console: No

HTTP RPC API: **Disabled**

WebSockets API: **Disabled**

P2P Port: 30303

Enable GraphQL Server: **No**

Signer: Internal

Enable USB (hardware wallets): No

Verbosity: 3 = Info

Generated Flags

```
--syncmode light --datadir C:\Users\gerar\AppData\Roaming\Ethereum --keystore C:\Users\gerar\AppData\Roaming\Ethereum\keystore --port 30303 --nousb
```

Use custom flags    RESTORE DEFAULTS

Default settings restored!    DISMISS

grid

- Aleth
- Geth**

SETTINGS    TERMINAL    METADATA

Sync Mode: **Fast**

**Change to fast if blockchain doesn't load**

HTTP RPC API

Enabled for All Origins (\*)

WebSockets API

Enabled for All Origins (\*)

Enable GraphQL Server

Yes, All Origins (\*) (Requires Geth >=v1.9.0)



# PD-4.3 Geth ports

```
> C:\Users\gerar\AppData\Roaming\grid\app_cache\bin\bin_geth\geth.exe --syncmode light --datadir C:\Users\gerar\AppData
> INFO [11-24|18:20:17.151] Dropping default light client cache provided=1024 updated=128
> INFO [11-24|18:20:17.154] Maximum peer count ETH=0 LES=10 total=50
> INFO [11-24|18:20:17.155] Starting peer-to-peer node instance=Geth/v1.9.7-stable-a718daa6/windows-amd64/go1.13.4
> INFO [11-24|18:20:17.155] Allocated cache and file handles database=C:\\Users\\gerar\\AppData\\Roaming\\Ethereum\\g
> INFO [11-24|18:20:17.186] Initialised chain configuration config="{ChainID: 1 Homestead: 1150000 DAO: 1920000 DAOSu
> INFO [11-24|18:20:17.186] Disk storage enabled for ethash caches dir=C:\\Users\\gerar\\AppData\\Roaming\\Ethereum\\
> INFO [11-24|18:20:17.186] Disk storage enabled for ethash DAGs dir=C:\\Users\\gerar\\AppData\\Local\\Ethash count=2
> INFO [11-24|18:20:17.195] Added trusted checkpoint block=8880127 hash=b67c33...e72e40
> INFO [11-24|18:20:17.195] Loaded most recent local header number=8993591 hash=2a67a3...546148 td=12997891579699747003
> INFO [11-24|18:20:17.196] Configured checkpoint registrar address=0x9a9070028361f7AAbE3f2F2Dc07F82C4a98A02a signed
> INFO [11-24|18:20:17.228] UDP listener up net=enode://09880b4a12a3575fcc46749419c9ecfb58e14be8f3b9c470ad45c6463d277
> WARN [11-24|18:20:17.230] Light client mode is an experimental feature
> INFO [11-24|18:20:17.232] New local node record seq=8 id=9c2e5ac5fd39dfc0 ip=127.0.0.1 udp=30303 tcp=30303
> INFO [11-24|18:20:17.232] Started P2P networking self=enode://09880b4a12a3575fcc46749419c9ecfb58e14be8f3b9c470ad45c
> INFO [11-24|18:20:17.236] GraphQL endpoint opened url=http://127.0.0.1:8547
> INFO [11-24|18:20:17.237] IPC endpoint opened url=\\\\.\\pipe\\geth.ipc
> INFO [11-24|18:20:17.238] HTTP endpoint opened url=http://127.0.0.1:8545 cors=* vhosts=localhost
> INFO [11-24|18:20:17.238] WebSocket endpoint opened url=ws://127.0.0.1:8546
> INFO [11-24|18:22:14.728] Block synchronisation started
```

# PD-4.3 Geth - node

C:\WINDOWS\system32\cmd.exe

```
geth --syncmode "light" --rpc console
```

```
INFO [10-03|18:50:02.009] Imported new block headers count=1 elapsed=3.997ms number=8670400 hash=105aef...794e9c
INFO [10-03|18:50:17.728] Imported new block headers count=1 elapsed=7.694ms number=8670401 hash=3fe965...2be7fb
INFO [10-03|18:50:41.997] Imported new block headers count=1 elapsed=4.976ms number=8670402 hash=fafe07...591b69
INFO [10-03|18:50:45.499] Imported new block headers count=1 elapsed=4.986ms number=8670403 hash=d1ba96...d414db
INFO [10-03|18:50:48.613] Imported new block headers count=1 elapsed=4.988ms number=8670404 hash=b5fa9f...2f3bc7
INFO [10-03|18:50:52.397] Imported new block headers count=1 elapsed=5.008ms number=8670405 hash=173c45...5d072c
INFO [10-03|18:51:10.292] Imported new block headers count=1 elapsed=4.986ms number=8670406 hash=73eac7...d432fb
INFO [10-03|18:51:18.400] Imported new block headers count=1 elapsed=3.960ms number=8670407 hash=f9d43f...c4bee4
INFO [10-03|18:51:20.385] Imported new block headers count=1 elapsed=4.987ms number=8670408 hash=8358a6...367f24
```

ethstats.net

**BEST BLOCK**  
#11,053,245

**UNCLES** (CURRENT / LAST 50)  
0/5

**LAST BLOCK**  
7s ago

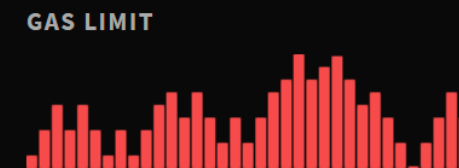
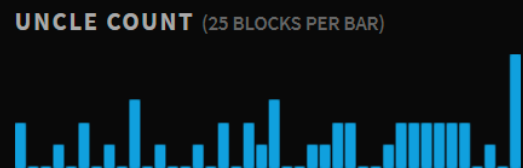
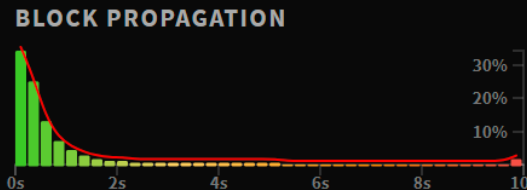
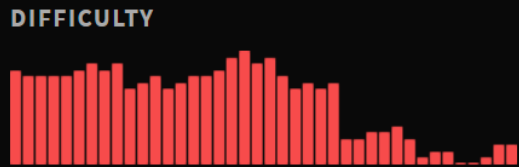
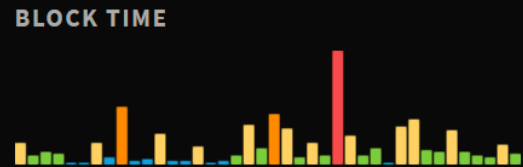
**AVG BLOCK TIME**  
13.39s

**ACTIVE NODES** 80/81

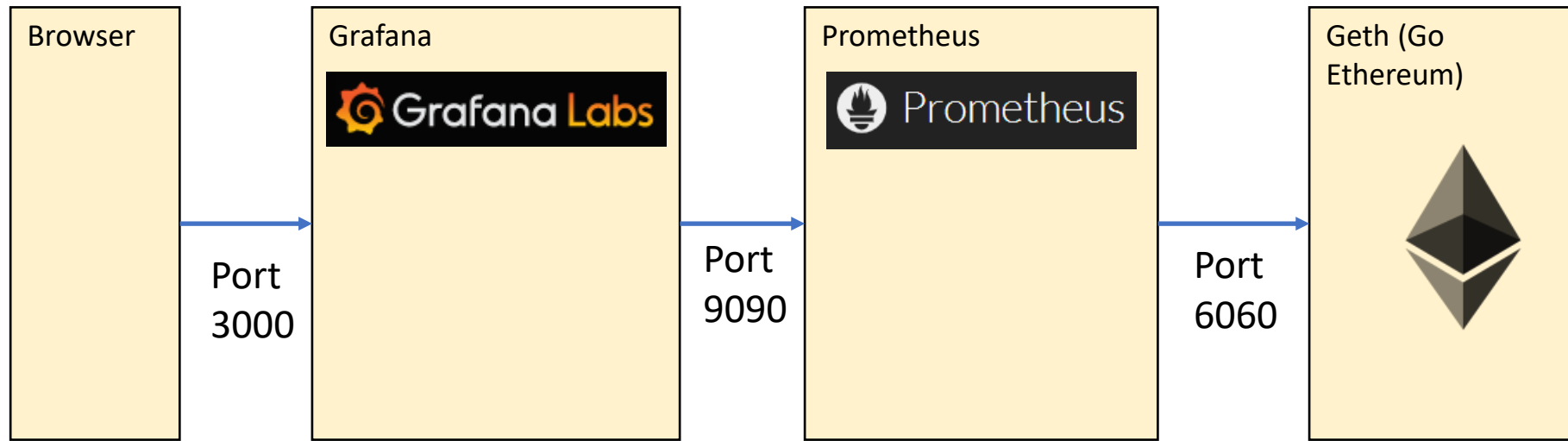
**GAS PRICE** 66.550 gwei

**GAS LIMIT** 12512120 gas

**PAGE LATENCY** 3



# PD-4.4 Management with Grafana & Prometheus



<https://grafana.com>

<https://prometheus.io>

[http://web3examples.com/ethereum/demo/Geth\\_Prometheus\\_Grafana.html](http://web3examples.com/ethereum/demo/Geth_Prometheus_Grafana.html)

# PD-4.4 Configure Geth (via Grid)

Ethereum Grid

CLIENT

Geth

Parity

Aleth

SIGNER

Clef

STORAGE

IPFS

**Geth** ●  
STOPPED

ABOUT VERSION **SETTINGS** TERMINAL METADATA

Enable Console: No

HTTP RPC API: Disabled

WebSockets API: Disabled

P2P Port: 30303

Enable GraphQL Server: No

Signer: Internal

Enable USB (hardware wallets): No

Verbosity: 3 = Info

Generated Flags

```
--syncmode light --datadir C:\Users\gerar\AppData\Roaming\Ethereum --keystore C:\Users\gerar\AppData\Roaming\Ethereum\keystore --port 30303 --noui --pprof --metrics --metrics.expensive
```

Use custom flags

RESTORE DEFAULTS

**Add parameters:**

`--pprof --metrics --metrics.expensive`

# PD-4.4 Start Geth (via Grid)

The screenshot displays the Ethereum Grid application interface. On the left, a sidebar lists various components: CLIENT (Geth, Parity, Aleth), SIGNER (Clef), STORAGE, and IPFS. The Geth client is currently selected and shown as 'CONNECTED' with a green dot. The main area features a terminal window with the following output:

```
> C:\Users\gerar\AppData\Roaming\grid\app_cache\bin\bin geth\geth.exe --syncmode light --datadir C:\Users\gerar\Ap
> INFO [11-24|16:40:53.122] Starting pprof server address=http://127.0.0.1:6060/debug/pprof
> INFO [11-24|16:40:53.123] Dropping default light client cache provided=1024 updated=128
> INFO [11-24|16:40:53.123] Enabling metrics collection
> INFO [11-24|16:40:53.124] Maximum peer count ETH=0 LES=10 total=50
> INFO [11-24|16:40:53.126] Starting peer-to-peer node instance=Geth/v1.9.6-stable-bd059680/windows-amd64/go1.13
> INFO [11-24|16:40:53.126] Allocated cache and file handles database=C:\\Users\\gerar\\AppData\\Roaming\\Ethereum
> INFO [11-24|16:40:53.166] Initialised chain configuration config="{ChainID: 1 Homestead: 1150000 DAO: 1920000 DA
> INFO [11-24|16:40:53.166] Disk storage enabled for ethash caches dir=C:\\Users\\gerar\\AppData\\Roaming\\Ethereu
> INFO [11-24|16:40:53.166] Disk storage enabled for ethash DAGs dir=C:\\Users\\gerar\\AppData\\Local\\Ethash coun
> INFO [11-24|16:40:53.175] Added trusted checkpoint block=8552447 hash=613fc3...9428eb
> INFO [11-24|16:40:53.175] Loaded most recent local header number=8700031 hash=405eae...ac22f8 td=12277738183744034
> INFO [11-24|16:40:53.176] Configured checkpoint registrar address=0x9a9070028361F7AAbE3f2F2Dc07F82C4a98A02a sig
> INFO [11-24|16:40:53.215] UDP listener up net=enode://b1017e3e0428970e9d69891600e0d6340c7d019e13067de2ec24774bfa
> WARN [11-24|16:40:53.217] Light client mode is an experimental feature
> INFO [11-24|16:40:53.218] New local node record seq=7 id=be3948639ad18725 ip=127.0.0.1 udp=30303 tcp=30303
> INFO [11-24|16:40:53.218] Started P2P networking self=enode://b1017e3e0428970e9d69891600e0d6340c7d019e13067de2ec
> INFO [11-24|16:40:53.218] IPC endpoint opened url=\\\\.\\pipe\\geth.ipc
```

# PD-4.4 Install & configure Prometheus

## prometheus.yml

```
global:
  scrape_interval: 5s
  scrape_timeout: 5s
  evaluation_interval: 5s
alerting:
  alertmanagers:
  - static_configs:
    - targets: []
    scheme: http
    timeout: 5s
scrape_configs:
- job_name: geth
  metrics_path: /debug/metrics/prometheus
  scheme: http
  static_configs:
  - targets: ['localhost:6060']
```

<https://prometheus.io>

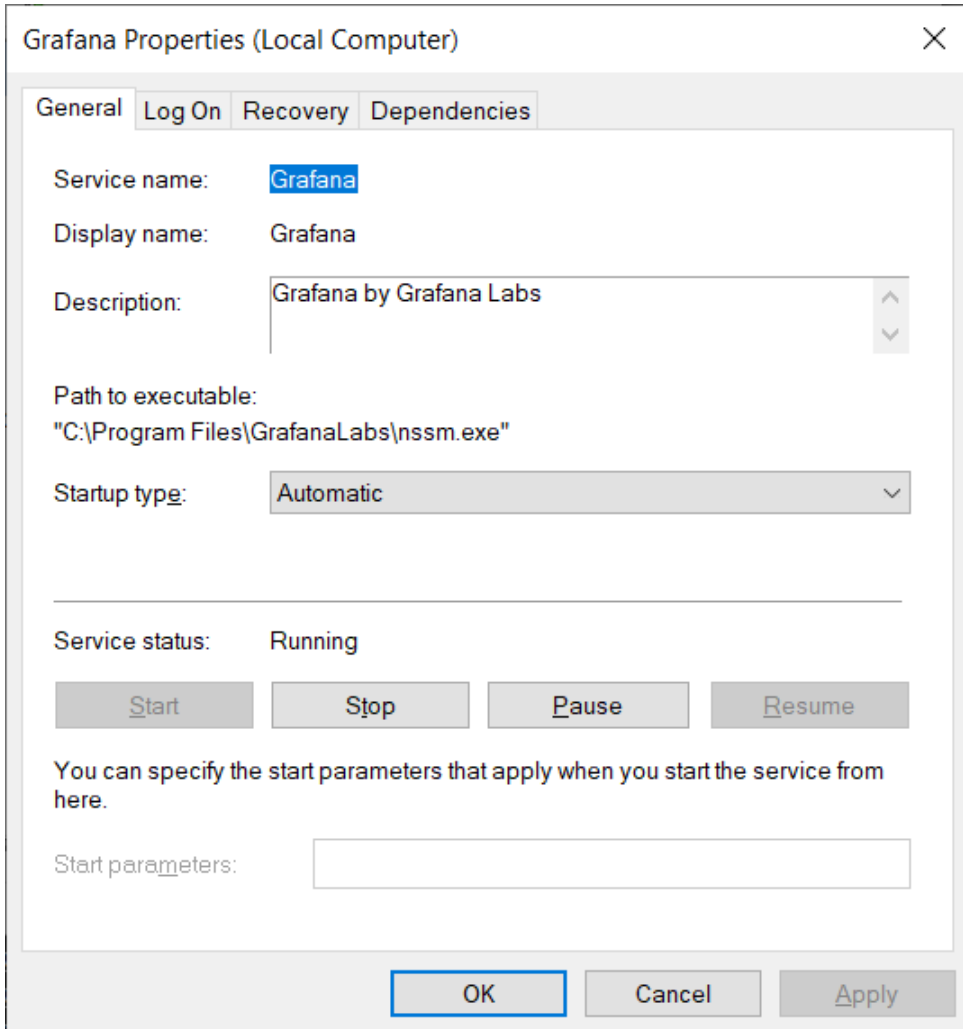
[http://web3examples.com/ethereum/grafana\\_prometheus/prometheus.yml](http://web3examples.com/ethereum/grafana_prometheus/prometheus.yml)

<https://github.com/karalabe/geth-prometheus/blob/master/prometheus.yml>

# PD-4.4 Start Prometheus

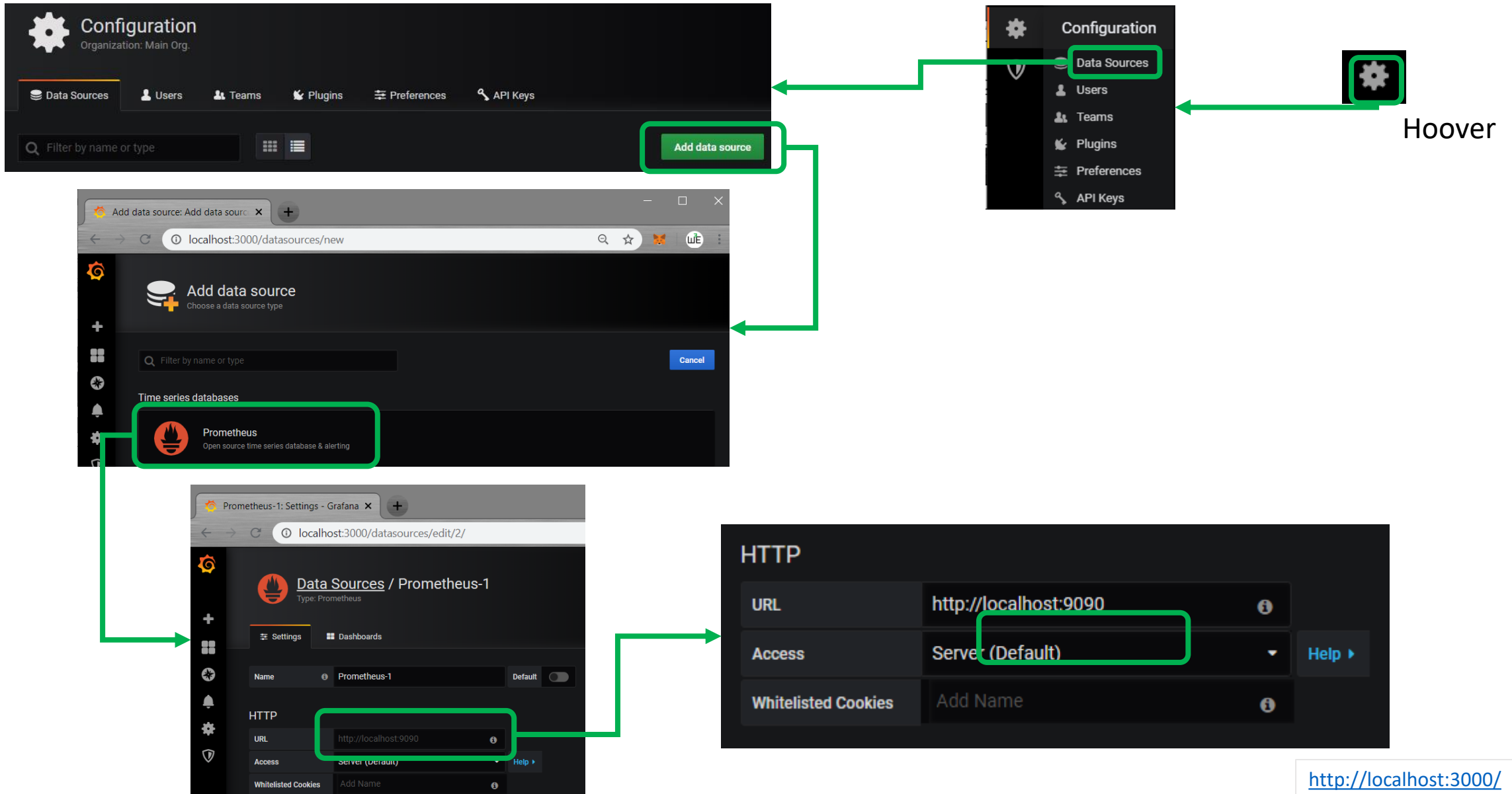
```
C:\tmp\prometheus.exe
level=info ts=2019-11-24T15:42:26.193Z caller=main.go:296 msg="no time or size retention was set so using the default time retention" duration=15d
level=info ts=2019-11-24T15:42:26.193Z caller=main.go:332 msg="Starting Prometheus" version="(version=2.13.0, branch=HEAD, revision=6ea4252299f542669aca11860abc2192bdc7bede)"
level=info ts=2019-11-24T15:42:26.194Z caller=main.go:333 build_context="(go=go1.13.1, user=root@f30bdad2c3fd, date=20191004-11:40:52)"
level=info ts=2019-11-24T15:42:26.194Z caller=main.go:334 host_details=(windows)
level=info ts=2019-11-24T15:42:26.194Z caller=main.go:335 fd_limits=N/A
level=info ts=2019-11-24T15:42:26.194Z caller=main.go:336 vm_limits=N/A
level=info ts=2019-11-24T15:42:26.201Z caller=main.go:657 msg="Starting TSDB ..."
level=info ts=2019-11-24T15:42:26.201Z caller=web.go:450 component=web msg="Start listening for connections" address=0.0.0.0:9090
level=info ts=2019-11-24T15:42:26.202Z caller=repair.go:59 component=tsdb msg="found healthy block" mint=1570274435313 maxt=1570276800000 ulid=01DTF03W6076D18Y4Z2K905BC3
level=info ts=2019-11-24T15:42:26.208Z caller=head.go:512 component=tsdb msg="replaying WAL, this may take awhile"
level=info ts=2019-11-24T15:42:26.214Z caller=head.go:536 component=tsdb msg="WAL checkpoint loaded"
level=info ts=2019-11-24T15:42:26.214Z caller=head.go:560 component=tsdb msg="WAL segment loaded" segment=1202 maxSegment=1206
level=info ts=2019-11-24T15:42:26.215Z caller=head.go:560 component=tsdb msg="WAL segment loaded" segment=1203 maxSegment=1206
level=info ts=2019-11-24T15:42:26.215Z caller=head.go:560 component=tsdb msg="WAL segment loaded" segment=1204 maxSegment=1206
level=info ts=2019-11-24T15:42:26.217Z caller=head.go:560 component=tsdb msg="WAL segment loaded" segment=1205 maxSegment=1206
level=info ts=2019-11-24T15:42:26.218Z caller=head.go:560 component=tsdb msg="WAL segment loaded" segment=1206 maxSegment=1206
level=info ts=2019-11-24T15:42:26.219Z caller=main.go:672 fs_type=unknown
level=info ts=2019-11-24T15:42:26.219Z caller=main.go:673 msg="TSDB started"
level=info ts=2019-11-24T15:42:26.219Z caller=main.go:743 msg="Loading configuration file" filename=prometheus.yml
level=info ts=2019-11-24T15:42:26.230Z caller=main.go:771 msg="Completed loading of configuration file" filename=prometheus.yml
level=info ts=2019-11-24T15:42:26.230Z caller=main.go:626 msg="Server is ready to receive web requests."
level=info ts=2019-11-24T15:42:35.671Z caller=head.go:596 component=tsdb msg="head GC completed" duration=1.0337ms
level=info ts=2019-11-24T15:42:35.685Z caller=head.go:666 component=tsdb msg="WAL checkpoint complete" first=1202 last=1203 duration=13.925ms
level=info ts=2019-11-24T15:42:35.705Z caller=head.go:596 component=tsdb msg="head GC completed" duration=1.0354ms
level=info ts=2019-11-24T15:42:35.720Z caller=head.go:596 component=tsdb msg="head GC completed" duration=1.0318ms
level=info ts=2019-11-24T15:42:35.734Z caller=head.go:666 component=tsdb msg="WAL checkpoint complete" first=1204 last=1205 duration=14.1954ms
```

# PD-4.4 Install Grafana

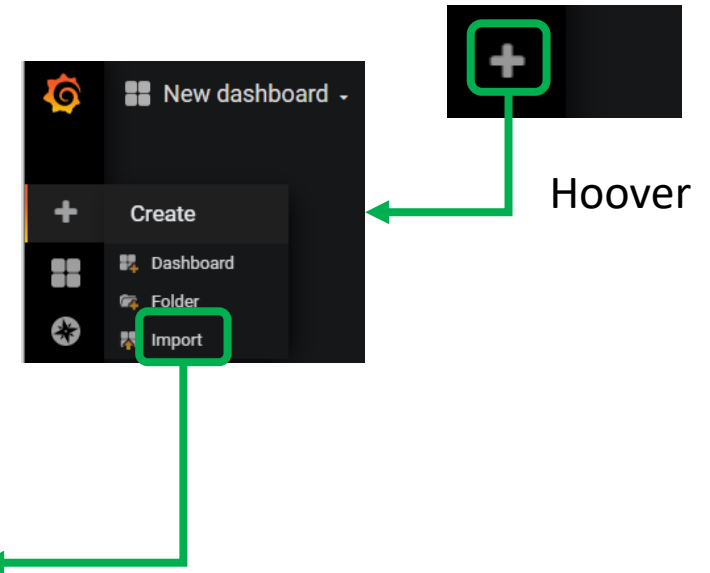
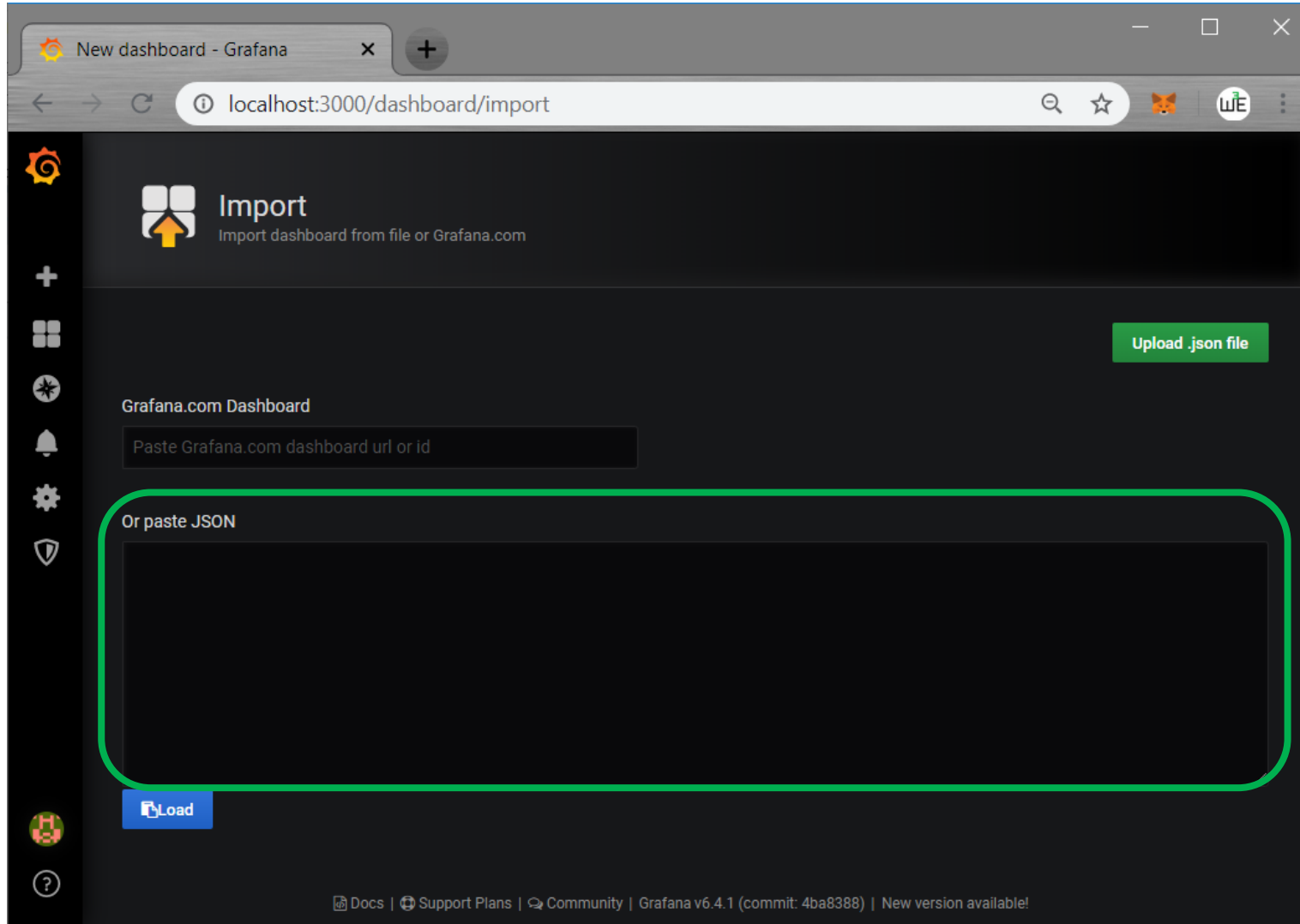




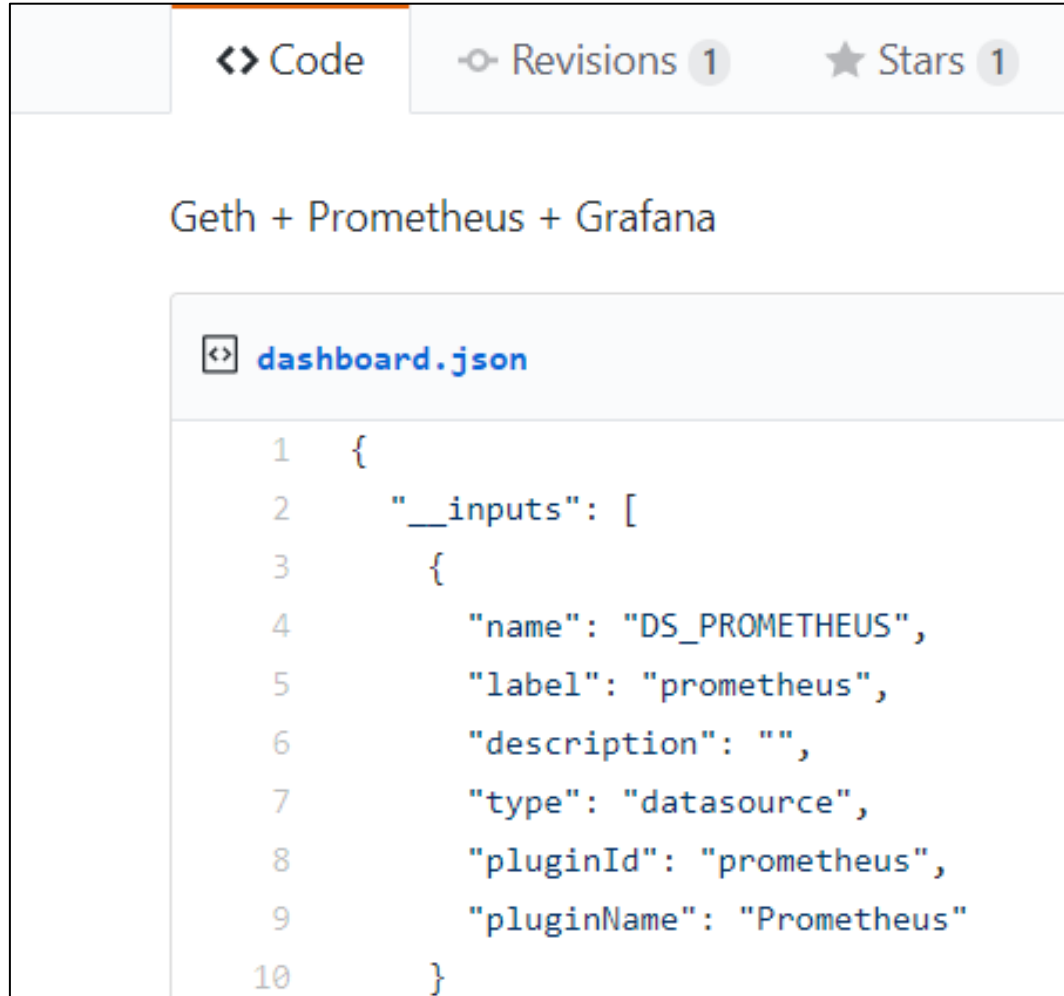
# PD-4.4 Configure datasource



# PD-4.4 Configure Dashboard



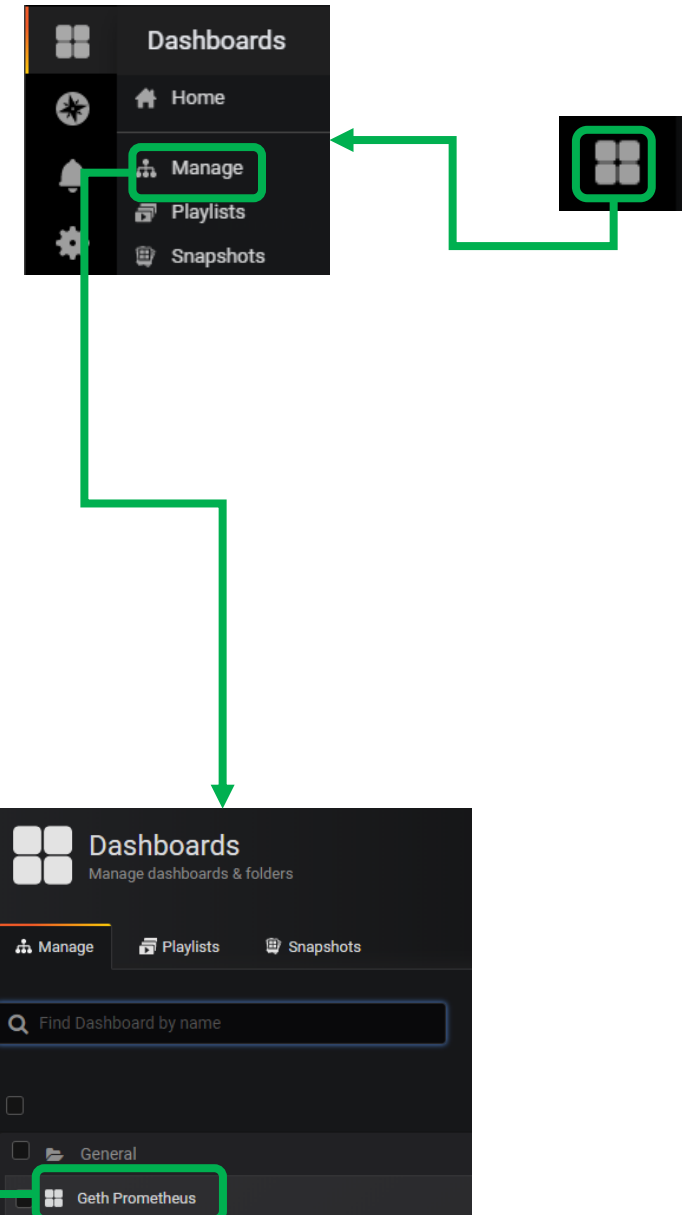
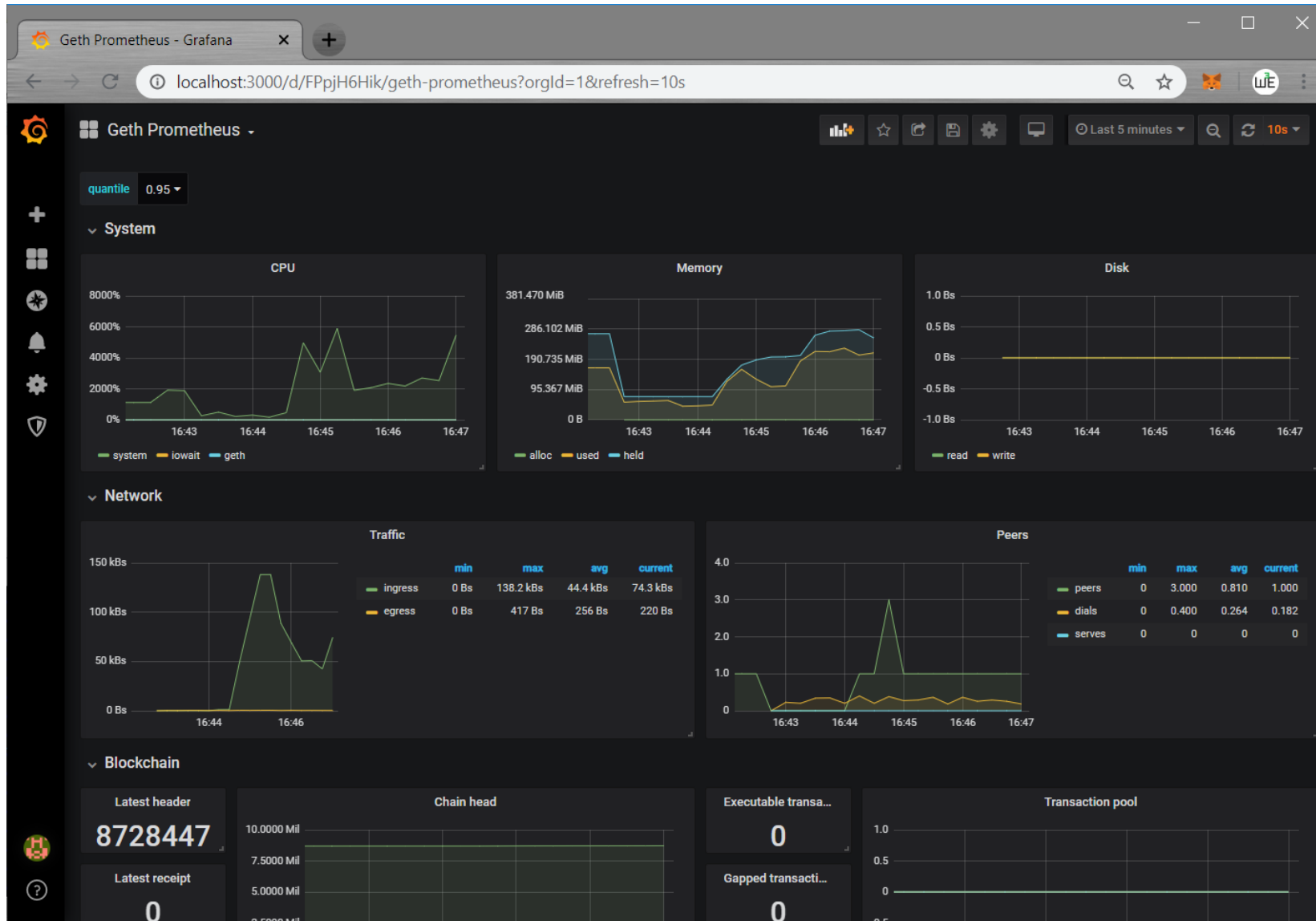
# PD-4.4 Dashboard configuration



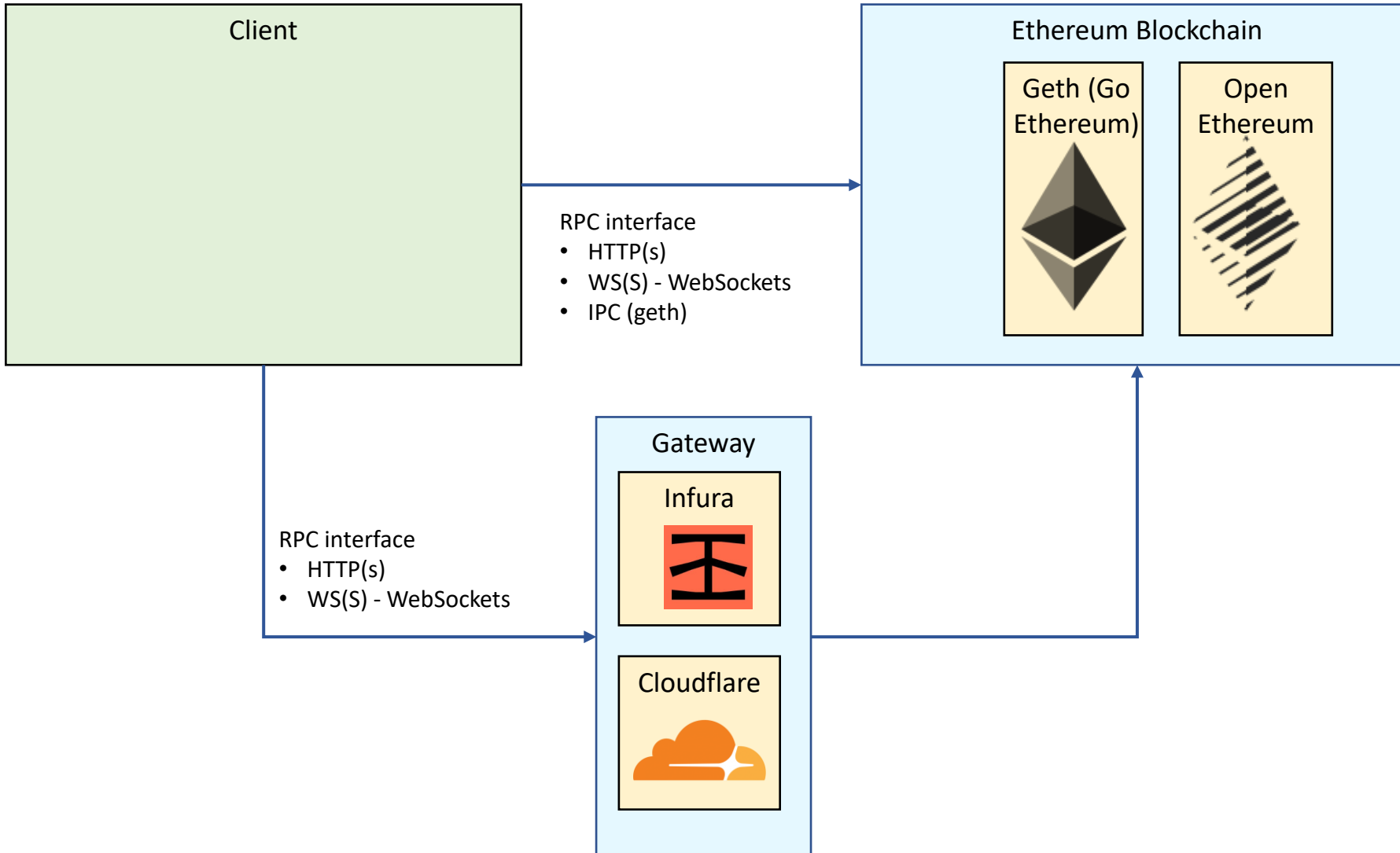
The screenshot shows a GitHub repository interface. At the top, there are tabs for 'Code', 'Revisions 1', and 'Stars 1'. Below the tabs, the repository name 'Geth + Prometheus + Grafana' is displayed. A file named 'dashboard.json' is selected and its content is shown in a code editor. The code is a JSON object with the following structure:

```
1  {
2    "__inputs": [
3      {
4        "name": "DS_PROMETHEUS",
5        "label": "prometheus",
6        "description": "",
7        "type": "datasource",
8        "pluginId": "prometheus",
9        "pluginName": "Prometheus"
10   }
```

# PD-4.4 Start Dashboard



# PD-4.5 RPC Interface



# PD-4.5 RPC Calls General information

Name	Function
web3_clientVersion	Current client version
eth_gasPrice	Current price per gas in wei
eth_hashrate	Number of hashes per second that the node is mining with
eth_mining	Is client actively mining new blocks?
eth_protocolVersion	Current ethereum protocol version
eth_syncing	Is client syncing?
net_listening	Is client actively listening for network connections?
net_peerCount	Number of peers currently connected to the client

[https://github.com/web3examples/ethereum/blob/master/rpc/general\\_info\\_mainnet.cmd](https://github.com/web3examples/ethereum/blob/master/rpc/general_info_mainnet.cmd)

<https://eth.wiki/json-rpc/api>

# PD-4.5 RPC Calls Network information

Name	Function
eth_chainId	Current chain id
net_version	Current network id (mainnet usually 1 )

## EVM Networks

A list of EVM networks. Wallets and Web3 middleware providers should be able to use the appropriate Chain ID and Network ID to connect to the correct chain.

This table is also available as a JSON feed at [chains.json](https://chains.json).

Chain ID	Name	Short Name	Chain	Network	Network ID
1	Ethereum Mainnet	eth	ETH	mainnet	1
3	Ethereum Testnet Ropsten	rop	ETH	ropsten	3
42	Ethereum Testnet Kovan	kov	ETH	kovan	42
43110	Athereum	ath	ATH	athereum	43110
5	Ethereum Testnet Görli	gor	ETH	goerli	5
6	Ethereum Classic Testnet Kotti	kot	ETC	kotti	6

<https://chainid.network/>

<https://eth.wiki/json-rpc/api>

# PD-4.5 RPC Calls Block & log information

Name	Function
eth_blockNumber	Number of most recent block
eth_getBlockByHash	Information about a block
eth_getBlockByNumber	Information about a block
eth_getStorageAt	Value from a storage position at a given address
eth_getCode	Code at a given address
eth_getLogs	All logs matching a given filter object



# PD-4.5 RPC Calls Transaction information

Name	Function
eth_getBlockTransactionCountByHash	Number of transactions in a block from a block matching the given block hash
eth_getBlockTransactionCountByNumber	Number of transactions in a block matching the given block number
eth_getTransactionByBlockHashAndIndex	Transaction by block hash and transaction index position
eth_getTransactionByBlockNumberAndIndex	Transaction by block number and transaction index position.
eth_getTransactionByHash	Transaction requested by transaction hash
eth_pendingTransactions	Returns the pending transactions list

# PD-4.5 RPC Calls Uncles

Name	Function
eth_getUncleCountByBlockHash	Number of uncles in this block
eth_getUncleCountByBlockNumber	Number of uncles in this block
eth_getUncleByBlockHashAndIndex	Information about a uncle
eth_getUncleByBlockNumberAndIndex	Information about a uncle

## Ethereum uncle

- orphan block
- mined just after a correct block was added to the main chain
- valid block that arrives too late
- a block can include max two uncles

## Reward for miner

- each uncle referenced earns 1/32 of block reward

## Rewards to miner of uncle block

- depends on distance to the main chain block it was referenced by
- max six generations
- max 7/8 block reward

<https://etherscan.io/uncles>

<https://eth.wiki/fundamentals/mining>

# PD-4.5 RPC Calls Account information

Name	Function
eth_accounts	List of addresses owned by client
eth_coinbase	Client coinbase address
eth_getBalance	Balance of the account of given address
eth_getProof	Account- and storage-values of the specified account including the Merkle-proof
eth_getTransactionCount	Number of transactions sent from an address

# PD-4.5 RPC Calls Transactions & function calls

Name	Function
eth_sign	The sign method calculates an Ethereum specific signature with: <code>sign(keccak256("\x19Ethereum Signed Message:\n" + len(message) + message))</code> . <b>Note</b> the address to sign with must be unlocked.
eth_estimateGas	Generates and returns an estimate of how much gas is necessary to allow the transaction to complete. The transaction will not be added to the blockchain.
eth_call	Executes a new message call immediately without creating a transaction on the block chain (e.g. read only)

Name	Function
eth_sendTransaction	Creates new message call transaction or a contract creation, if the data field contains code
eth_getTransactionReceipt	Get the contract address, after the transaction was mined, when you created a contract.
eth_sendRawTransaction	Creates new message call transaction or a contract creation for signed transactions.

# PD-4.5 RPC Calls Utilities

Name	Function
web3_sha3	Returns Keccak-256 hash of the given data Note: not the standardized SHA3-256

## Windows

```
set request=web3_sha3
```

```
set param="0x68656c6c6f20776f726c64"set
```

```
body={"jsonrpc":"2.0","method":"%request%","params":[%param%],"id":67}
```

```
curl -H "Content-Type: application/json" -g --data "%body:"=""%" https://mainnet.infura.io
```

## Result

```
{  
  "jsonrpc":"2.0",  
  "id":67,  
  "result":"0x47173285a8d7341e5e972fc677286384f802f8ef42a5ec5f03bbfa254cb01fad"  
}
```

[https://github.com/web3examples/ethereum/blob/master/rpc/web3\\_sha3\\_mainnet.infura.io.cmd](https://github.com/web3examples/ethereum/blob/master/rpc/web3_sha3_mainnet.infura.io.cmd)

<https://eth.wiki/json-rpc/api>

# PD-4.5 RPC Calls Mining

Name	Function
eth_mining	Is client is actively mining new blocks?
eth_hashrate	Number of hashes per second that the node is mining with
eth_submitWork	Submit a proof-of-work solution
eth_getWork	Returns the hash of the current block, the seedHash, and the boundary condition to be met ("target")

# PD-4.5 RPC Calls Filters

Name	Function
eth_newBlockFilter	Filter to notify when a new block arrives
eth_newPendingTransactionFilter	Filter to notify when new pending transactions arrive.
eth_getFilterChanges	Polling method for a filter, which returns an array of logs which occurred since last poll.
eth_newFilter	Filter to notify logs changes
eth_getFilterLogs	Returns an array of all logs matching filter with given id.
eth_uninstallFilter	Uninstalls a filter with given id. Should always be called when watch is no longer needed.

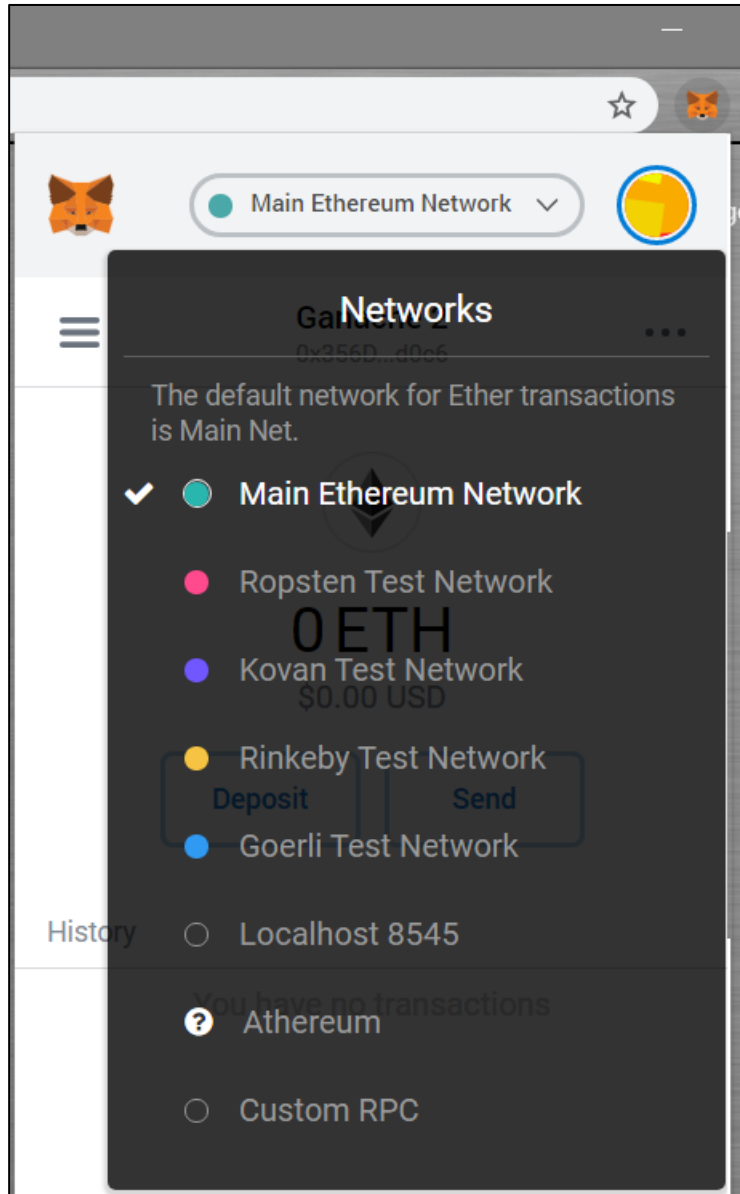




# PD-4.7 RPC URL's and testnetworks

Mainnet URL	Websockets	web3_clientVersion
<a href="https://mainnet.infura.io/v3/..">https://mainnet.infura.io/v3/..</a>	wss://mainnet.infura.io/ws/v3/..	Geth/v1.8.27-omnibus-c94f741c/linux-amd64/go1.11.1
<a href="https://cloudflare-eth.com">https://cloudflare-eth.com</a>		cloudflare-geth
<a href="https://main-rpc.linkpool.io">https://main-rpc.linkpool.io</a>	wss://main-rpc.linkpool.io/ws	OpenEthereum//v3.0.1-stable-8ca8089-20200601/x86_64-unknown-linux-gnu/rustc1.43.1
<a href="https://rpc.slock.it/mainnet">https://rpc.slock.it/mainnet</a>		Parity-Ethereum//v2.5.13-stable-253ff3f-20191231/x86_64-linux-gnu/rustc1.40.0

# PD-4.7 MetaMask test networks



Goerli



athereum

# PD-4.7 Test networks

Network	Ropsten	Kovan	Rinkeby	Görli	Athereum
Consensus Protocol	Proof of Work (best emulates mainnet environment)	Proof of Authority	Proof of Authority (Clique)	Proof of Authority (Clique)	Avalanche
Supported Clients	Both Geth / Parity	Parity only	Geth only	Multi-client	AVA
Average Block Times	~15 sec.	~4 sec.	~15 sec.	~16 sec.	< 1 sec

# PD-4.7 Chain registry

```
1  {
2    "name": "Ethereum Testnet Ropsten",
3    "chain": "ETH",
4    "network": "ropsten",
5    "rpc": [
6      "https://ropsten.infura.io/v3/${INFURA_API_KEY}"
7    ],
8    "faucets": [
9      "https://faucet.ropsten.be?${ADDRESS}"
10   ],
11   "nativeCurrency": {
12     "name": "Ropsten Ether",
13     "symbol": "ROP",
14     "decimals": 18
15   },
16   "infoURL": "https://github.com/ethereum/ropsten",
17   "shortName": "rop",
18   "chainId": 3,
19   "networkId": 3,
20   "ens": {
21     "registry": "0x112234455c3a32fd11230c42e7bccd4a84e02010"
22   }
23 }
```

<https://github.com/ethereum-lists/chains>

[https://github.com/ethereum-lists/chains/blob/master/\\_data/chains/3.json](https://github.com/ethereum-lists/chains/blob/master/_data/chains/3.json)

<https://chainid.network/chains.json>

<https://chainid.network>

# PD-4.7 RPC URL's

Test URL	Websockets	web3_clientVersion
<a href="https://ropsten.infura.io/v3/..">https://ropsten.infura.io/v3/..</a>	wss://ropsten.infura.io/ws/v3/..	Geth/v1.9.5-omnibus-6ef96469-20190920/linux-amd64/go1.12
<a href="https://kovan.infura.io/v3/..">https://kovan.infura.io/v3/..</a>	wss://kovan.infura.io/ws/v3/..	Parity-Ethereum//v2.6.4-beta-badb045-20190926/x86_64-linux-gnu/rustc1.36.0
<a href="https://rinkeby.infura.io/v3/..">https://rinkeby.infura.io/v3/..</a>	wss://rinkeby.infura.io/ws/v3/..	Geth/v1.9.6-omnibus-81a21b6f-20191004/linux-amd64/go1.12
<a href="https://goerli.infura.io/v3/..">https://goerli.infura.io/v3/..</a>	wss://goerli.infura.io/ws/v3/..	Geth/v1.9.6-omnibus-81a21b6f-20191004/linux-amd64/go1.12
<a href="https://rpc.goerli.mudit.blog">https://rpc.goerli.mudit.blog</a>		Geth/v1.9.6-unstable-311419c7-20190923/linux-amd64/go1.11.5
<a href="https://rpc.slock.it/goerli">https://rpc.slock.it/goerli</a>		Slock.it-Proxy//v1.0.0
<a href="https://goerli.prylabs.net">https://goerli.prylabs.net</a>	wss://goerli.prylabs.net/websocket	Geth/v1.9.6-stable-bd059680/linux-amd64/go1.13.1
<a href="https://api.avax-test.network/ext/bc/C/rpc">https://api.avax-test.network/ext/bc/C/rpc</a>		

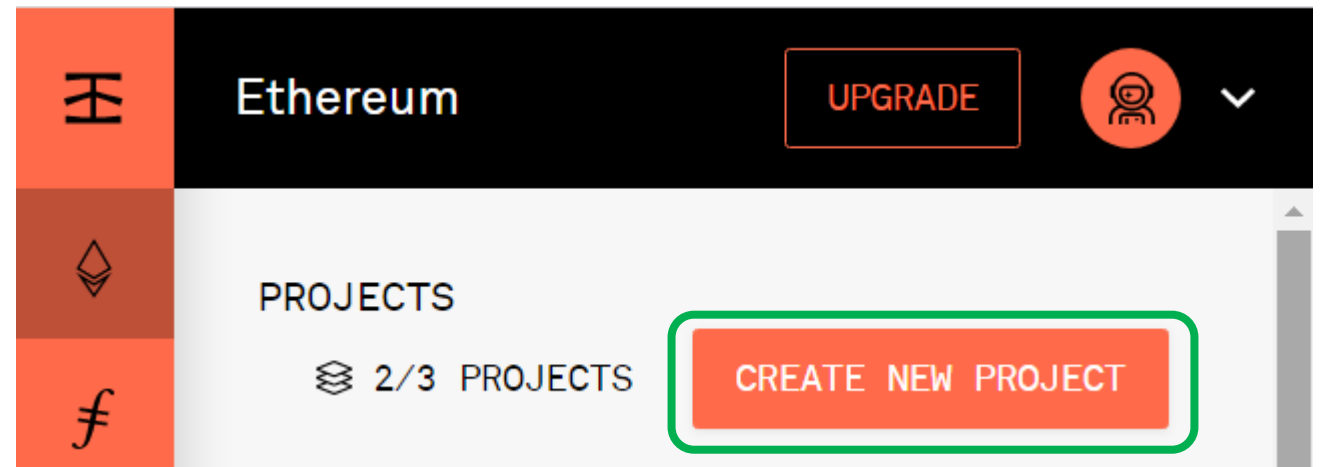
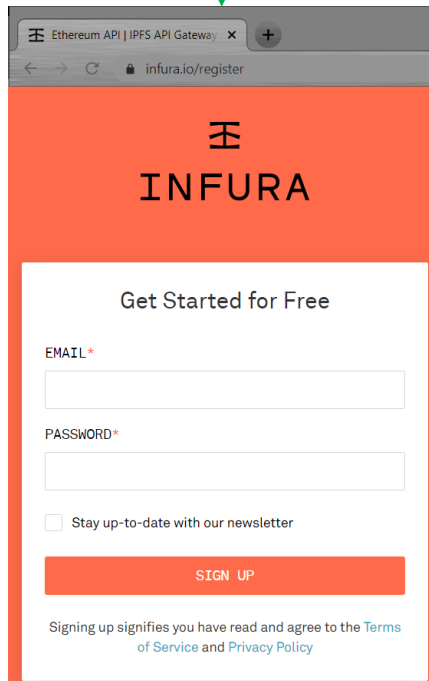
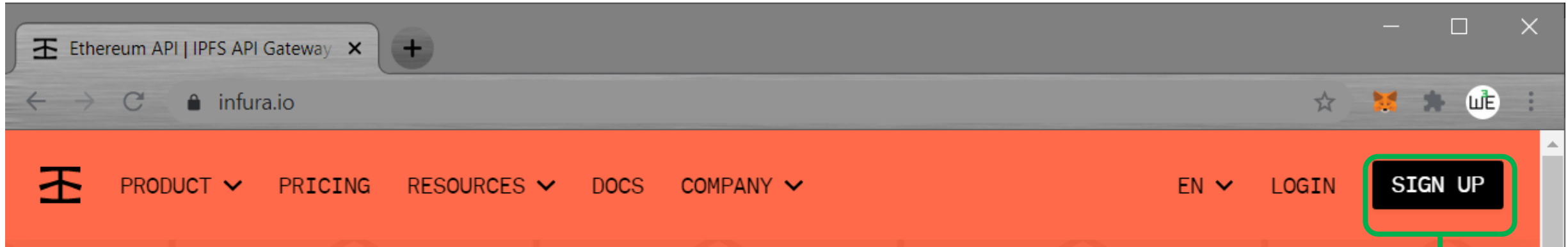
# PD-4.7 Testnet information

Network	More info	Chainnr	Faucet	Github
Ropsten	<a href="https://github.com/ethereum/ropsten">https://github.com/ethereum/ropsten</a>	3	<a href="https://faucet.metamask.io">https://faucet.metamask.io</a> <a href="https://faucet.ropsten.be">https://faucet.ropsten.be</a> <a href="https://teth.bitaps.com">https://teth.bitaps.com</a>	<a href="https://github.com/ethereum/ropsten">https://github.com/ethereum/ropsten</a>
Kovan	<a href="https://kovan-testnet.github.io/website">https://kovan-testnet.github.io/website</a>	42	<a href="https://faucet.kovan.network">https://faucet.kovan.network</a> <a href="https://gitter.im/kovan-testnet/faucet">https://gitter.im/kovan-testnet/faucet</a>	<a href="https://github.com/kovan-testnet/proposal">https://github.com/kovan-testnet/proposal</a>
Rinkeby	<a href="https://www.rinkeby.io">https://www.rinkeby.io</a>	4	<a href="https://faucet.rinkeby.io">https://faucet.rinkeby.io</a>	<a href="https://github.com/ethereum/EIPs/issues/225">https://github.com/ethereum/EIPs/issues/225</a>
Goerli	<a href="https://goerli.net">https://goerli.net</a>	5	<a href="https://goerli-faucet.slock.it">https://goerli-faucet.slock.it</a> <a href="https://faucet.goerli.mudit.blog">https://faucet.goerli.mudit.blog</a>	<a href="https://github.com/goerli/testnet">https://github.com/goerli/testnet</a>
Athereum	<a href="https://athereum.avax.network">https://athereum.avax.network</a>	0xa869	<a href="https://faucet.avax-test.network">https://faucet.avax-test.network</a>	<a href="https://github.com/ava-labs">https://github.com/ava-labs</a>

# PD-4.7 Testnet explorers & dashboards

Network	Dashboard	Explorer
Ropsten		<a href="https://ropsten.etherscan.io">https://ropsten.etherscan.io</a> <a href="https://blockexplorer.one/eth/ropsten">https://blockexplorer.one/eth/ropsten</a> <a href="https://teth.bitaps.com">https://teth.bitaps.com</a>
Kovan		<a href="https://kovan.etherscan.io">https://kovan.etherscan.io</a>
Rinkeby	<a href="https://stats.rinkeby.io">https://stats.rinkeby.io</a>	<a href="https://rinkeby.etherscan.io">https://rinkeby.etherscan.io</a> <a href="https://blockexplorer.one/eth/rinkeby">https://blockexplorer.one/eth/rinkeby</a>
Goerli	<a href="https://stats.goerli.net">https://stats.goerli.net</a>	<a href="https://goerli.etherscan.io">https://goerli.etherscan.io</a>
Athereum		<a href="https://cchain.explorer.avax-test.network">https://cchain.explorer.avax-test.network</a>

# PD-4.8 Request Infura API key



<https://infura.io/register>