Intro to Ethereum Development and ConsenSys tools

A primer

By Marc Lijour

April 21, 2018

The largest blockchain company in the world with 800 employees across 28 countries

Who am I?

https://www.linkedin.com/in/marclijour/

Access these slides

http://bit.ly/2CKK5x3

or find by date:

https://github.com/marclijour/presentations

Table of Contents

Ethereum

Ethereum is a **decentralized platform that runs smart contracts**: applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third party interference.
— https://ethereum.org

A short history of Ethereum

Key Milestones:

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- (October 16, 2017) Launch of Metropolis (vByzantium) –version 3
- (2017) ETH goes from $7 to more than $700 (100x increase)

Check the nice infographic (Invezz, 2017).

More information:
- a "prehistory" of the Ethereum protocol (Buterin, 2017).
- the official *Ethereum White Paper*.

Store of value

Figure: ETH price (Coindesk, 2017)

Decentralization

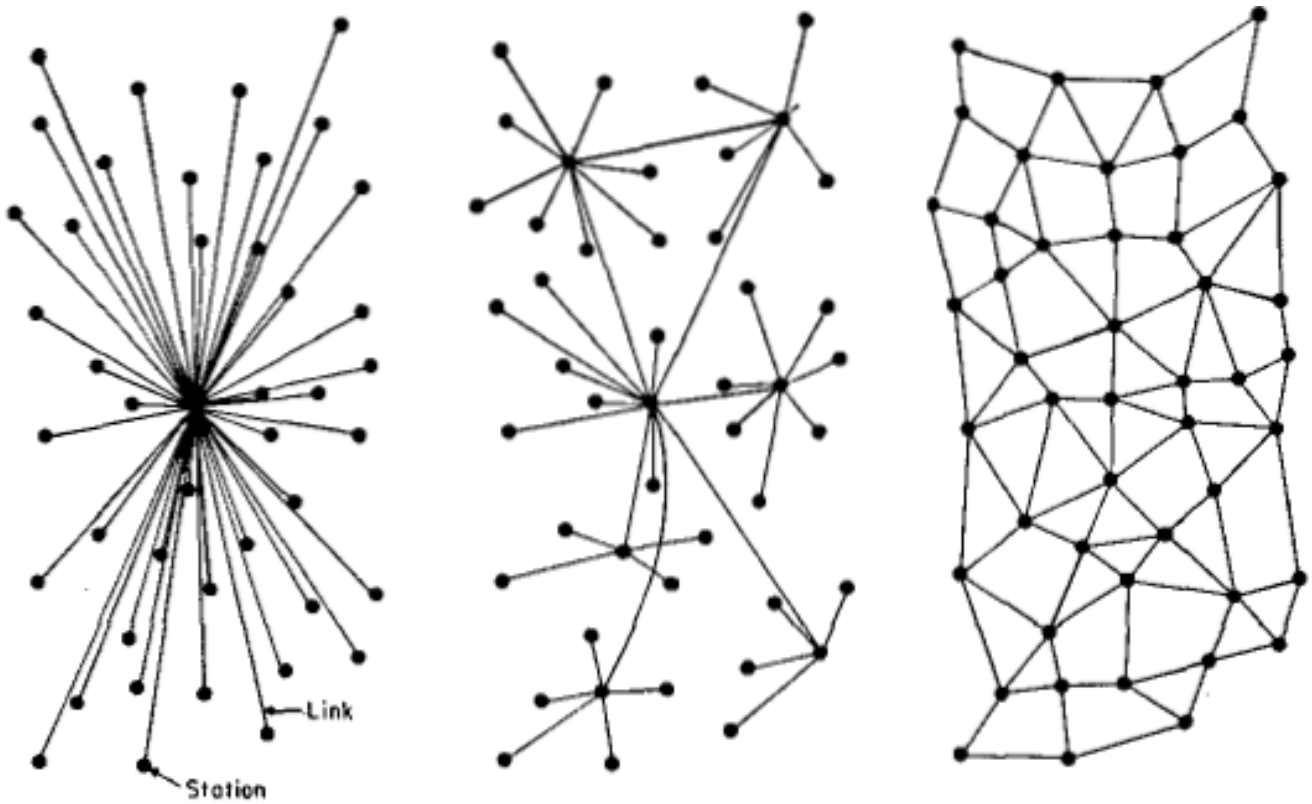


Fig. 1—(a) Centralized. (b) Decentralized. (c) Distributed networks.

Client Types

- Full node

Client Types

- Full node
- Light node

Client Types

- Full node
- Light node
- Something in between (e.g. "fast" for geth)

Disk Space

Full Archive Ethereum node

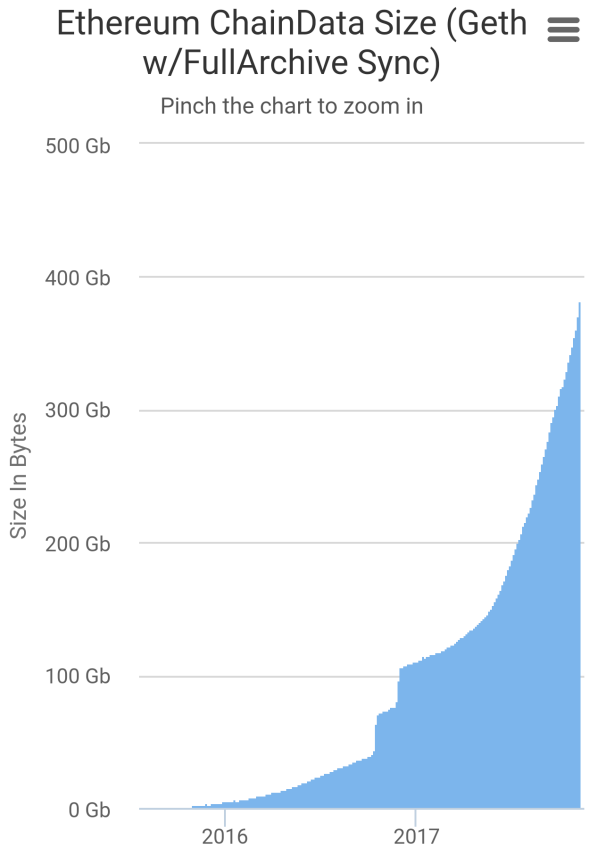


Figure: Miners need a lot of space (Reddit, 2017)

Disk Space

Ethereum vs. Bitcoin

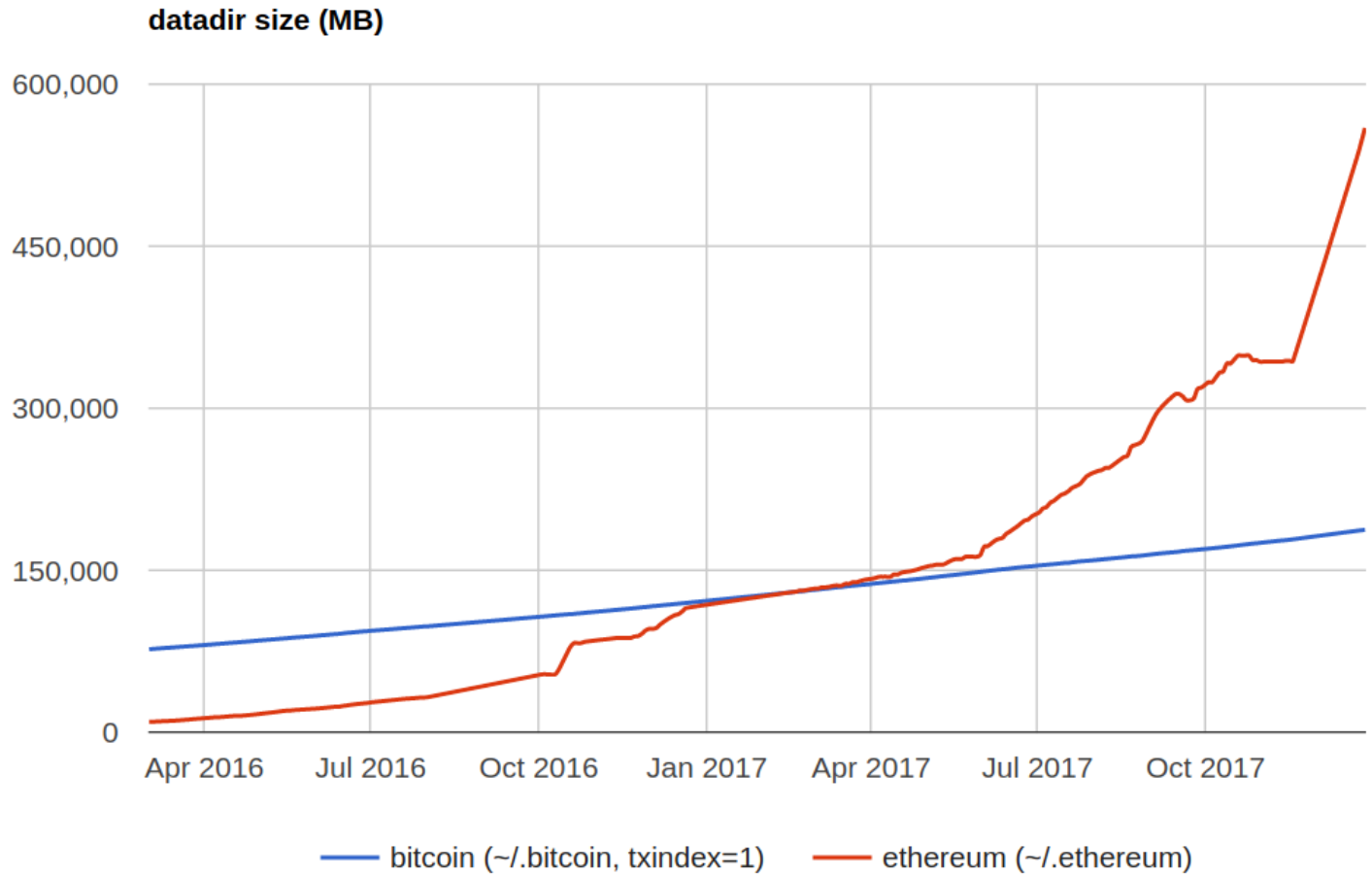


Figure: Disk space used by Geth (`fast`) vs. Bitcoin (Daniel, 2017)

Disk Space

With Geth `--syncmode fast` (default mode)

This mode initializes a ∼20 GB database, then turns in full node.

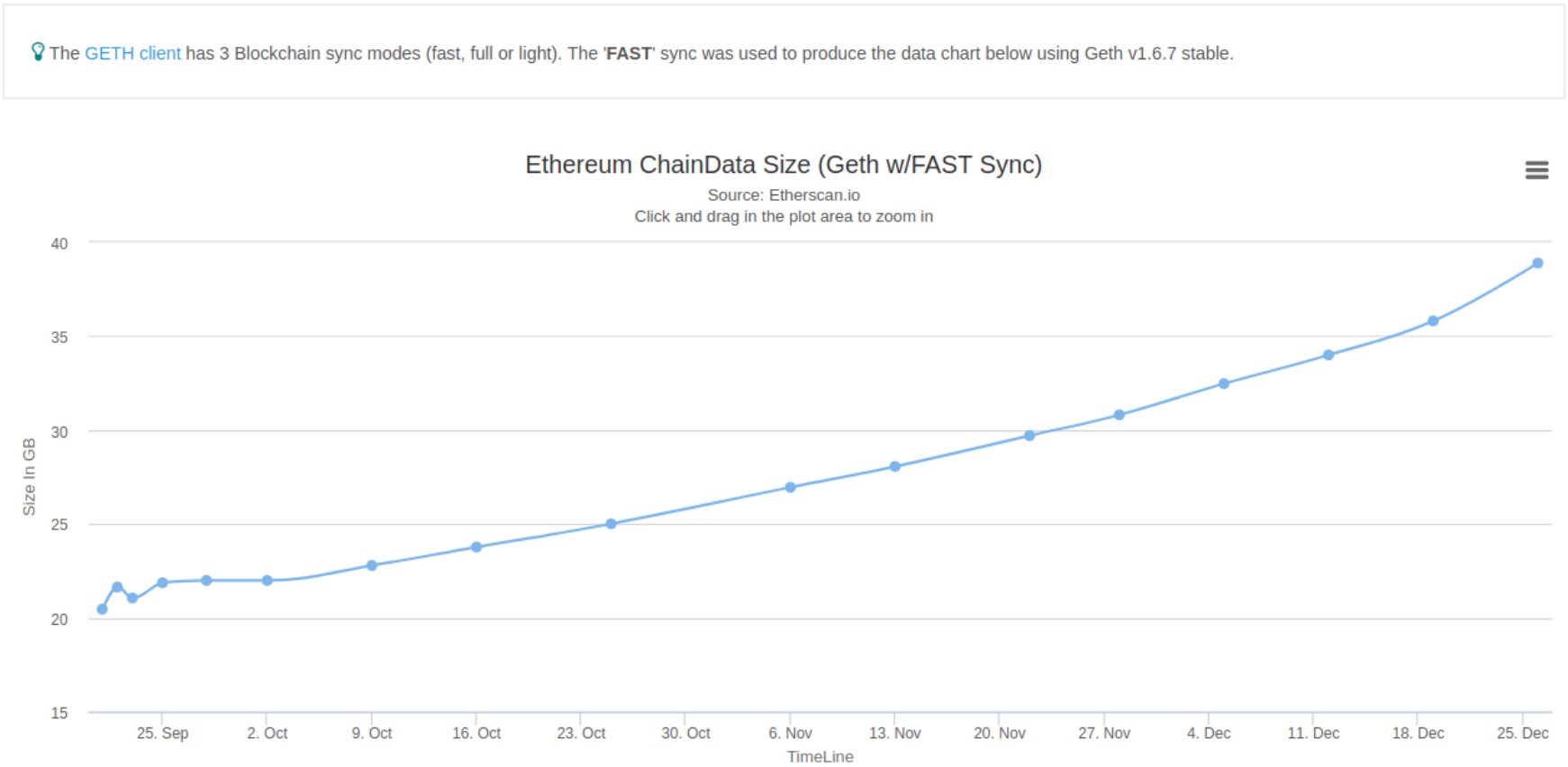


Figure: Disk space used by Geth (in fast mode) (Etherscan, 2017)

Disk Space

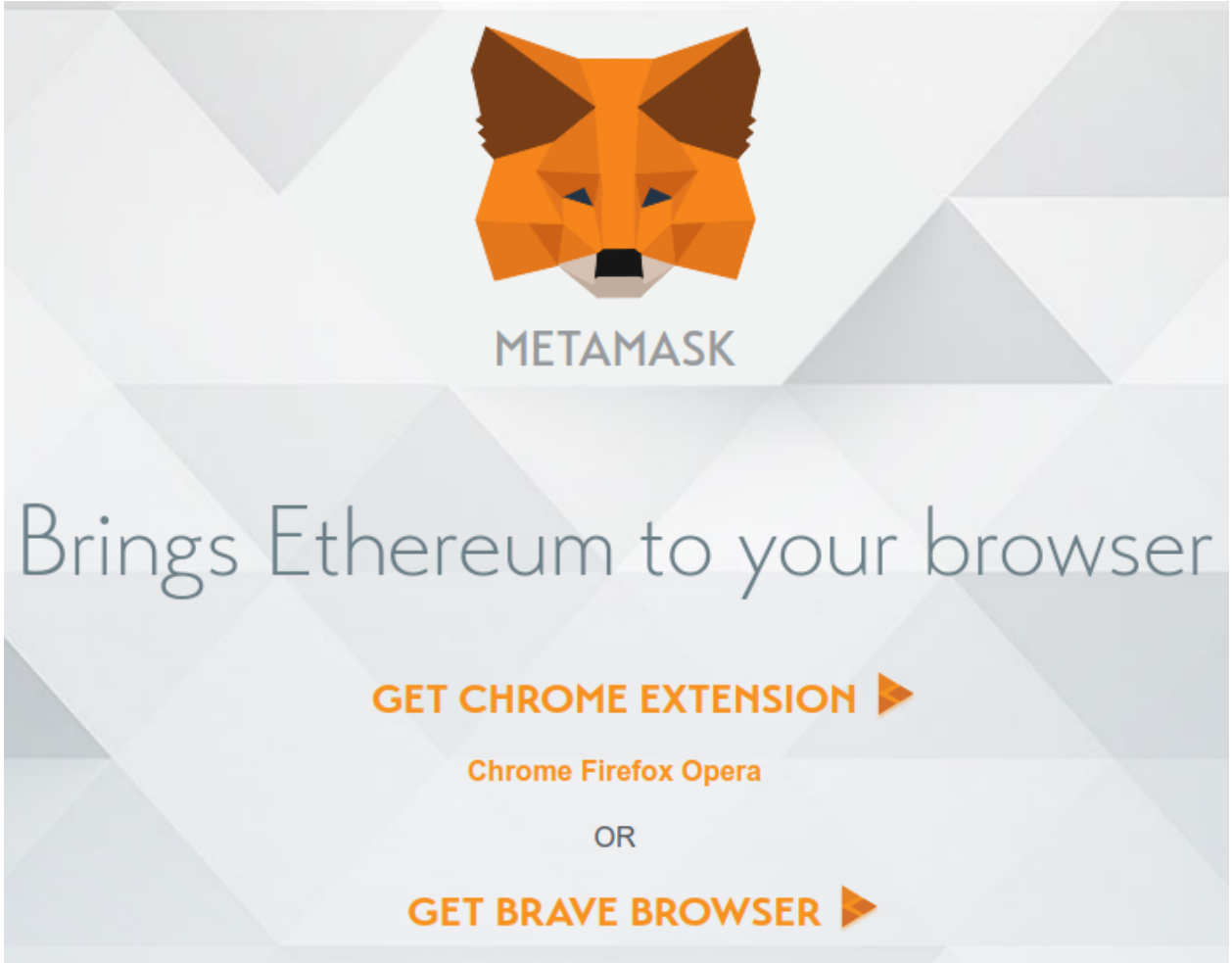
Parity allows for continuous state trie pruning

In green, the configuration running as *full node*.
A light client can fit in ∼5 MB.

ID	Pruning Mode	Database Configuration	Block Verification	Available Blocks	Available States	Chaindata Size	Parity CLI Flags to use this configuration
0	Archive	+Fat +Trace	Full	All	All	385.000 GB	--pruning archive --tracing on --fat-db on
1	Archive	+Trace	Full	All	All	334.000 GB	--pruning archive --tracing on
2	Archive		Full	All	All	326.000 GB	--pruning archive
3	Fast	+Fat +Trace	Full	All	Recent	37.000 GB	--tracing on --fat-db on
4	Fast	+Trace	Full	All	Recent	34.000 GB	--tracing on
5	Fast		Full	All	Recent	26.000 GB	--no-warp
6	Fast	+Warp	Ancient-PoW-Only	All	Recent	25.000 GB	
7	Fast	+Warp -Ancient	No-Ancient	Recent	Recent	5.300 GB	--no-ancient-blocks
8	Light		Headers-Only	None	None	0.005 GB	--light

Figure: Disk space used by Parity (Afri, 2017)

Metamask



https://metamask.io

Practical Applications

for personal or business use

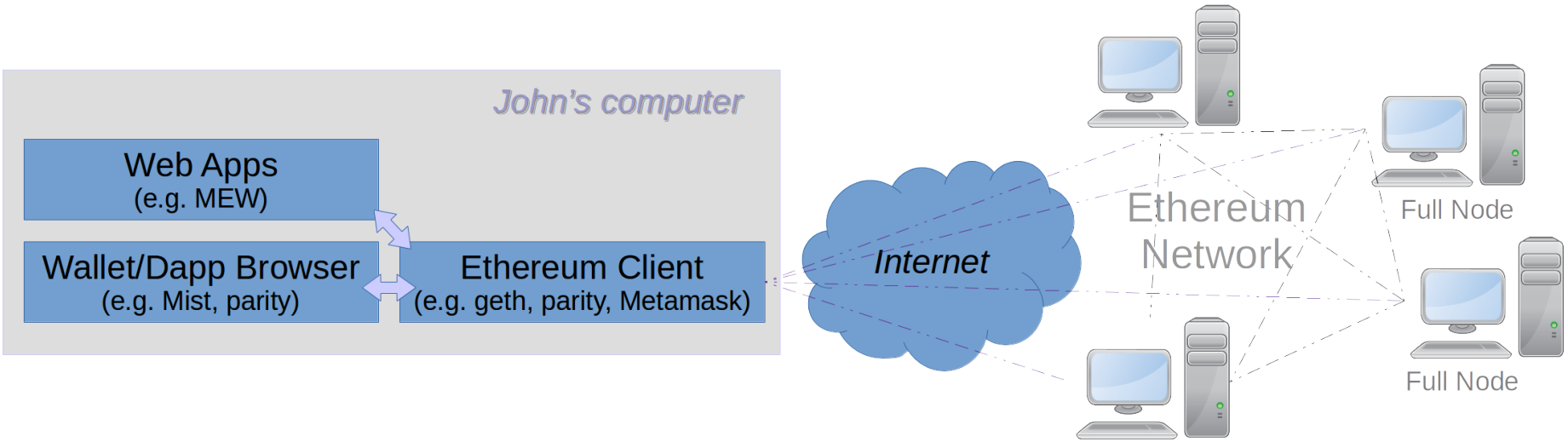


Table of Contents

Sizing up

1) Ethereum Node, Wallet, historical data, Smart Contracts, and Dapps:
   - Linux machine (Ubuntu 16.04 / Linux Mint 18.x –until April 2021)
   - Parity (or Geth)
   - A Solidity compiler

2) Developer light setup: (works on ChromeOS)
   - Chrome browser (or Chromium) –any OS
   - Metamask Extension
   - Remix IDE

3) Developer Pro setup:
   - truffle

Parity

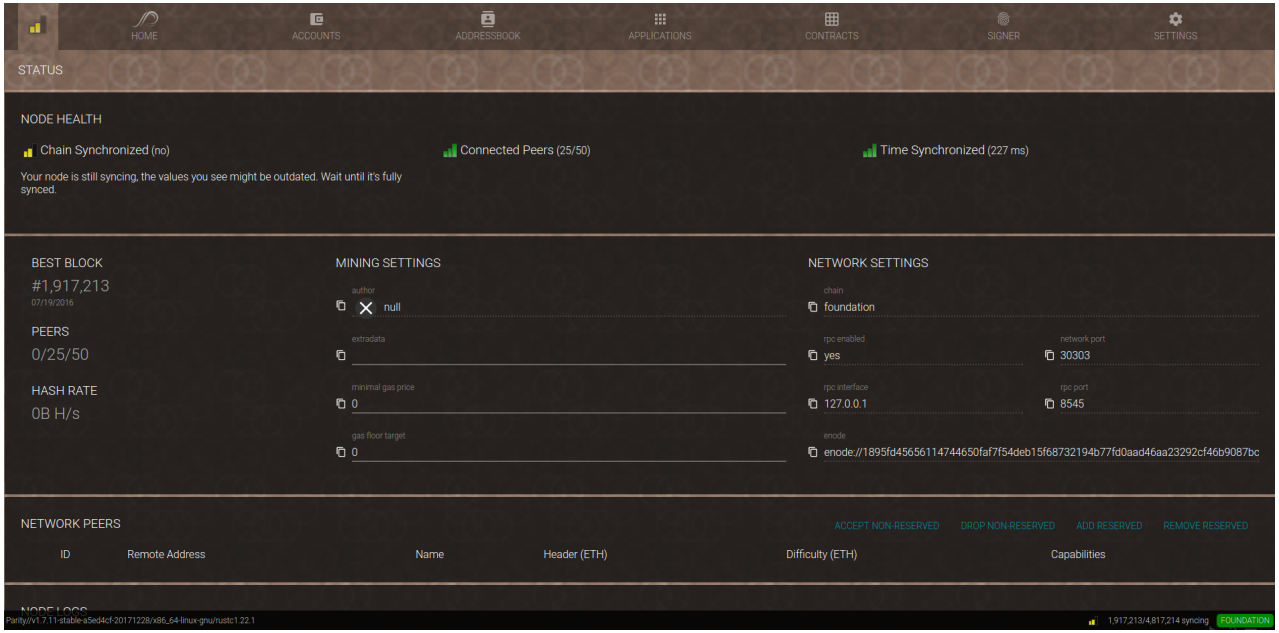
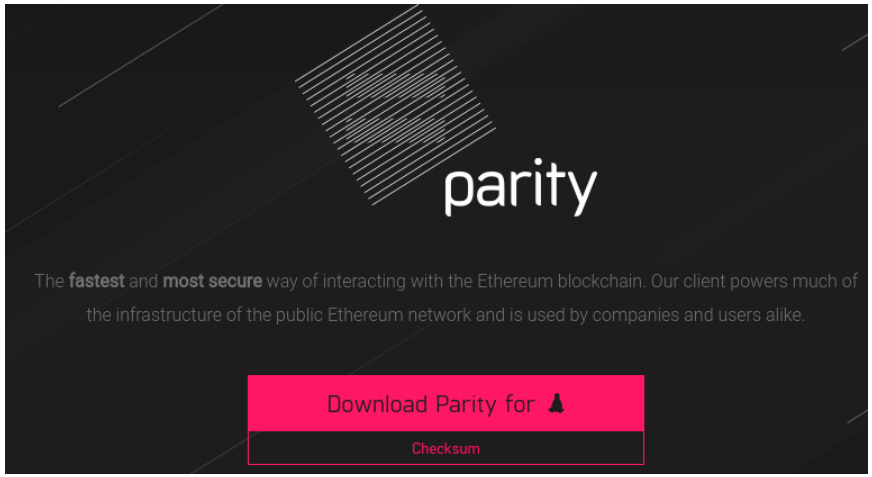


Figure: The Parity client syncing

- Typical Account Management, multi-sig, hardware support
- Access Dapps directly (e.g. app to create an ERC-20 token)
- Code editor and Solidity compiler for smart contracts
- Fast and reliable (written in Rust)
- Most OS, Docker images; and compliant with JSON-RPC API

Installing Parity

Installing Parity



https://www.youtube.com/watch?v=WNT2O6xyDmM (Windows-based, 16 min)

1. Go to https://www.parity.io
2. Download the relevant binaries, e.g. on Linux:
3. Check the checksum: `$ md5sum parity_1.7.11_amd64.deb`
4. Install: `$ sudo dpkg -i parity_1.7.11_amd64.deb`
5. Check the version: `$ parity -v`

Run Parity on the Kovan Testnet

```
$ parity --light --testnet
2017-12-28 23:38:25  Starting Parity/v1.7.11-stable-a5ed4cf-20171228/x86_64-linux-gnu/rustc1.22.1
2017-12-28 23:38:25  Keys path /home/marc/.local/share/io.parity.ethereum/keys/Kovan
2017-12-28 23:38:25  DB path /home/marc/.local/share/io.parity.ethereum/chains/kovan/db/9bf388941c25ea98
2017-12-28 23:38:25  Path to dapps /home/marc/.local/share/io.parity.ethereum/dapps
2017-12-28 23:38:25  Running in experimental Light Client mode.
...
```

Then go to http://localhost:8180 (or http://web3.site if online), and follow the instructions.

- After reading the legal terms and conditions, you can create your first account.
- Click on the top left-most logo (yellow bars) to see the status of your node.
- **It may take days to sync!**

Try running your first Dapp

Follow the tutorial at https://wiki.parity.io/Deploying-Dapps-to-Parity-Wallet (using chevdor's dapp generator and yeoman)

On Linux Ubuntu, make sure you have npm, and make a soft link to node before running `init.sh`:

```
$ sudo apt install npm
$ sudo ln -s /usr/bin/nodejs /usr/bin/node
$ ./init.sh
```

Installing Geth

Installing Geth

Instructions (all OSes) at https://github.com/ethereum/go-ethereum/wiki/Building-Ethereum.
Ubuntu/Mint: https://github.com/ethereum/go-ethereum/wiki/Installation-Instructions-for-Ubuntu

```
$ sudo apt-get install software-properties-common
$ sudo add-apt-repository -y ppa:ethereum/ethereum
$ sudo apt-get update
```

Run the first line to install the full suite (geth, bootnode, evm, disasm, rlpdump, ethtest), or the second line for geth only:

```
$ sudo apt-get install ethereum
$ sudo apt-get install geth
```

Create a new account, and you should be ready to run geth:

```
$ geth account new
$ geth
```

Installing a Solidity Compiler

Provided the previous steps were completed:

```
$ sudo apt-get install solc
$ which solc
```

And in geth, to let it know where solc can be found:

```
$ admin.setSolc("/usr/bin/solc")
```

Now test the code by following the instructions at
https://github.com/ethereum/go-ethereum/wiki/Contract-Tutorial

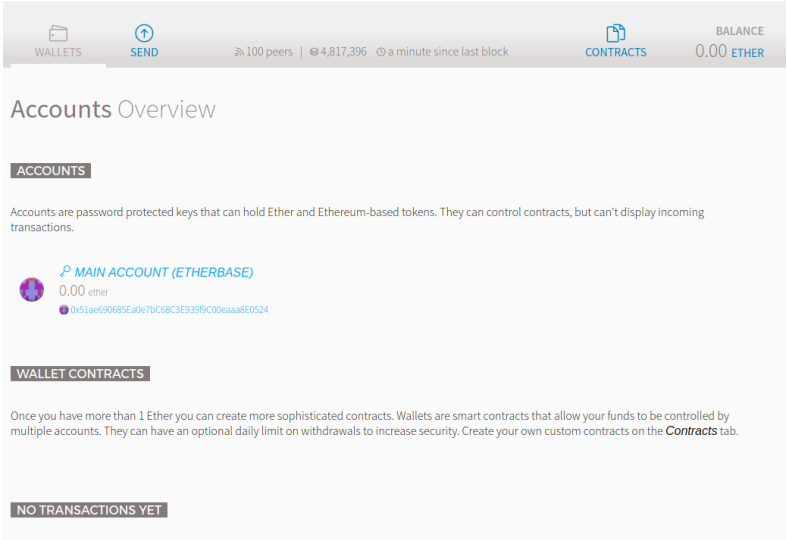
Code Editor

- Vim
- Vim Solidity
- Vim Syntastic

And you still need a wallet

Options:

- Mist Browser (beta) (featured on the right, see also the recent security warning re. Chromium)
- MyEtherWallet (MEW) supports advanced features including hardware wallets



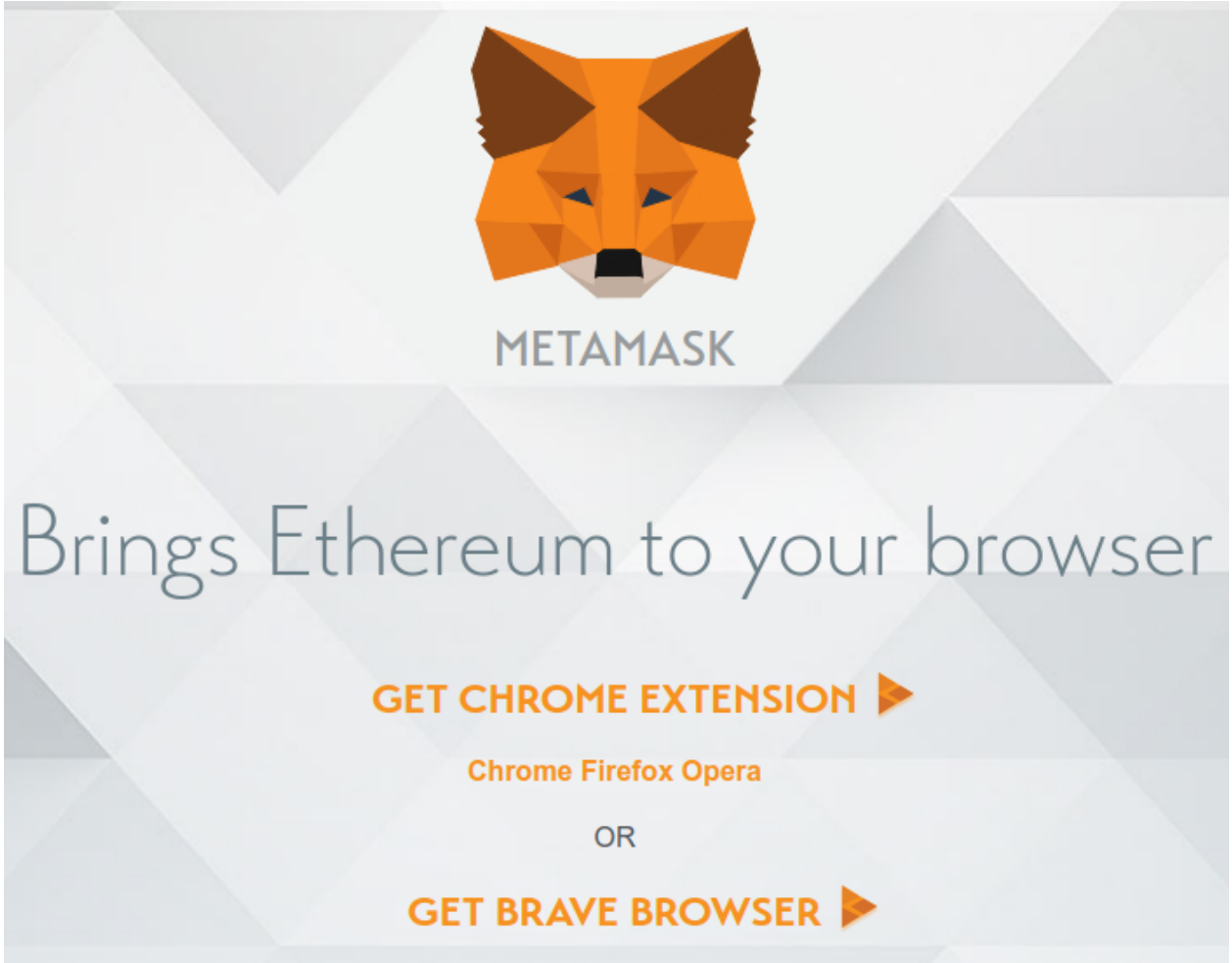
Mist Browser (beta)
https://wallet.ethereum.org
Try on Chrome vs Firefox

Table of Contents

ConsenSys Dev Tools in Numbers

https://www.youtube.com/watch?v=WKwR51ANy9E

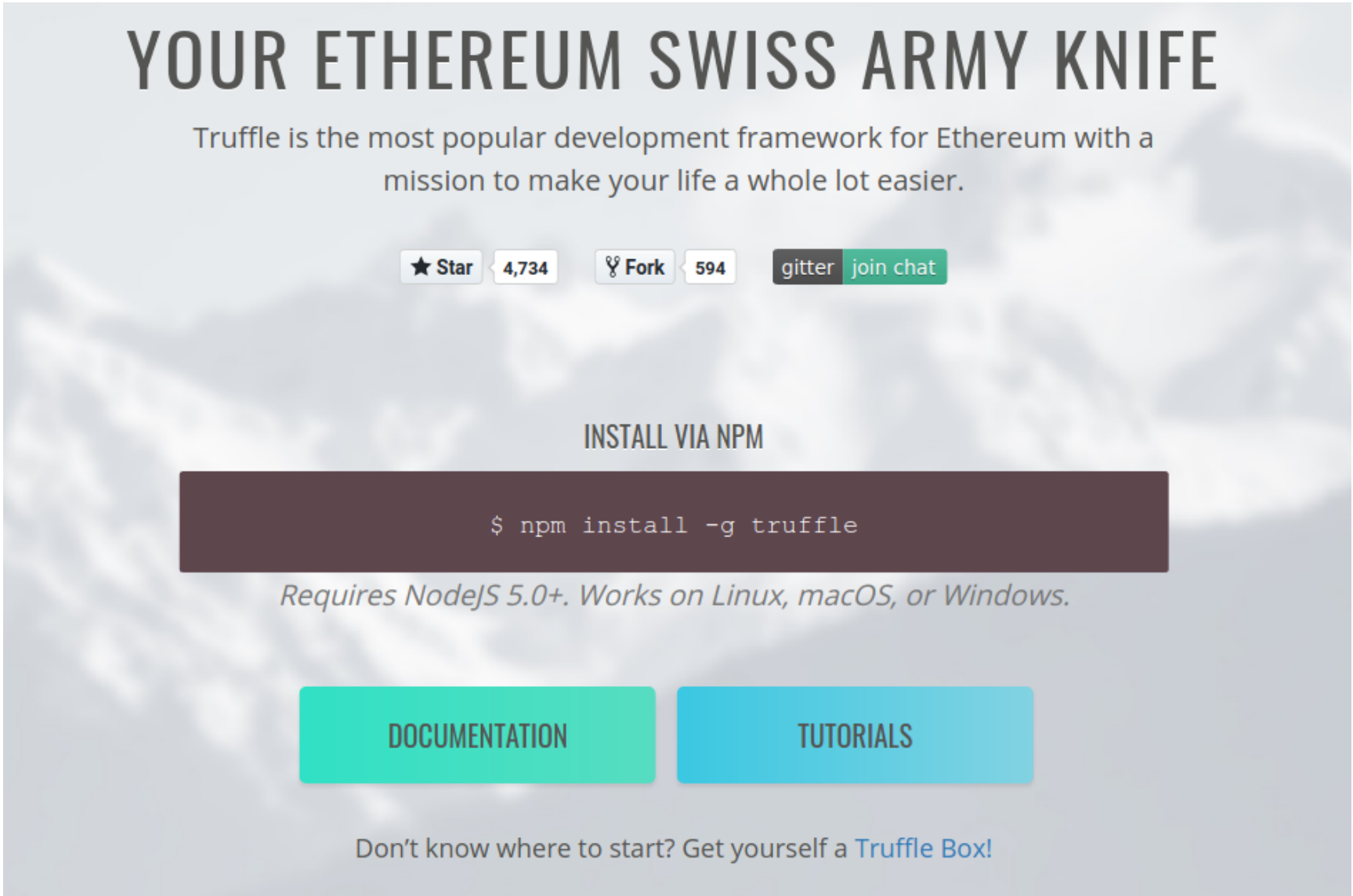
Metamask



https://metamask.io

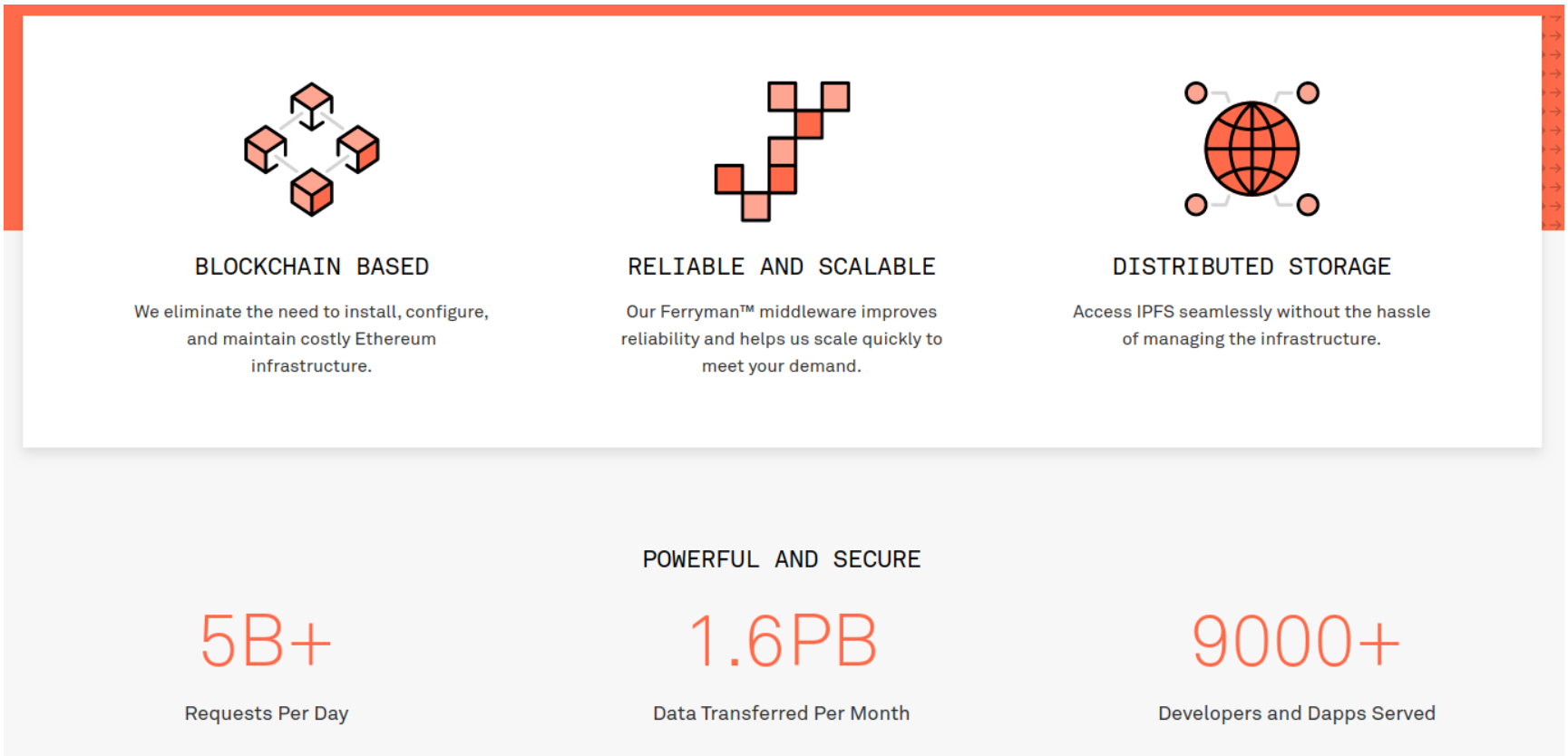
Truffle Framework

http://truffleframework.com



Infura

http://infura.io



Mythril

https://github.com/ConsenSys/mythril

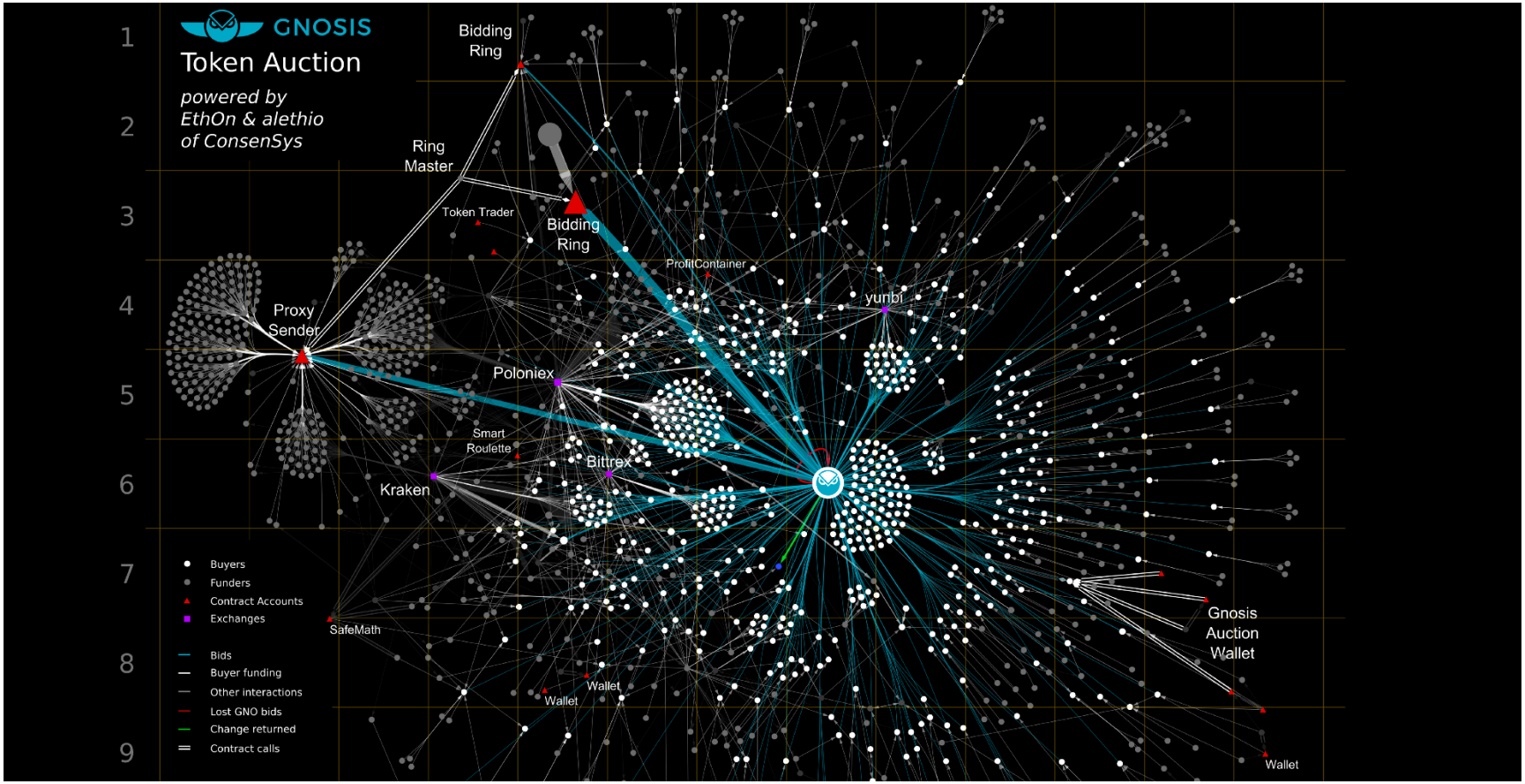
Mythril is a security analysis tool for smart contracts.
It comes as a Python package that requires a solidity compiler and a C++ compiler.

```
$ sudo apt install libssl-dev
$ sudo apt install gcc g++
$ sudo apt install solc
$ sudo pip3 install mythril
$ myth -x contracts/higherbidder.sol
```

See also https://hackernoon.com/introducing-mythril-a-framework-for-bug-hunting-on-the-ethereum-blockchain-9dc5588

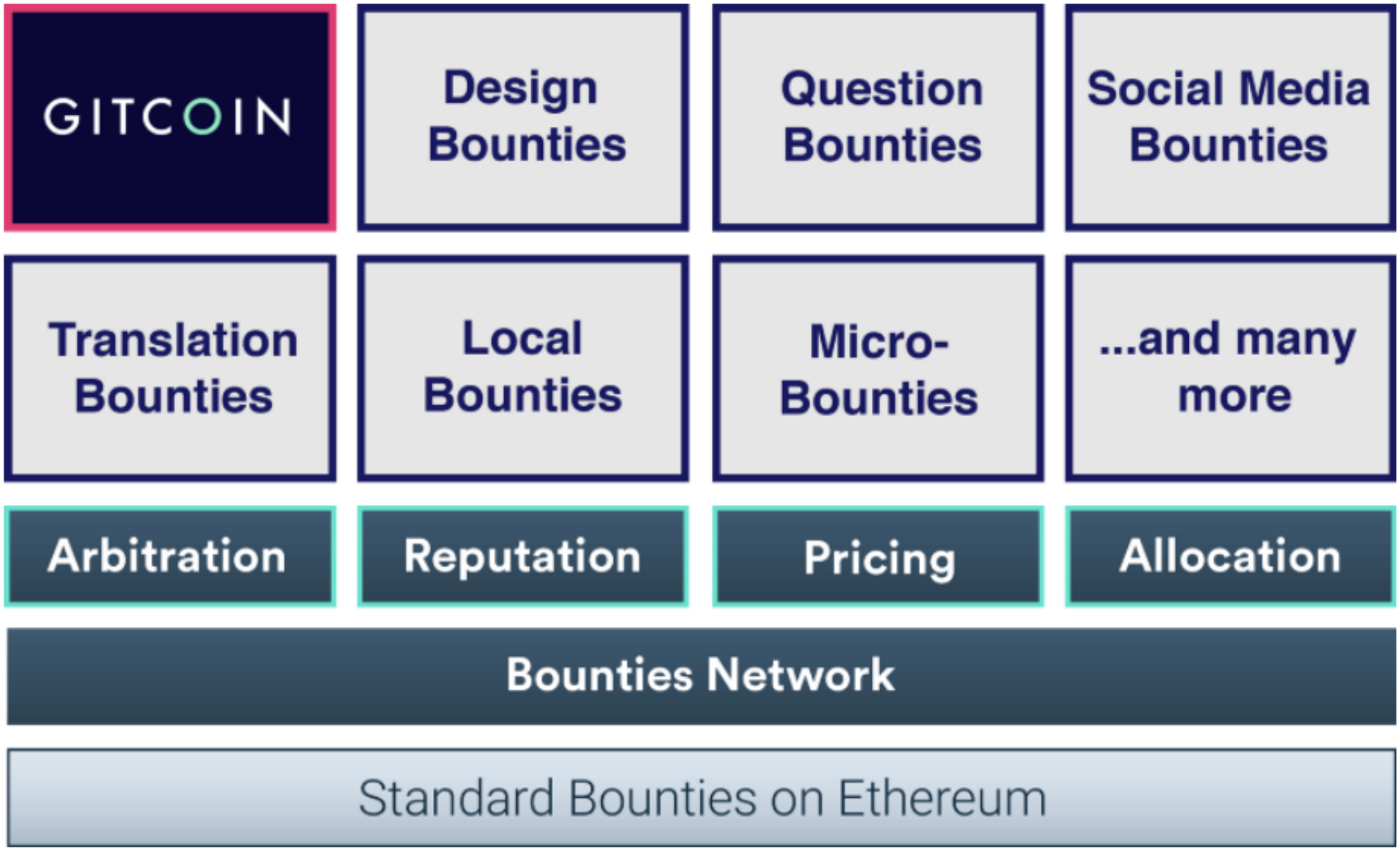
Big Data and Analytics on Ethereum

https://aleth.io



Getting paid for your work: The Bounties Network

https://bounties.network



Gitcoin (depth-first) and Bounties Network (breadth-first) have integrated!

Gitcoin

https://gitcoin.co

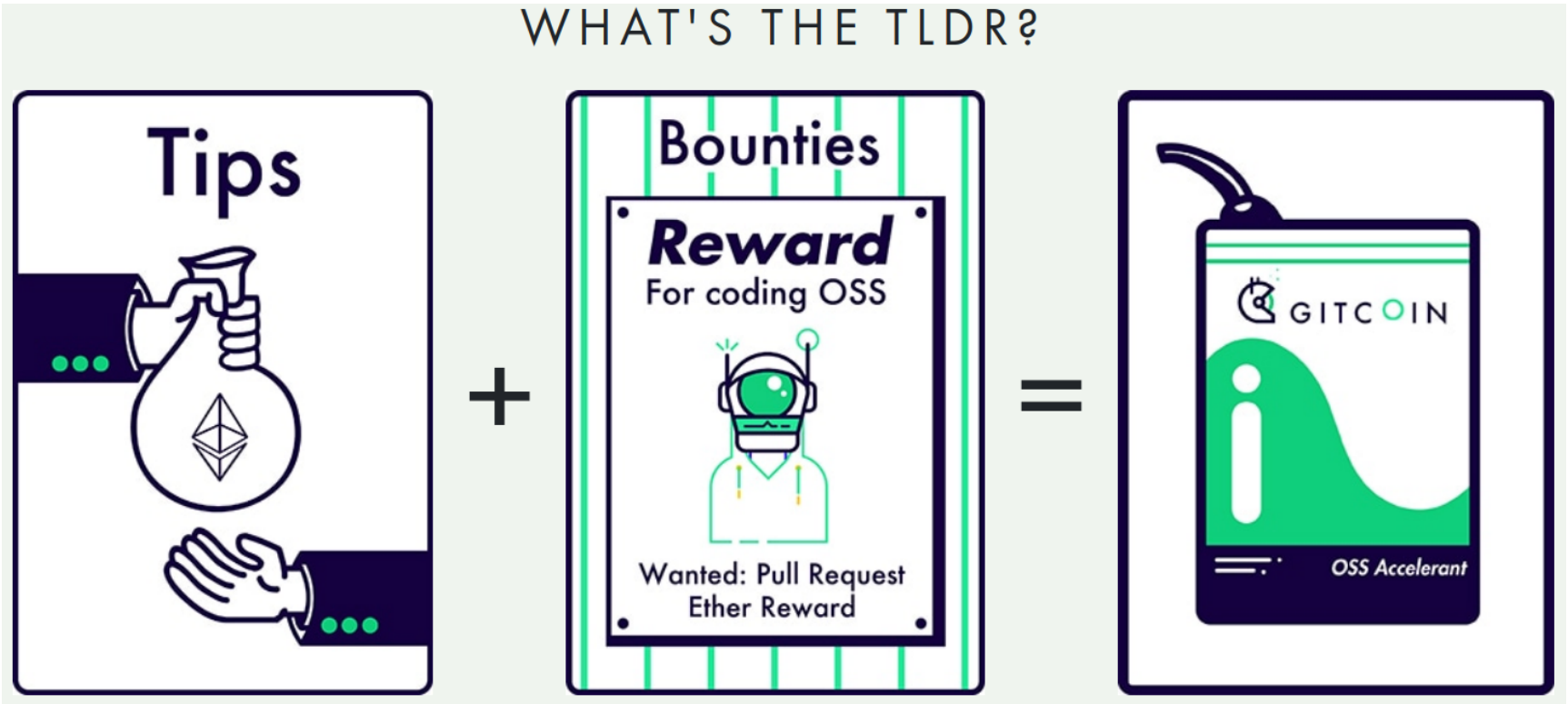


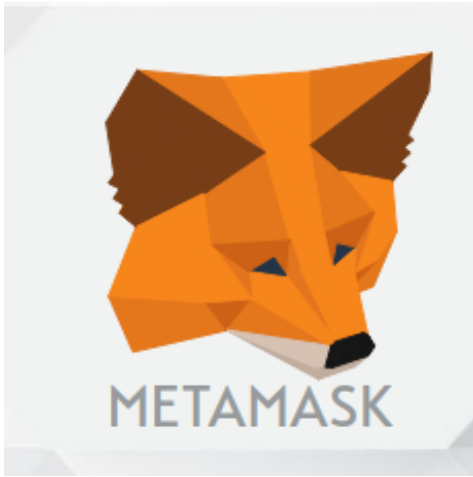
Table of Contents

Let's have some fun!

Install MetaMask

Follow step by step:

1. Install the Chrome/Chromium extension
2. Watch the intro on Youtube
3. Create an account
4. Switch to the Ropsten Testnet (top-left in MetaMask)
5. Fill your account with Ether from https://faucet.metamask.io



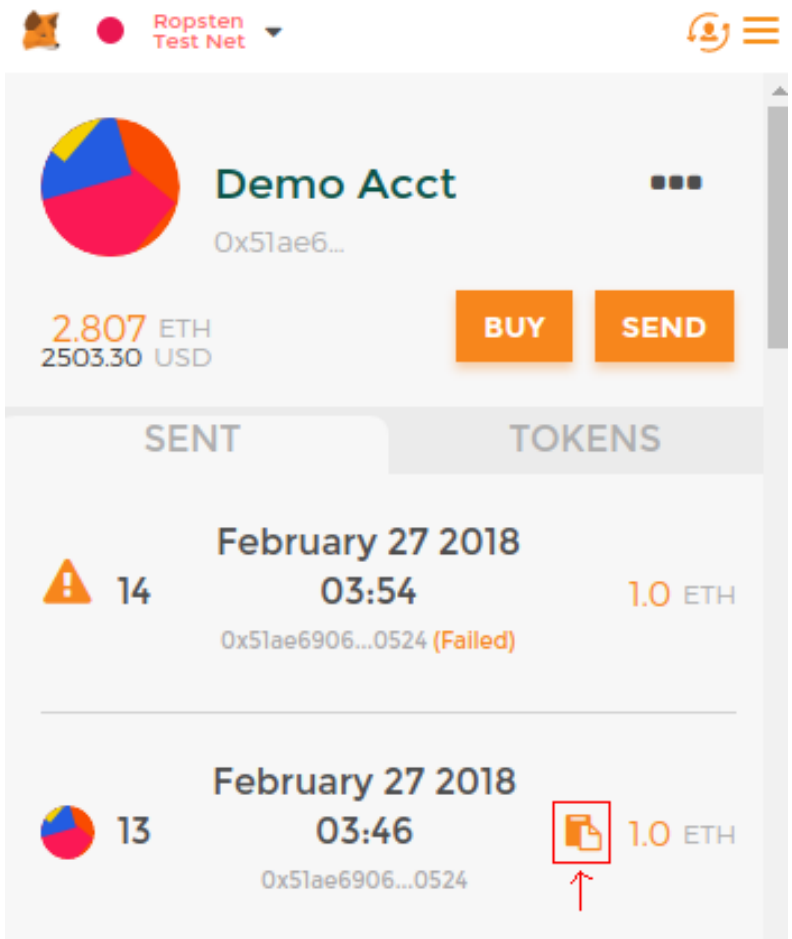
https://metamask.io

Try sending ETH to yourself with Metamask

1. Make sure you're on Ropsten, with some ETH from the faucet
2. Click on "Send" and fill:
   - Account: paste your own address (same account)
   - Amount: 1 ETH
   - Transaction data: convert some text in HEX format with https://www.asciitohex.com, remove all spaces and write it with a 0x prefix (e.g. 0x49742773207469 6d6520746f2072756e)
3. Click on "Next"
4. Use a gas price > 30 (the higher the faster)
5. Confirm the transaction

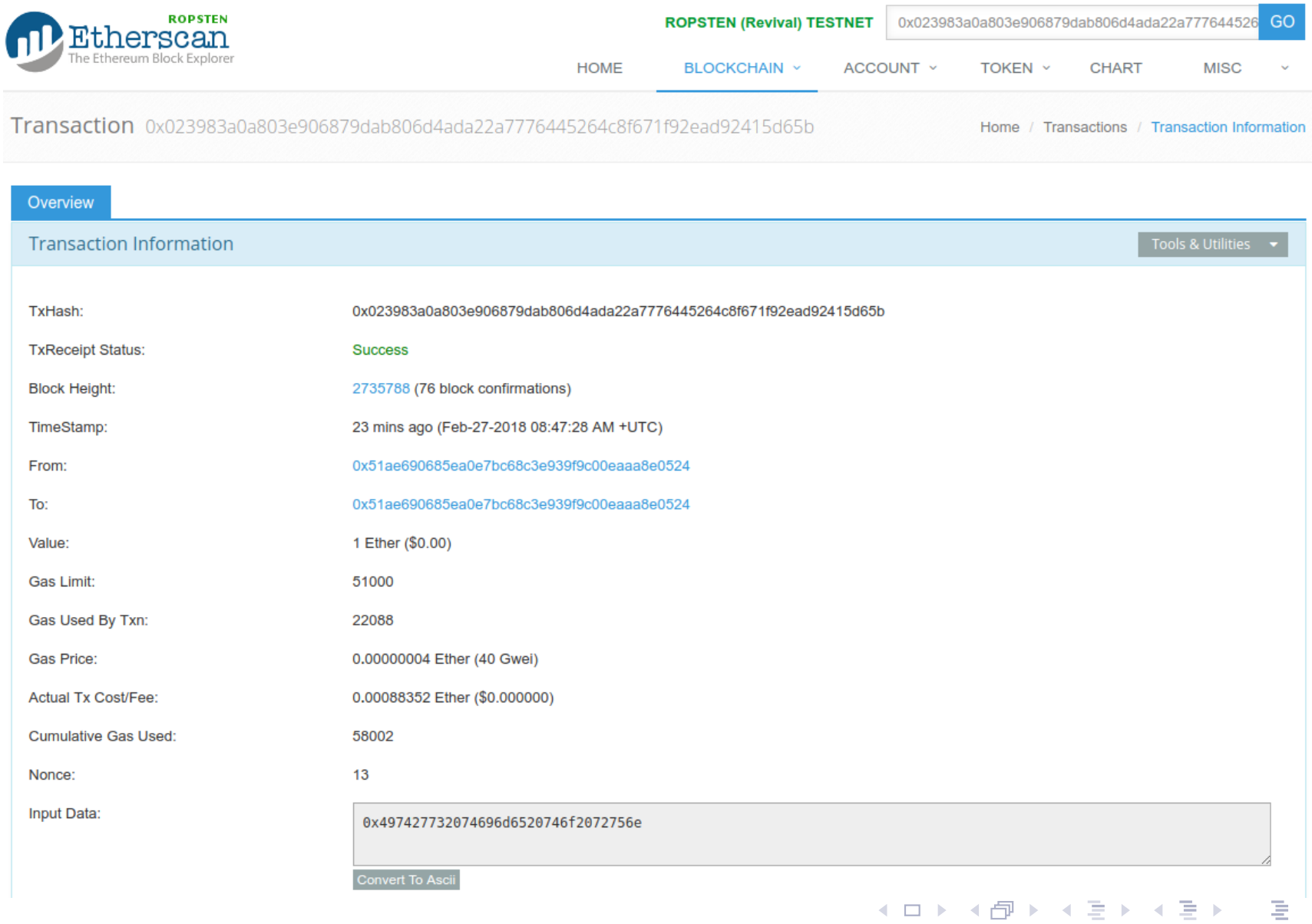
Check the transaction on Etherscan

Copy the transaction



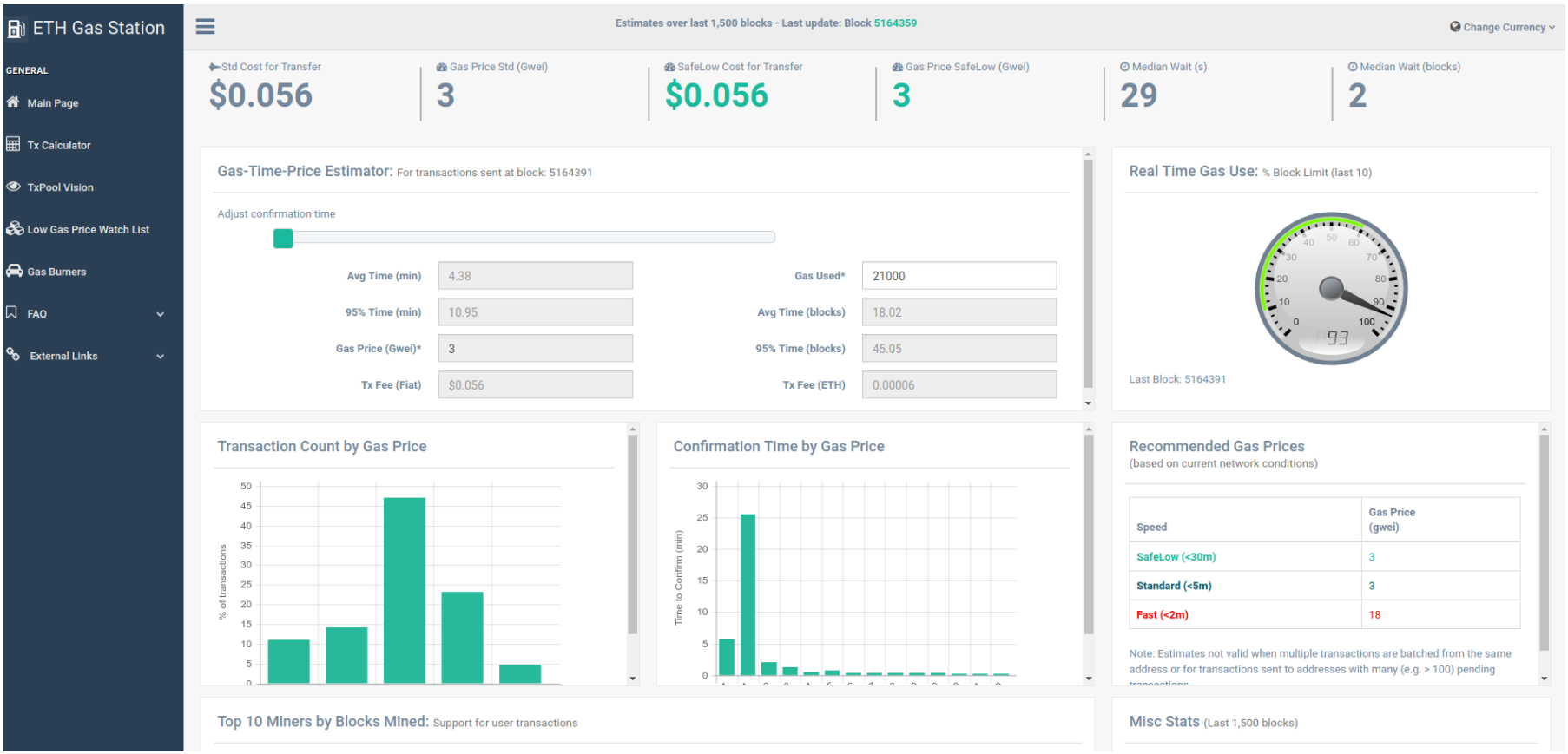
Check the transaction on Etherscan

and click on "Convert to Ascii"

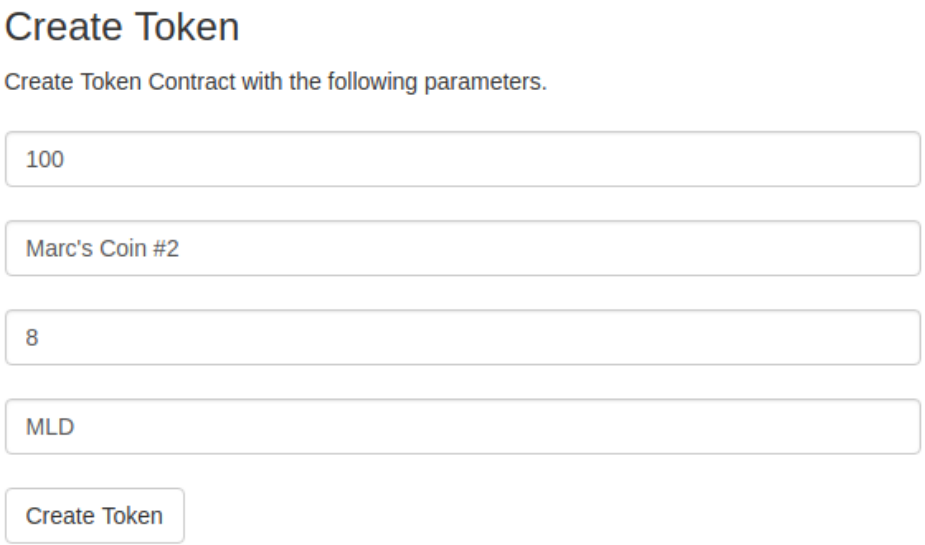


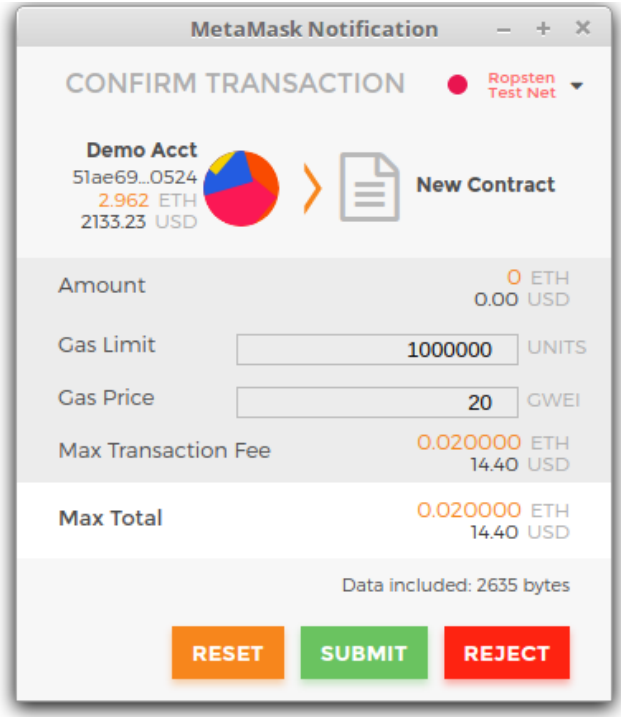
A note about gas price

https://ethgasstation.info



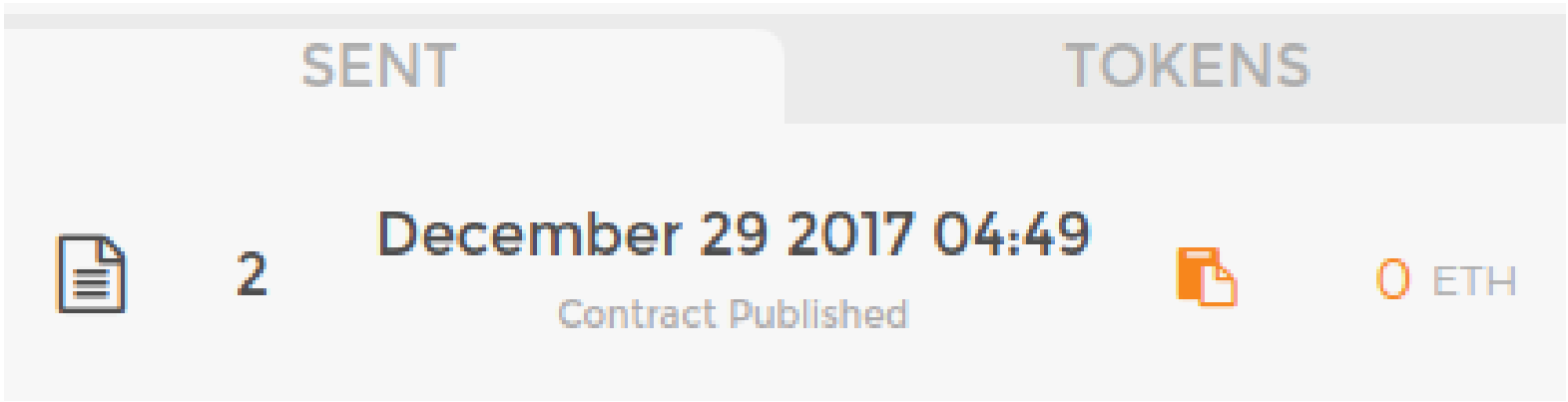
Create your own (ERC-20) token





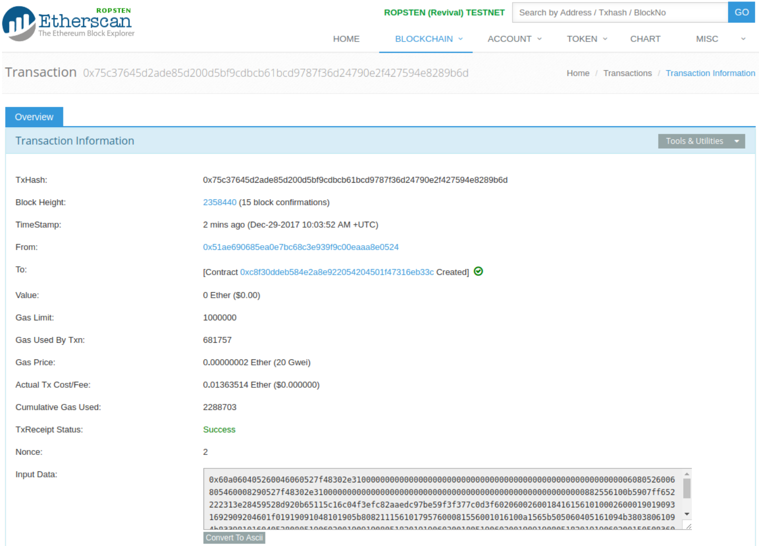
1. Use the Token Factory Dapp at https://tokenfactory.surge.sh/#/factory
2. MetaMask will pop up (see picture above)
3. Submit the transaction (on the Ropsten Testnet)
4. Check your transaction on https://ropsten.etherscan.io

Check your Smart Contract



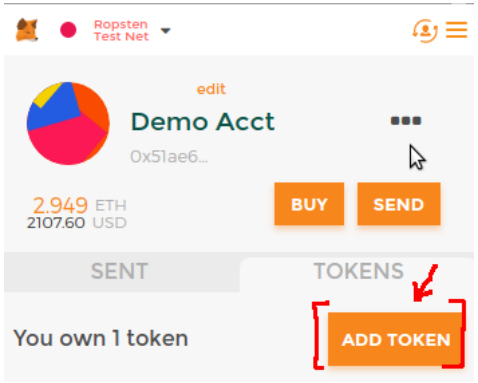
1. Select the "Sent" tab
2. Check the orange Copy icon (Tx Hash)
3. Click on "Contract Published"
4. That should bring you to Etherscan (see next page)

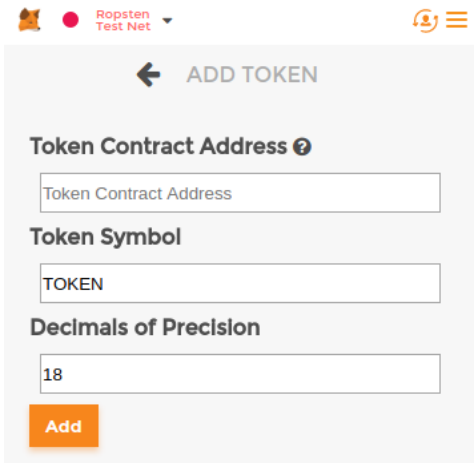
Verify the status of your transaction on Etherscan



Transaction Information: note the “To” line with your contract address

Watch your Token



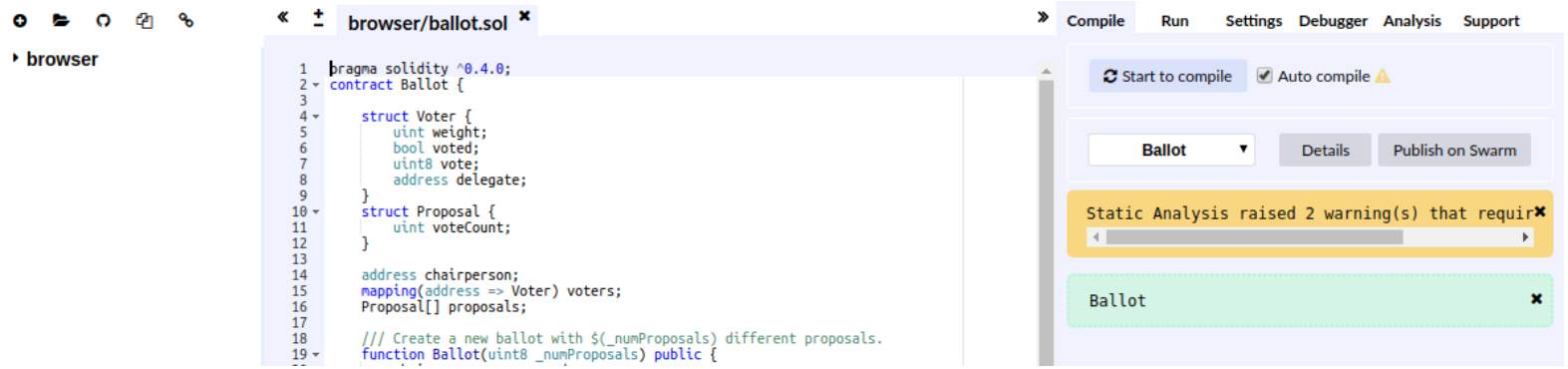


1. Click on the "Add Token" button
2. Wait for the next window (picture on the right)
3. Copy your contract address (from Etherscan)
4. Go back to your Token Factory tab, which should show an UI to interact with your contract or go to the URL: https://tokenfactory.surge.sh/#/token/0x... (replace 0x... by your contract address)
5. Move coins around
6. In MetaMask, click on your token to check the tx on Etherscan

Too easy?

Let's code it in Solidity like the pros!

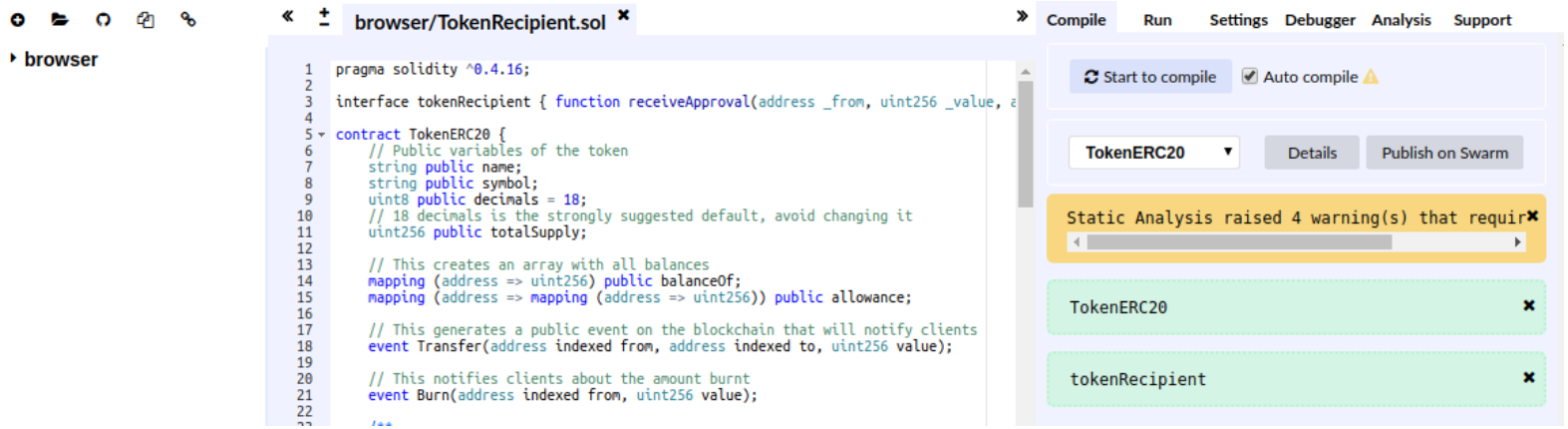
Coding your first ERC-20 Smart Contract



1. Open the Remix IDE at https://remix.ethereum.org
2. Close the ballot file
3. Create a new file named TokenRecipient.sol
4. Copy the code from https://ethereum.org/token (second white box, under "The Code", starting with "pragma")
5. Switch to the "Run" tab (top-right bar, after Compile)

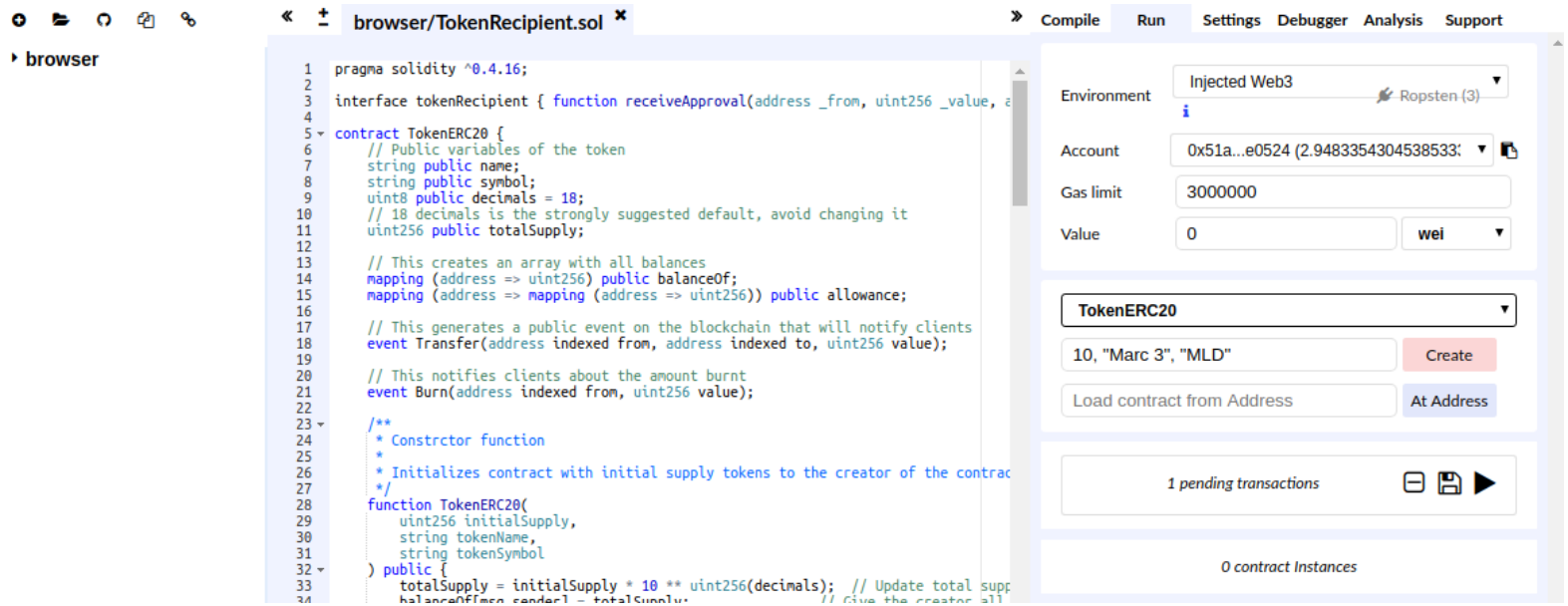
Reference:
ERC-20 Token Standard

Compiling Successfully



1. Two green boxes should show on the right
2. TokenERC20 is the name of the contract (class)
3. tokenRecipient is the name of the interface
4. Switch to the "Run" tab (top right)

Submitting the Smart Contract



1. Under the dropdown showing "TokenERC20", add a number (total amount of tokens to issue) and two strings (the latter is the token symbol)
2. Add enough gas (top right, try 30)
3. Click Create and check whether MetaMask needs confirmation

Interacting with the contract

1. A new interface will pop up on the bottom right corner of the IDE

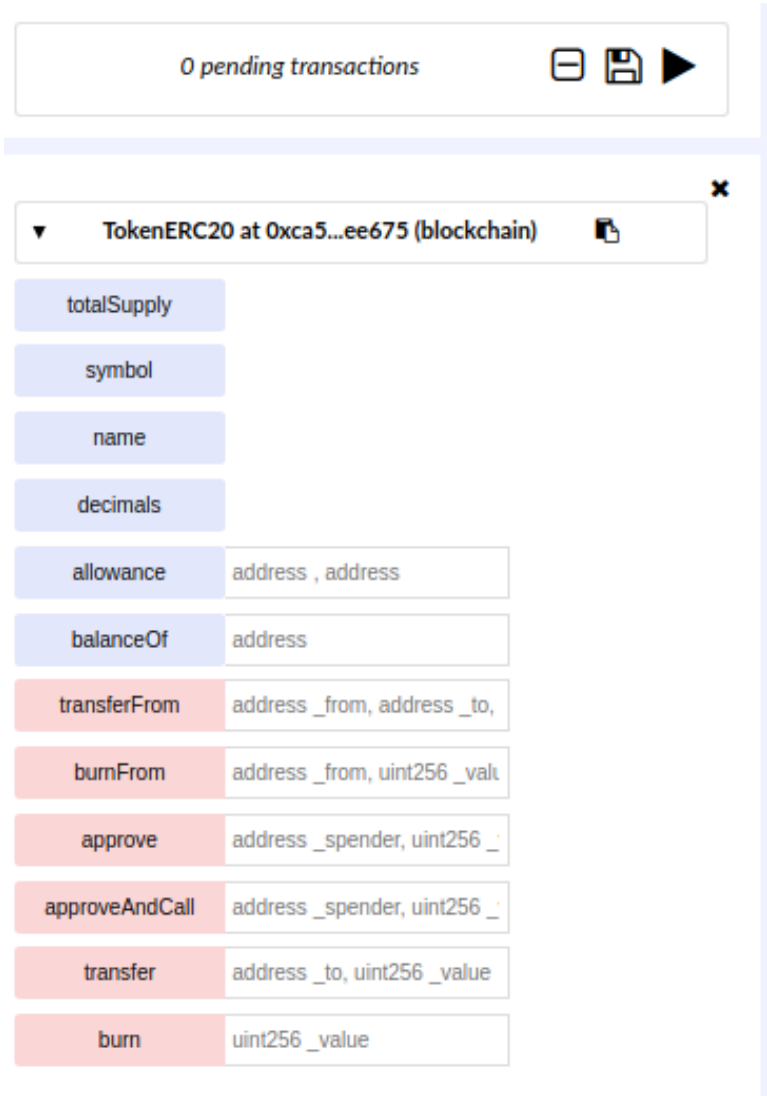
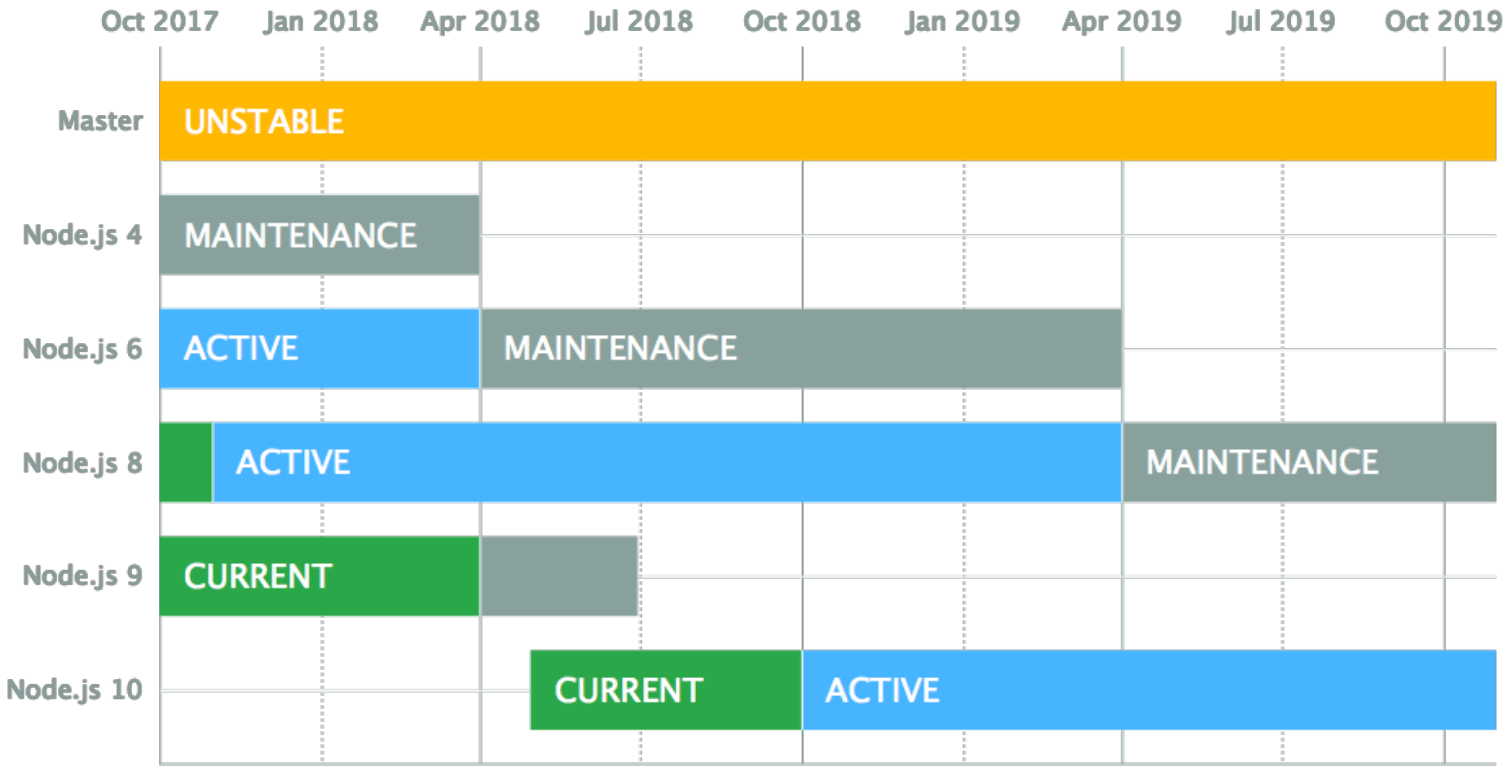


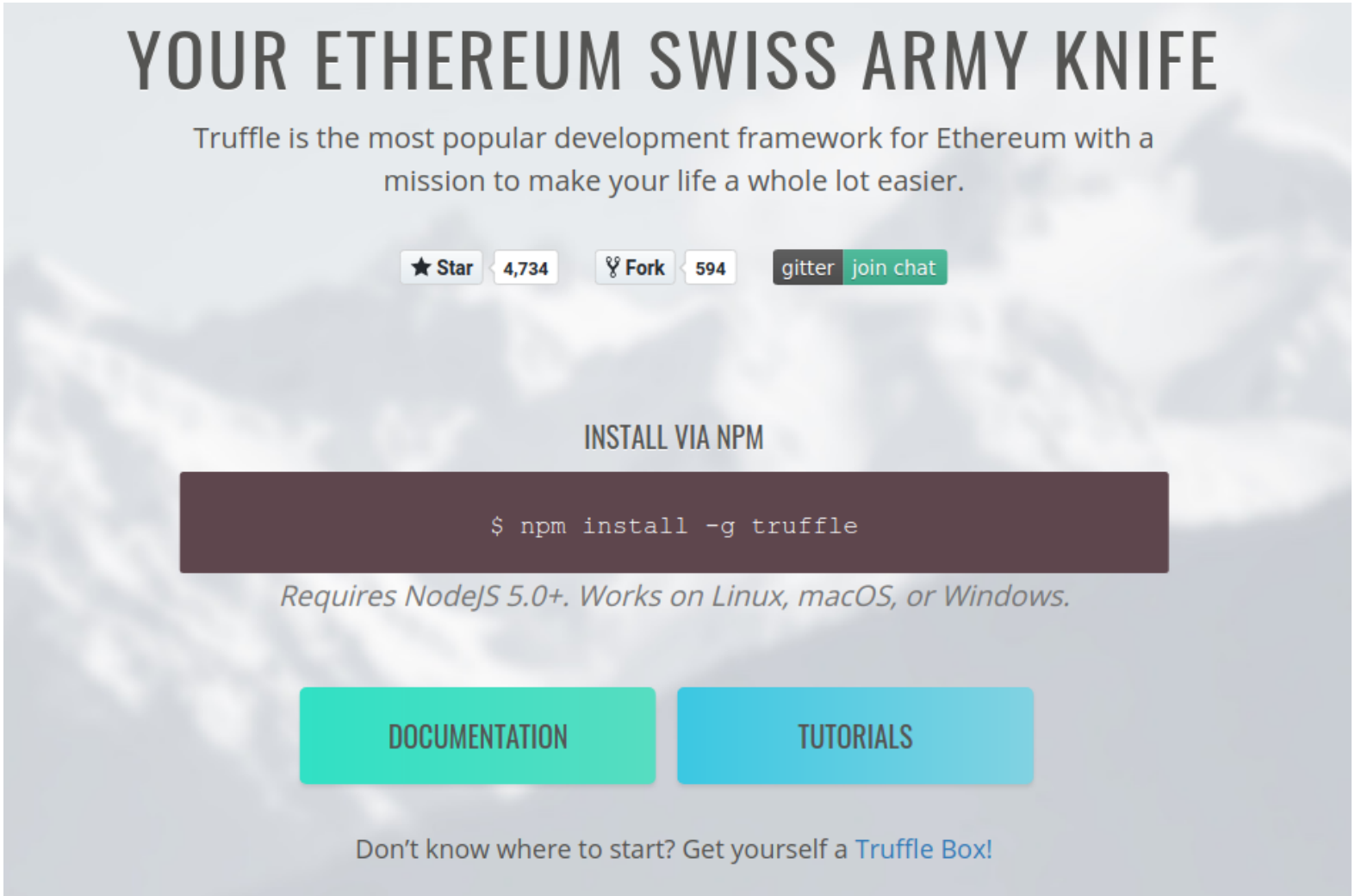
Table of Contents

Required dependency: node.js > 5

Install version 8 –in LTS maintenance until December 2019.
Run a script from https://nodejs.org/en/download/package-manager/



Installing Truffle



Let's build our first Dapp with Truffle

http://truffleframework.com/tutorials/pet-shop

Let's build an ERC20 Token Contract with Truffle

http://truffleframework.com/tutorials/robust-smart-contracts-with-openzeppelin

Table of Contents

Let's create our own permission-based private Blockchain based on Ethereum!

Create a PoA chain with Parity

- PoA: Proof of Authority

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- Parity supports two PoA consensus algorithm: Aura, and Tendermint (experimental)
- Let's follow Parity's Demo PoA tutorial
- Simple Hands-on at https://github.com/marclijour/parity-poa-tutorial

Parity's Demo PoA tutorial

Objectives:

1. Setup two connected nodes on one machine (for demo)
2. Gain familiarity with Parity (UI and command line)
3. Gain a better understanding of diverse types of blockchain (public/private, permissionless/permission-based) and different types of consensus algorithms

Parity's Demo PoA tutorial

Step 1: download the files

This tutorial assumes than you have installed Parity. Instructions are shown for a machine running Linux Ubuntu. The first step consists in cloning the GitHub repo in your machine. You'll run command from within that directory.

```
$ git clone https://github.com/marclijour/parity-poa-tutorial.git
```

Parity's Demo PoA tutorial

Step 2: create nodes and accounts

From the "parity-poa-tutorial" directory, open two terminals and type one line in each:

```
$ parity --config node0.starthere
$ parity --config node1.starthere
```

Open another console and run these scripts:

```
$ ./create_first_authority_address_on_node0.sh
$ ./create_second_authority_address_on_node1.sh
$ ./create_user__address_on_node0.sh
```

Parity's Demo PoA tutorial

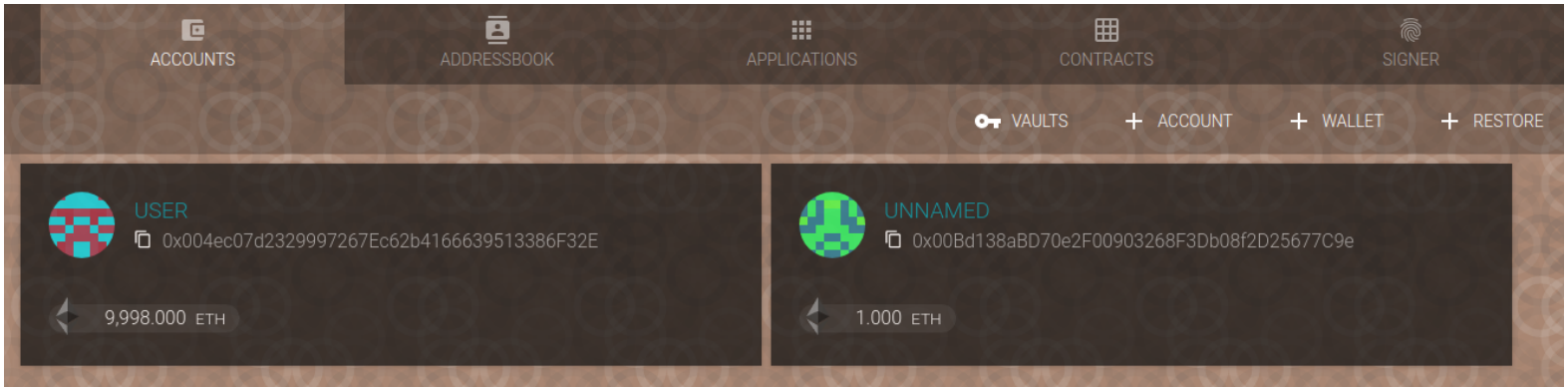
Step 3: start the chain on PoA

In two separate terminals, restart parity with this new configuration.

```
$ parity --config node0.toml
$ parity --config node1.toml
```

Parity's Demo PoA tutorial – Step 4: setup the Parity UI

Open two different windows or tabs in your browser for node 0 (at http://localhost:8181) and node 1 (at http://localhost:8182).

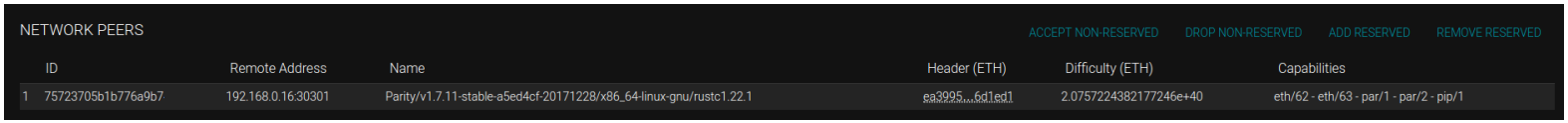


Restore the accounts as above:
- on node 0: `node0` (password = node0), and `user` (password = user)
- on node 1: `node1` (password = node1)

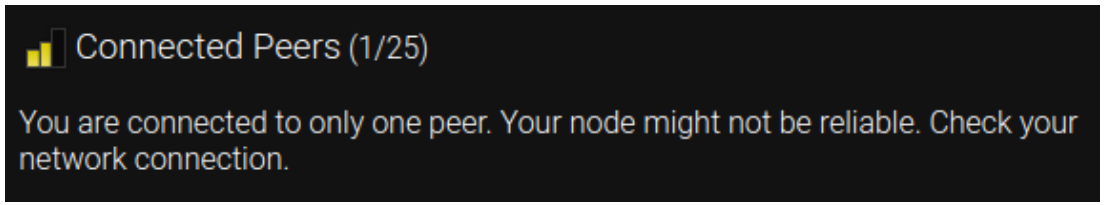
Parity's Demo PoA tutorial

Step 4: connect the nodes with each other

Check the console were you started node 0, and look for the Public Node URL. It should ressemble something like this: `enode://<long hash>@<IP Address>:<Port Number>`



Go to the Status tab (the leftmost tab) in the Web UI for node 1, and look for the Network Peers section. Click on ADD RESERVED, and copy the URL (including enode://).



Check the console output and the Web UI. Both should acknowledged another peer (1/25 Peers instead of 0/25 Peers).

Parity's Demo PoA tutorial

Step 5: send transactions

Run the following scripts and watch the balance for each account in the Web UIs.

```
$ send_from_user_to_node0_account.sh
$ send_from_user_to_node1_account.sh
```

You can also try in a separate console, where you can read the JSON-formatted response.

```
$check_balance_in_node0_account.sh
$check_balance_in_node1_account.sh
```

Parity's Demo PoA tutorial

Step 6: add nodes to the network

Run parity with the right chain specification and let other nodes know (by adding them by enode URL). You just need the demo-spec.json file to get started.

```
$ parity --chain demo-spec.json
```

It's the beginning of a rewarding journey...

Next Steps and Recommended Readings

- Starting on Blockchain: key learning resources
- Fairly exhaustive references from Andreessen Horowitz
- Parity Wiki (e.g. Token Deployment)
- Ethereum White Paper and Wiki
- MOOCs: Udemy (Solidity), edX (Hyperledger)
- Building Blockchain Projects: Building decentralized Blockchain applications with Ethereum and Solidity by Narayan Prusty (2017) *–check the section on Proof of Authority (PoA)*

Thank you!

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