Ethereum Development

An introduction to developing Smart Contracts on Ethereum

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The Art and Science of Eternal Blossom

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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.
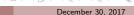— https://ethereum.org

A short history of Ethereum

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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).

Also, see the official *Ethereum White Paper*.

Store of value

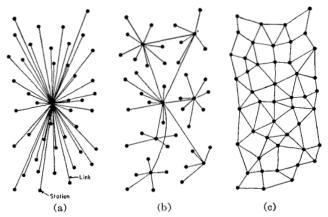Figure: ETH price (Coindesk, 2017)

Decentralization

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

Client Types

- Full node

Client Types

- Full node
- Light node

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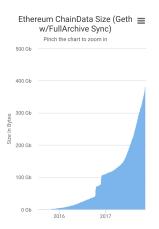- Light node
- Something in between (e.g. "fast" for geth)

Disk Space
Full Archive Ethereum node

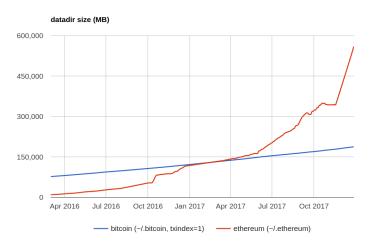Figure: Miners need a lot of space (Reddit, 2017)

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.
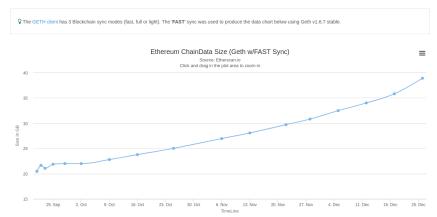

Figure: Disk space used by Geth (in fast mode) (Etherscan, 2017)

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)

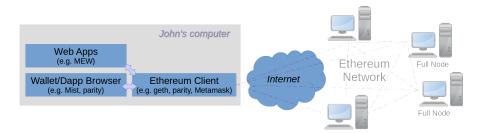# Practical Applications
for personal or business use

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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

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 60+ minutes to sync!**

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/nodejs /usr/bin/node
$ ./init.sh
```

Installing Geth

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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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

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
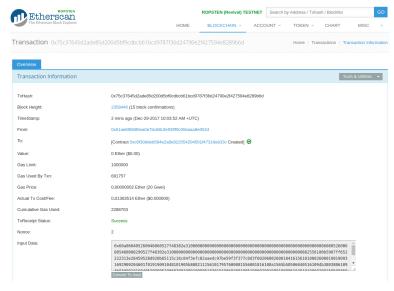
Check your Smart Contract

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

Thank you!

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Twitter: @marclijour

References

Afri. (2017, December). The Ethereum-blockchain size will not exceed 1TB anytime soon. Retrieved from https://dev.to/5chdn/the-ethereum-blockchain-size-will-not-exceed-1tb-anytime-soon-58a

Coindesk. (2017). Ethereum (ETH) Price. Retrieved from https://www.coindesk.com/ethereum-price/

Daniel. (2017, December). Retrieved from http://bc.daniel.net.nz

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