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#### 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





#### Key Milestones:

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- (2017) ETH goes from \$7 to more than \$700 (100x increase)

Check the nice infographic (Invezz, 2017).

Also, see the official Ethereum White Paper.



#### Store of value



Figure: ETH price (Coindesk, 2017)



#### Decentralization

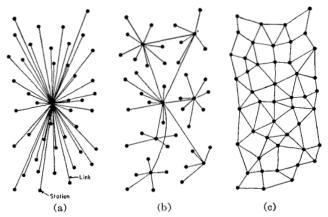


Fig. 1—(a) Centralized. (b) Decentralized. (c) Distributed networks.



## Client Types

• Full node



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## Client Types

- Full node
- Light node



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## Client Types

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



#### Full Archive Ethereum node

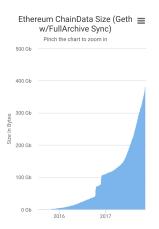


Figure: Miners need a lot of space (Reddit, 2017)



#### Ethereum vs. Bitcoin

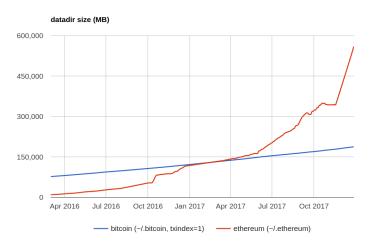


Figure: Disk space used by Geth (fast) vs. Bitcoin (Daniel, 2017)



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With Geth --syncmode fast (default mode)

This mode initializes a  $\sim$ 20 GB database, then turns in full node.

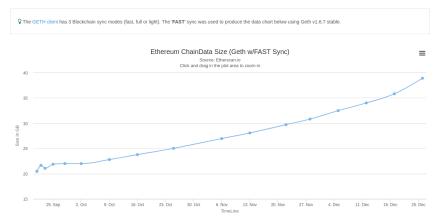


Figure: Disk space used by Geth (in fast mode) (Etherscan, 2017)



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Parity allows for continuous state trie pruning

In green, the configuration running as full node. A light client can fit in  ${\sim}5$  MB.

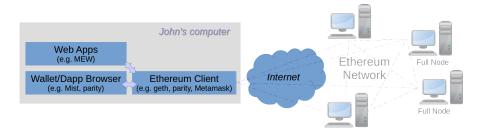
| ID  | Pruning Mode | Database Configuration | Block Verification | Available Blocks | Available States | Chaindata Size | Parity CLI Flags to use this configuration |
|-----|--------------|------------------------|--------------------|------------------|------------------|----------------|--|
| (   | Archive      | +Fat +Trace            | Full               | All              | All              | 385.000 GB     | pruning archivetracing onfat-db on         |
| - 1 | Archive      | +Trace                 | Full               | All              | All              | 334.000 GB     | pruning archivetracing on                  |
| - 2 | Archive      |                        | Full               | All              | All              | 326.000 GB     | pruning archive                            |
| - 3 | Fast         | +Fat +Trace            | Full               | All              | Recent           | 37.000 GB      | tracing onfat-db on                        |
| 4   | Fast         | +Trace                 | Full               | All              | Recent           | 34.000 GB      | tracing on                                 |
|     | Fast         |                        | Full               | All              | Recent           | 26.000 GB      | no-warp                                    |
| (   | 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)



### **Practical Applications**

for personal or business use







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## Assumptions & Recommendations

- 1) Ethereum Node, Wallet, Smart Contracts, and Dapps:
  - Linux machine (Ubuntu 16.04 / Linux Mint 18.x –until April 2021)
  - Parity (or Geth)
  - A Solidity compiler
- 2) Quick setup, Portable, for Users and Developers on the go:
  - Chrome browser (or Chromium) –any OS
  - Metamask Extension
  - Remix IDE



## **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



### Lab 1: set up a full Development Environment

# Installing Parity



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## Installing Parity



 $\rm https://www.youtube.com/watch?v{=}WNT2O6xyDmM \mbox{ (Windows-based, 16 min)}$ 

- Go to https://www.parity.io
- 2 Download the relevant binaries, e.g. on Linux:
- Oheck the checksum: \$ md5sum parity\_1.7.11\_amd64.deb
- Install: \$ sudo dpkg -i parity\_1.7.11\_amd64.deb
- ⑤ Check the version: \$ parity -v



## Run Parity on the Kovan Testnet

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 60+ minutes to sync!



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#### Try running your first Dapp

#### Follow the tutorial at

https://github.com/paritytech/parity/wiki/Tutorial-Part-1.

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/nodeis /usr/bin/node

<sup>\$ ./</sup>init.sh

Lab 1 (b): set up a full Development Environment

# Installing Geth



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### Installing Geth

#### Instructions (all OS) at

https://github.com/ethereum/go-ethereum/wiki/Building-Ethereum.

```
$ 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
```



## 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



## 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



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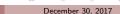
Setting a Development Machine

3 Hands-on Smart Contracts



# Let's have some fun!





#### Install MetaMask

#### Follow step by step:

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



https://metamask.io



## Create your own (ERC-20) token





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



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### Check your Smart Contract

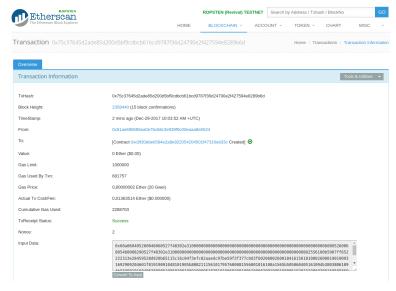


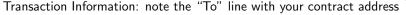
- Select the "Sent" tab
- Check the orange Copy icon (Tx Hash)
- Click on "Contract Published"
- That should bring you to Etherscan (see next page)





# Verify the status of your transaction on Etherscan





### Watch your Token





- Olick on the "Add Token" button
- Wait for the next window (picture on the right)
- Oppy your contract address (from Etherscan)
- 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)
- Move coins around
- In MetaMask, click on your token to check the tx on Etherscan

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# 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
- Close the ballot file
- Oreate a new file named TokenRecipient.sol
- Oppy the code from https://ethereum.org/token (second white box, under "The Code", starting with "pragma")
- Switch to the "Run" tab (top-right bar, after Compile)

#### Reference:

ERC-20 Token Standard



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## Compiling Successfully



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



## Submitting the Smart Contract



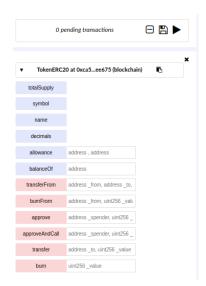
- Under the dropdown showing "TokenERC20", add a number (total amount of tokens to issue) and two strings (the latter is the token symbol)
- Add enough gas (top right, try 30)
- Olick Create and check whether MetaMask needs confirmation



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### Interacting with the contract

 A new interface will pop up on the bottom right corner of the IDF





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



PoA: Proof of Authority



- PoA: Proof of Authority
- PoA is another type of consensus algorithm (not PoW), with no mining required





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- The Kovan test network, Hyperledger and Ripple run on a PoA
- 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



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### Objectives:

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



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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



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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
```



<sup>\$ ./</sup>create\_second\_authority\_address\_on\_node1.sh

<sup>\$ ./</sup>create\_user\_\_address\_on\_node0.sh

Step 3: start the chain on PoA

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

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





<sup>\$</sup> 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:8180) and node 1 (at http://localhost:8181).



#### Restore the accounts as above:

- on node 0: node0 (password = node0), and user (password = user)
- on node 1: node1 (password = node1)



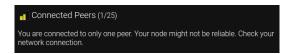
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#### Step 4: connect the nodes with each other

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).

Step 5: send transactions

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

```
$ 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
```





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.

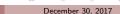
\$ parity --chain demo-spec.json



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





# Next Steps and Recommended Readings

- Starting on Blockchain: key learning resources
- 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)

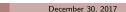


### Thank you!

Email: marc.lijour@ayanaconsulting.net

Twitter: @marclijour





### References

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