



Ethereum Workshop

An Introduction to Tools, Solidity & Smart
Contracts

Preparation

- Download and install:
 - Geth – an Ethereum client
Installation instructions:
<https://github.com/ethereum/go-ethereum/wiki/Building-Ethereum>
 - Mist – a DApp browser
Download the file starting with Mist-* (you need to scroll down a bit to find the list of files)
<https://github.com/ethereum/mist/releases>
 - Download all files from:
http://jonaspfannschmidt.com/eth_workshop/



Agenda

- 1) A brief introduction to Ethereum
- 2) Setting up a private blockchain
- 3) Interacting with the blockchain
- 4) Mist
- 5) Solidity & Smart Contracts
- 6) Remix IDE

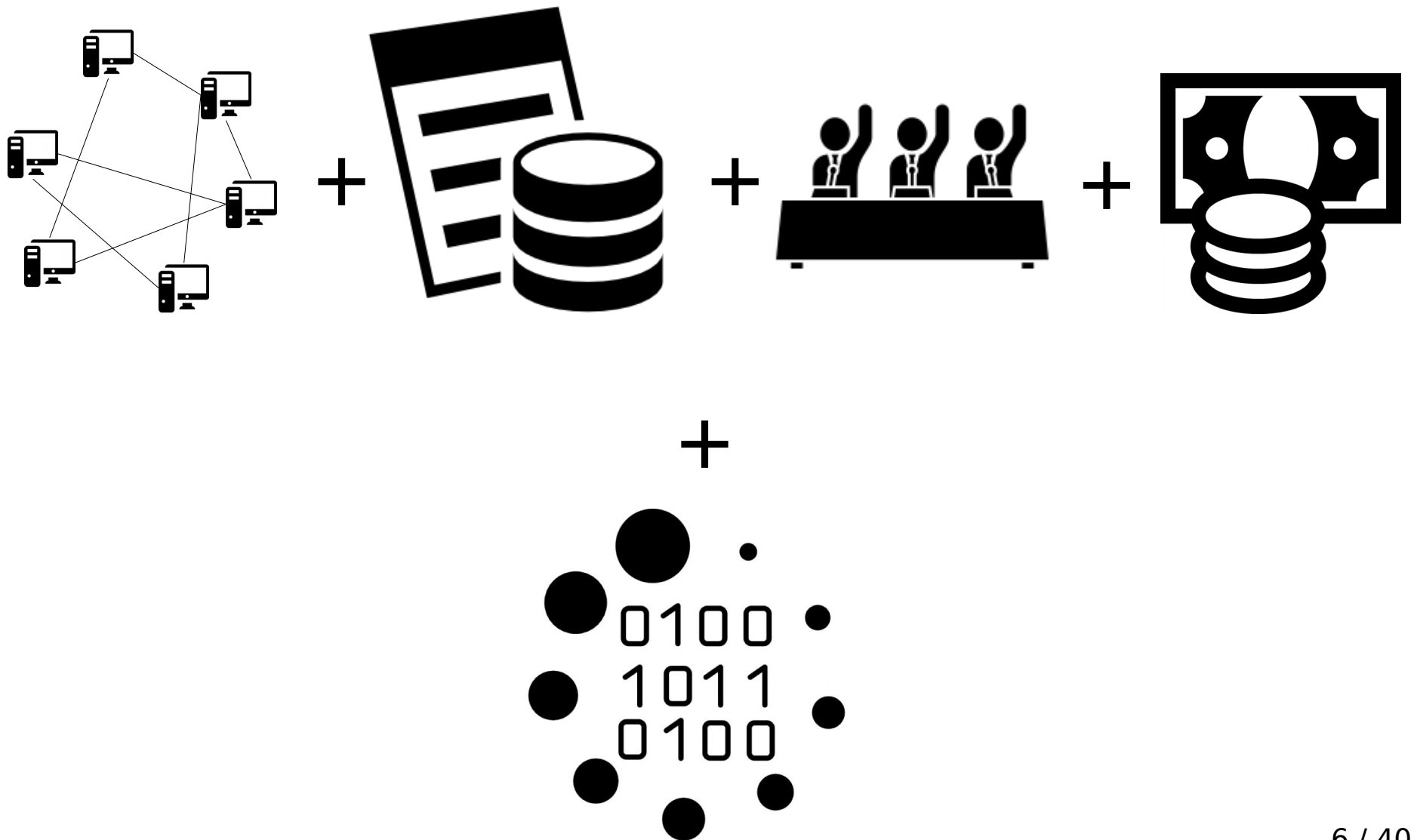


1. A brief introduction to Ethereum

Blockchain Introduction



Ethereum

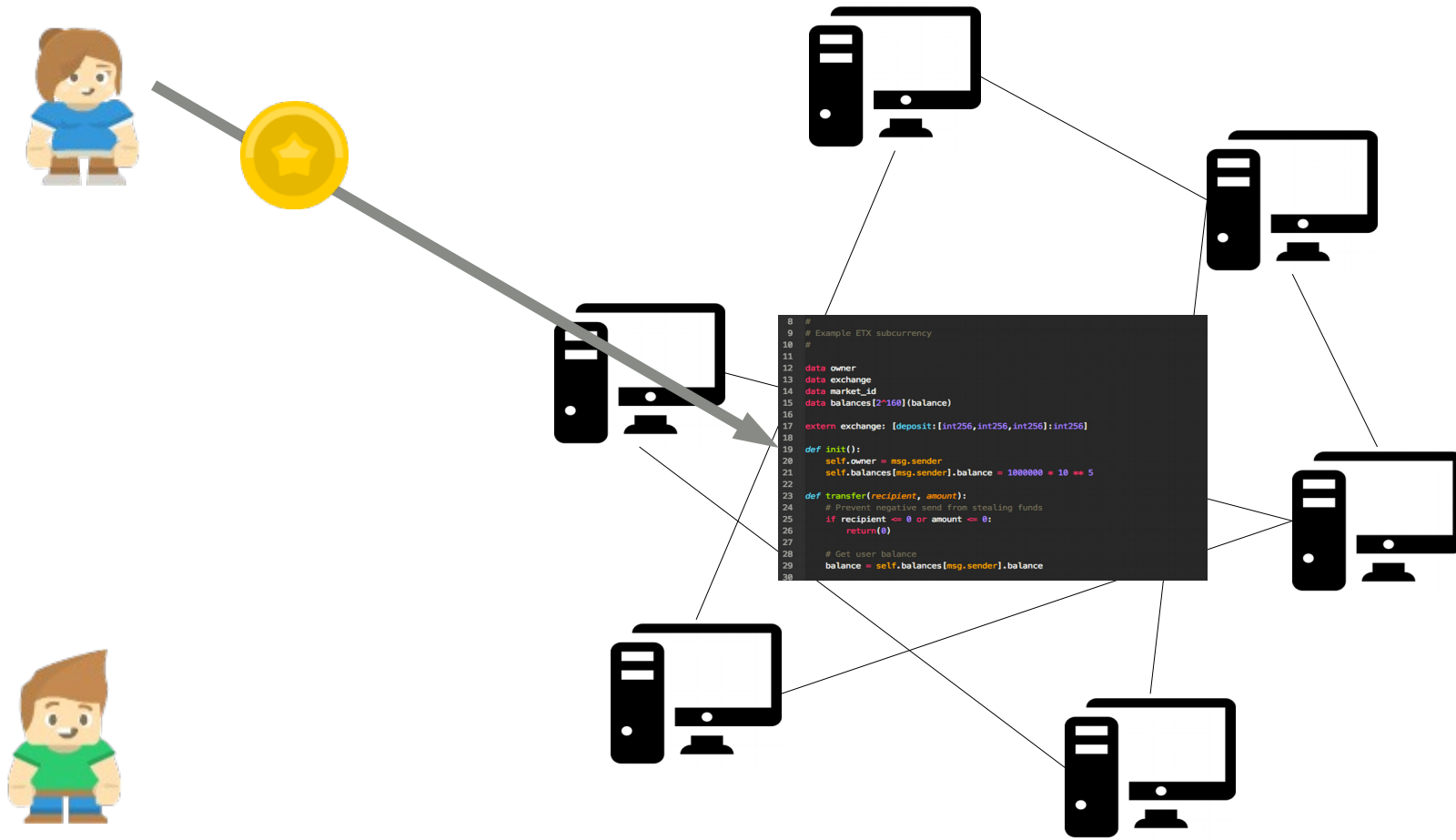


Why?

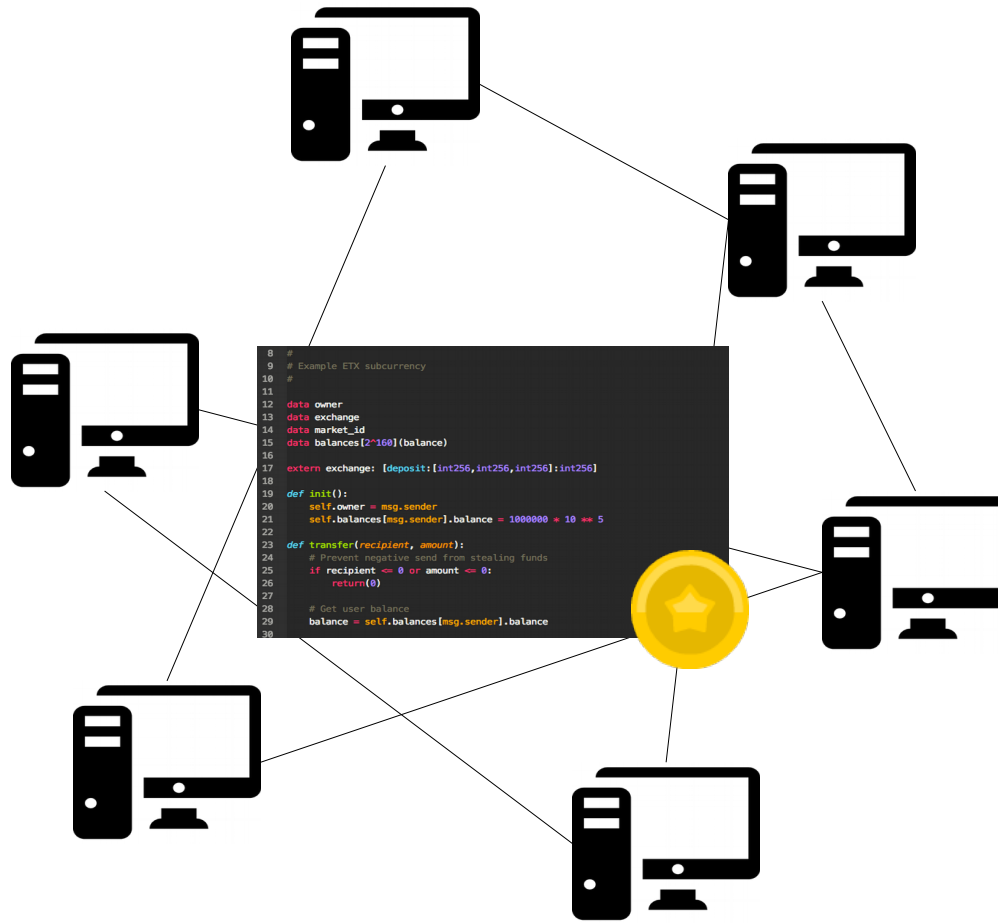


```
8  #
9  # Example ETX subcurrency
10 #
11
12 data owner
13 data exchange
14 data market_id
15 data balances[2^160](balance)
16
17 extern exchange: [deposit:[int256,int256,int256]:int256]
18
19 def init():
20     self.owner = msg.sender
21     self.balances[msg.sender].balance = 1000000 * 10 ** 5
22
23 def transfer(recipient, amount):
24     # Prevent negative send from stealing funds
25     if recipient <= 0 or amount <= 0:
26         return(0)
27
28     # Get user balance
29     balance = self.balances[msg.sender].balance
30
```

Why?



Why?





2. Setting up a private blockchain

Accounts

```
> geth --datadir ~/.ethereum/workshop  
account new
```

- `geth` – **Go Ethereum** client
- `--datadir <DIRECTORY>` – Store all data (incl. the blockchain in DIRECTORY)
- `account new` – Create a new account

Windows!



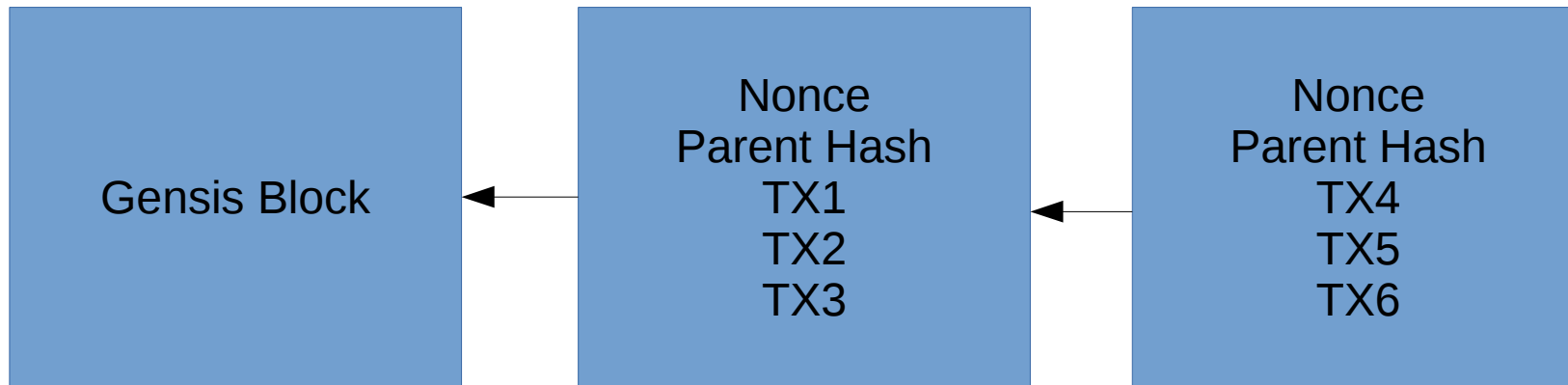
- On Windows machines, replace:
`~/ .ethereum/workshop`
with:
`C:\Users\[USERNAME]\workshop`

Accounts

```
> geth --datadir ~/.ethereum/workshop  
account list
```

- `account list` – List all existing accounts

Blockchain Data Structure



The genesis block

```
{
  "config": {
    "chainId": 42,
    "homesteadBlock": 0,
    "eip155Block": 0,
    "eip158Block": 0
  },
  "nonce": "0x000000000000000042",
  "timestamp": "0x00",
  "parentHash": "0x0000000000[... ]000000000000",
  "extraData": "0x00",
  "gasLimit": "0x4c4b40",
  "difficulty": "0x6666",
  "mixhash": "0x0000000000000000[... ]000000000000",
  "coinbase": "0x0000000000000000[... ]000000000000"
}
```

Initialize the blockchain

```
> geth --datadir ~/.ethereum/workshop  
init genesis.json
```

- `init <GENESIS FILE>` – Initialize a new blockchain from a genesis file

Start a miner

```
> geth --datadir ~/.ethereum/workshop  
--networkid 42 --mine --minerthreads  
1
```

- `--networkid <NUMBER>` – A unique number for this blockchain network
- `--mine` – Make this blockchain node a miner
- `--minerthreads <NUMBER>` – How many threads (which indirectly means CPUs) are used for mining



Predefined network ids

- 1) Frontier
- 2) Morden (disused)
- 3) Ropsten
- 4) Rinkeby

Plan B if something doesn't work

```
> geth --dev
```

- `--dev` – Developer mode: pre-configured private network – Cannot connect to other nodes

Start a console

```
> geth attach  
ipc:///home/jonas/.ethereum/workshop/g  
eth.ipc
```

- `attach <PATH>` – Attach a console to a running geth instance using IPC

Windows!



- On Windows machines run just:
`> geth attach`



2. Interacting with the blockchain

admin API

- `admin.nodeInfo` – Gives us the enode id and a bunch of useful information
- `admin.peers` – Lists all connected nodes our node knows
- `admin.addPeer("enode://fc[...]03")` – Manually add another node

<https://github.com/ethereum/go-ethereum/wiki/JavaScript-Console#management-api-reference>



personal API

- `personal.listAccounts` – List of all (local) accounts
- `personal.unlockAccount("0xc73[...]5b")` – Lists all connected nodes our node knows

<https://github.com/ethereum/go-ethereum/wiki/JavaScript-Console#management-api-reference>



web3js

- `web3.eth.getBalance("0xc[...]5b")` – Get balance of account. This works for all accounts.

<https://github.com/ethereum/wiki/wiki/JavaScript-API#web3js-api-reference>

Dealing with numbers

- `number.toString(10)` – Converts a bignumber to a human-readable string
<https://github.com/ethereum/wiki/wiki/JavaScript-API#a-note-on-big-numbers-in-web3js>
<https://github.com/MikeMcl/bignumber.js/>
- `web3.fromWei(number, "ether")` – Converts from wei to ether
<https://github.com/ethereum/wiki/wiki/JavaScript-API#web3fromwei>
<https://converter.murkin.me/>
- `web3.toWei(number, "ether")` – From ether to wei

web3js

- ```
web3.eth.sendTransaction(
 {"from": "0xc73e[...]2cfbc025b",
 "to": "0x00[...]00",
 "value": 111111
})
```

  - Send wei from an address to another address



## **3. Mist**

# Starting Mist

```
> mist --rpc
/home/jonas/.ethereum/workshop/geth.ip
c
```

- `--rpc` – Path to node IPC socket file OR HTTP RPC hostport

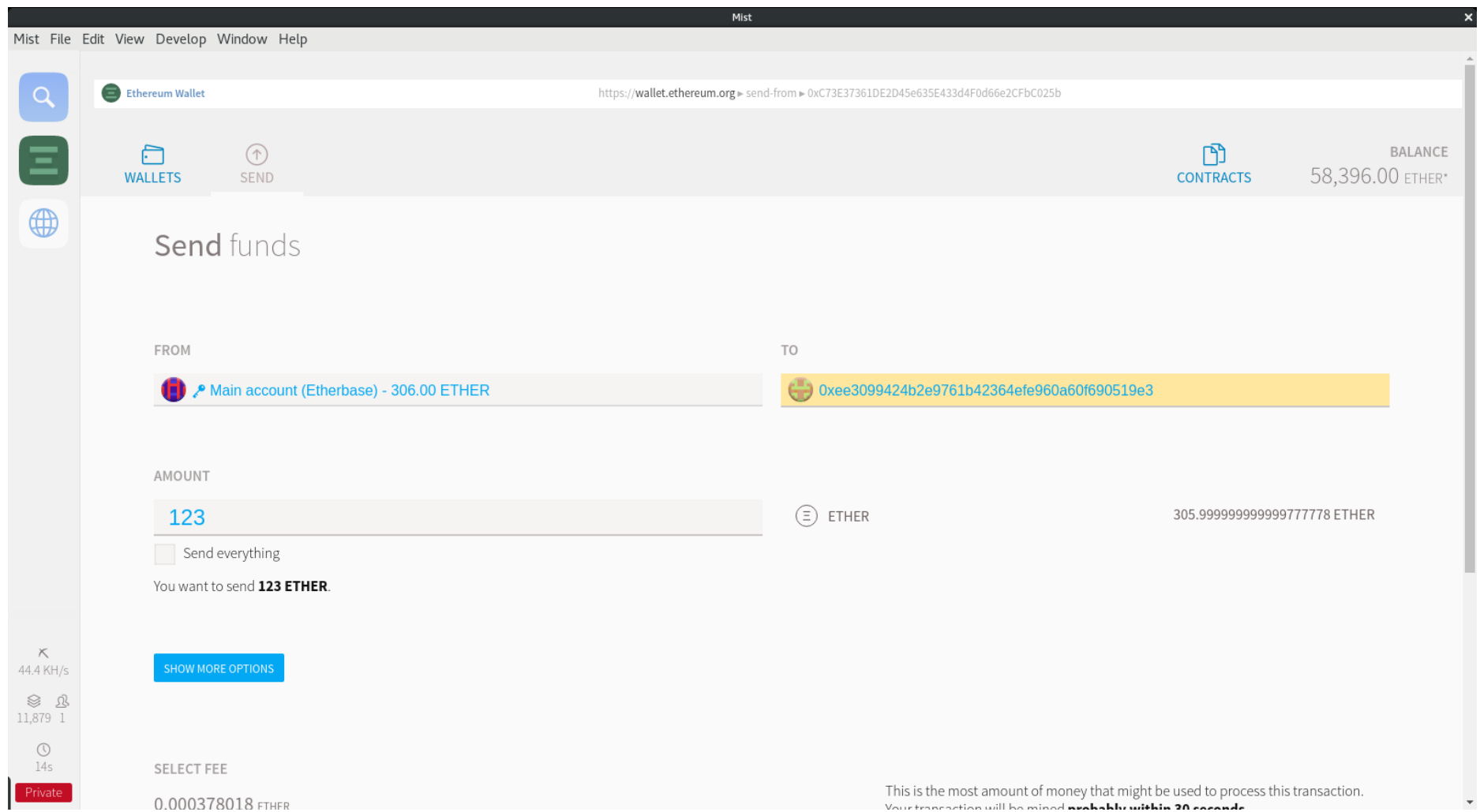
# Windows!



- On Windows machines run:  

```
> "C:\Program Files\Mist\Mist.exe"
--rpc \\.pipe\geth.ipc
```

# Mist





## **4. Solidity & Smart Contracts**



# Smart Contracts

```
pragma solidity ^0.4.15;
```

```
contract MyCoin {
 mapping (address => uint) balances;

 function MyCoin() {
 balances[tx.origin] = 10000;
 }

 function sendCoin(address receiver, uint amount) returns(bool sufficient) {
 if (balances[msg.sender] < amount) return false;
 balances[msg.sender] -= amount;
 balances[receiver] += amount;
 return true;
 }

 function getBalance(address addr) returns(uint) {
 return balances[addr];
 }
}
```

# Smart Contracts

```
pragma solidity ^0.4.15;
```

```
contract MyCoin {
 mapping (address => uint) balances;
```

```
 function MyCoin() {
 balances[tx.origin] = 10000;
 }
```

```
 function sendCoin(address receiver, uint amount) returns(bool sufficient) {
 if (balances[msg.sender] < amount) return false;
 balances[msg.sender] -= amount;
 balances[receiver] += amount;
 return true;
 }
```

```
 function getBalance(address addr) returns(uint) {
 return balances[addr];
 }
}
```

# Smart Contracts

```
pragma solidity ^0.4.15;
```

```
contract MyCoin {
 mapping (address => uint) balances;
```

```
 function MyCoin() {
 balances[tx.origin] = 10000;
 }
```

```
 function sendCoin(address receiver, uint amount) returns(bool sufficient) {
 if (balances[msg.sender] < amount) return false;
 balances[msg.sender] -= amount;
 balances[receiver] += amount;
 return true;
 }
```

```
 function getBalance(address addr) returns(uint) {
 return balances[addr];
 }
}
```

# Smart Contracts

```
pragma solidity ^0.4.15;
```

```
contract MyCoin {
 mapping (address => uint) balances;
```

```
 function MyCoin() {
 balances[tx.origin] = 10000;
 }
```

```
 function sendCoin(address receiver, uint amount) returns(bool sufficient) {
 if (balances[msg.sender] < amount) return false;
 balances[msg.sender] -= amount;
 balances[receiver] += amount;
 return true;
 }
```

```
 function getBalance(address addr) returns(uint) {
 return balances[addr];
 }
}
```

# Smart Contracts

```
pragma solidity ^0.4.15;
```

```
contract MyCoin {
 mapping (address => uint) balances;
```

```
 function MyCoin() {
 balances[tx.origin] = 10000;
 }
```

```
 function sendCoin(address receiver, uint amount) returns(bool sufficient) {
 if (balances[msg.sender] < amount) return false;
 balances[msg.sender] -= amount;
 balances[receiver] += amount;
 return true;
 }
```

```
 function getBalance(address addr) returns(uint) {
 return balances[addr];
 }
```

```
}
```



## **5. Remix IDE**

# Remix

The screenshot displays the Remix Solidity IDE interface. The main editor shows the source code for a contract named `MyCoin` in `MyCoin.sol`. The code is as follows:

```
1 pragma solidity ^0.4.14;
2
3 contract MyCoin {
4 mapping (address => uint) balances;
5
6 function MyCoin() {
7 balances[tx.origin] = 10000;
8 }
9
10 function sendCoin(address receiver, uint amount) returns(bool sufficient) {
11 if (balances[msg.sender] < amount) return false;
12 balances[msg.sender] -= amount;
13 balances[receiver] += amount;
14 return true;
15 }
16
17 function getBalance(address addr) returns(uint) {
18 return balances[addr];
19 }
20 }
21
```

The right-hand sidebar contains the deployment settings for the contract `browser/MyCoin.sol:MyCoin`. The settings are:

- Environment: Injected Web3
- Account: 0xc73...c025b (1415.99999999999977778 €)
- Gas limit: 3000000
- Value: 0

Below the settings, there are buttons for `Publish`, `At Address`, and `Cre...`. A legend indicates the types of transactions: `Publish` (purple), `Attach` (green), `Transact` (red), `Transact(Payable)` (red), and `Call` (blue). A link for `Contract details (bytecode, interface etc.)` is also present.



# Questions?