



Introduction of Ethereum

About Me

- Software Developer at ION Trading
- 10+ years of experience in Java and related tech.
- Cofounder & Leader Delhi & NCR Java User Group (JUG)
- Speaker to conferences JavaOne, AIOUG OTN Yathra
- Started exploring BitCoin, AltCoins, Blockchain, Ethereum and Smart Contracts since few months.



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Objective ?

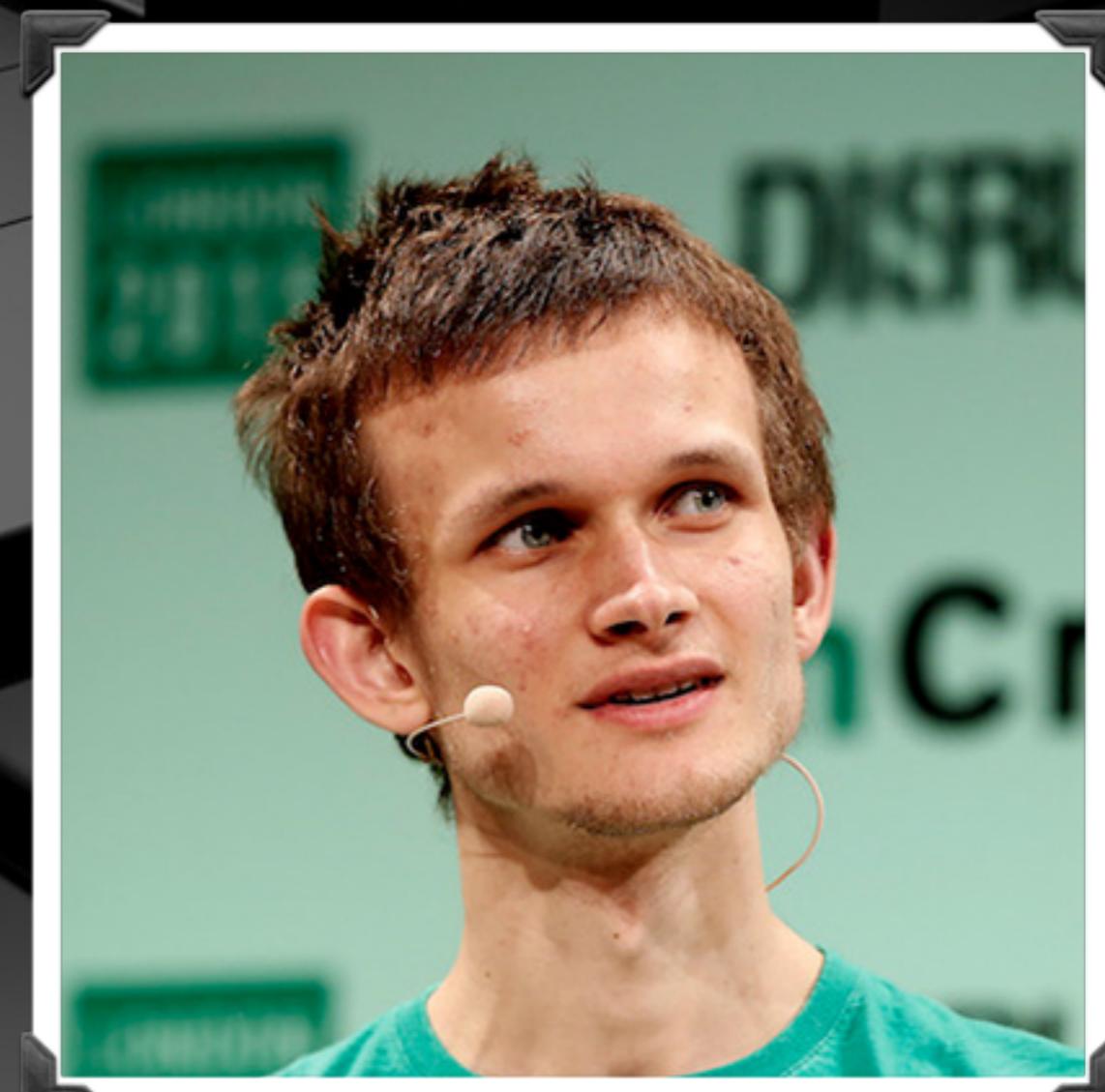
- Give you brief idea about Ethereum
- How Ethereum's ecosystem works ?
- Hands-on with Ethers (ETH) on Ethereum
 - Wallet generation
 - Get some test Ethers
 - Transaction on Ethereum network
 - Create/Deploy/Test Smart Contract using Solidity
- Connect to Ethereum network using web3j Java APIs

Prerequisites

- What is Cryptocurrency ?
- What is Blockchain ?
- What are the Wallets ?
- For Ethereum Hands-on
 - MetaMask Plugin installed
 - Some test Ethers (<https://tinyurl.com/test-ether>)

Ethereum

- Proposed in a white paper by Vitalik Buterin in late 2013
- Development was funded in July 2014 by crowd sale (1 Bitcoin = 2000 Ethers)
- May 2015 first version-0 launched
- Current version Ethereum 2, aka Homestead
- Second most popular cryptocurrency just after BitCoin
- Opensource



What is Ethereum ?

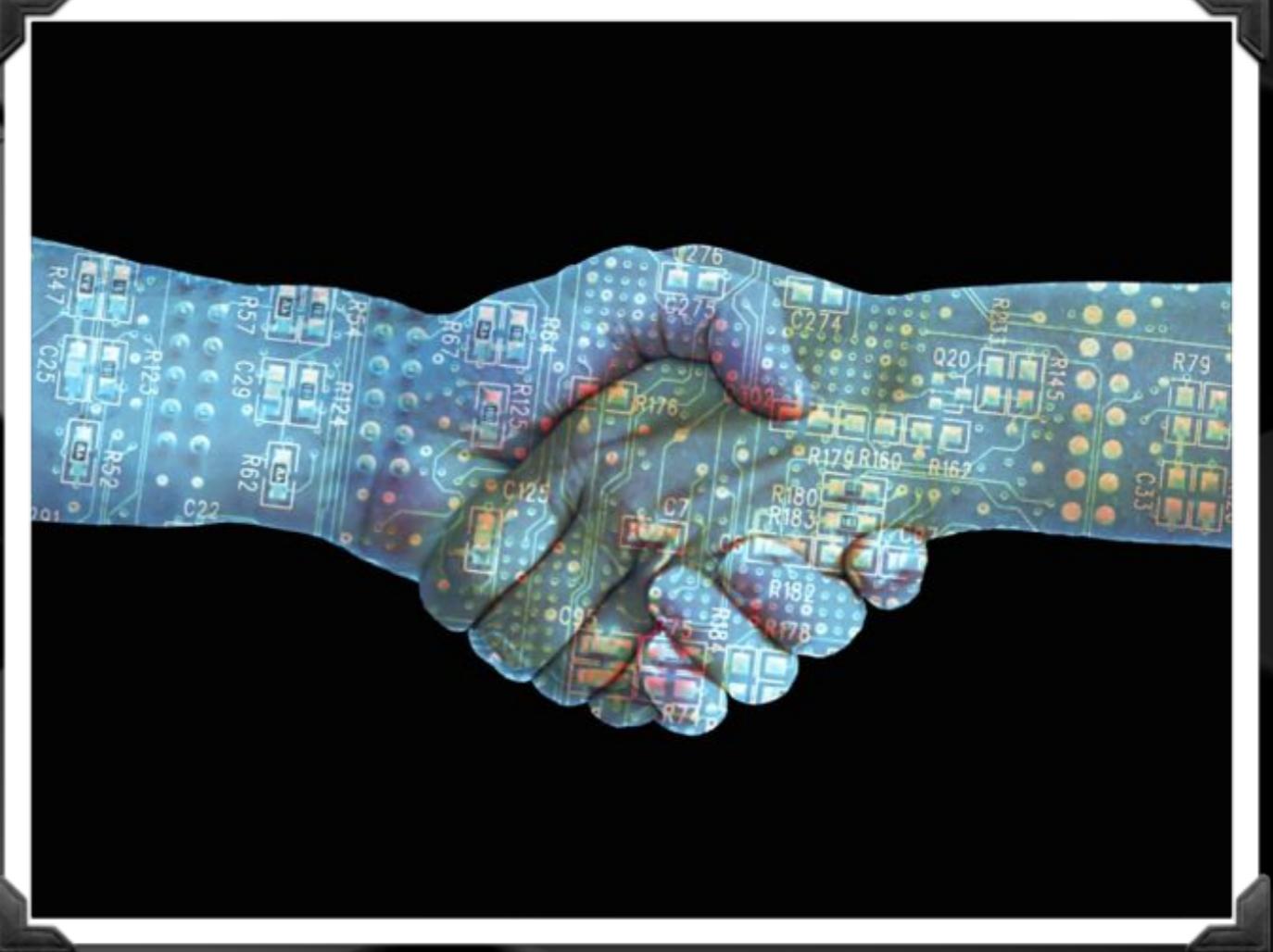
- Ethereum is open-source, public, blockchain based distributed computing platform
- Like Bitcoin no one controls or owns Ethereum
- Ethereum is a programmable blockchain
- Its cryptocurrency is called Ether
- Ethers can be transferred between accounts
- Ethers are needed to perform any transaction on Ethereum network

EVM

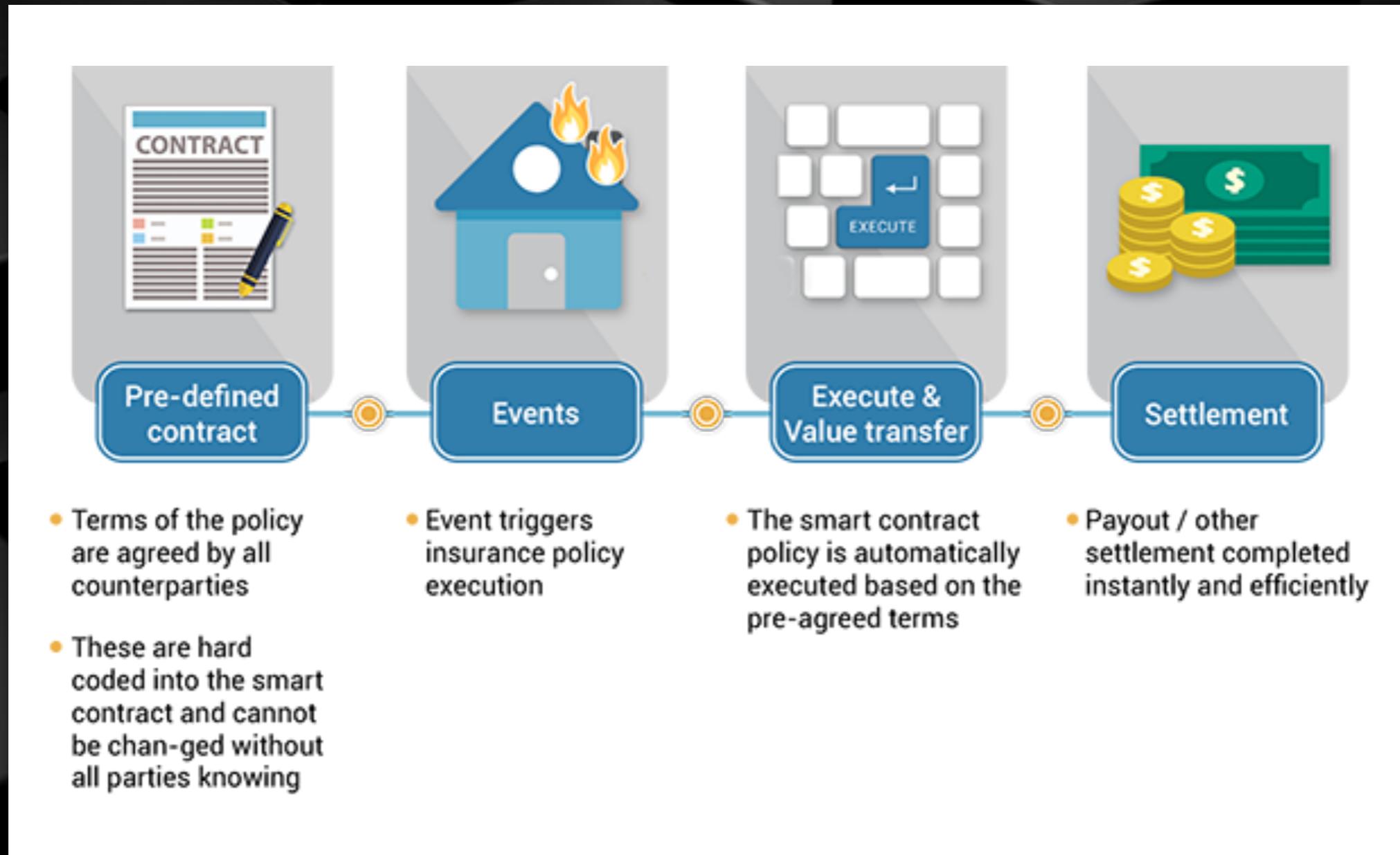
- Ethereum Virtual Machine
- Every node in the Ethereum networks runs EVM
- Smart contracts gets executed inside EVM

Smart Contracts

- If This Then This
- Code on Blockchain
- Once deployed, cannot be changed
- Stores Rules and Terms of Contract
- Execute agreed terms



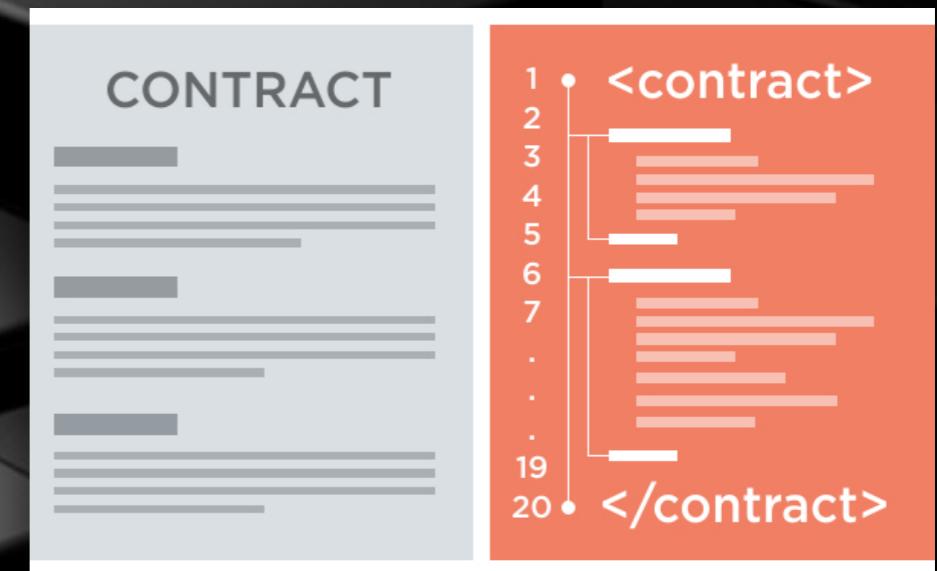
Example: Travel Insurance



Usage of Ethereum

- Smart Contract (DApps)
- Token Creation
- Crowdfunding or Initial Coin Offerings (ICOs)

TOKENS



Accounts

- Externally Owned Accounts
- Contract Accounts (Smart Contracts)



Externally Owned Accounts

- Your Ethereum Wallet
- Can have Ether balance
- Send / receive Ether
- Send transaction
 - Ether transfer
 - Trigger Smart Contract code
- Controlled using Private Keys
- No associated Smart Contract code



Contract Accounts

- Smart Contract Code associated
- No Private Keys are associated
- Can have Ether balance
- Code execution triggered by transaction
- Can call other Smart Contracts
- Manipulate persistent storage and states

Transaction

- Different types of Transaction
 - Send Ether (ETH)
 - Deploy a new contract
 - Calling a method of Smart Contract
- Every transaction requires Gas to execute
- Gas is paid to the miners in “Wei”

Wei

- 10^3 Wei = 1 KWei (Kilo wei)
- 10^6 Wei = 1 MWei (Mega wei)
- 10^9 Wei = 1 GWei (Giga wei)
- 10^{12} Wei = 1 Szabo
- 10^{15} Wei = 1 Finney
- 10^{18} Wei = 1 Ether

Gas

- Transaction fee must be paid to Node, who processed it
- Transaction fee paid in Gas
- Each operation in EVM is assigned some fixed number of gas it takes
- For every transaction specify
 - Gas Limit (Unit)
 - Gas Price (Gas cost in Wei)



Gas Limit (Unit of Gas)

- Maximum amount of unit of Gas you want to spend
- Why need GasLimit? to avoid situation if transaction stuck in loop
- Low gas limit could cause “Out of Gas” error
 - Transaction fail
 - All changes reverted
 - **Gas got consumed**
- **Unused Gas is refunded back**



$\text{MaxFee} = \text{gasLimit} * \text{gasPrice}$

$\text{FeePaid} = \text{gasUsed} * \text{gasPrice}$

$\text{UnusedGas} = \text{MaxFee} - \text{FeePaid}$

Gas Price (Price in Wei)

- Average Gas price is 21 Gwei
- Providing too much gas price can cost you more
- Choose average price based on your transaction priority (slow / faster)



Companies using Ethereum & Blockchain

- Worldwide Supercomputer (<https://golem.network>)
- Global Settlement Network (<https://ripple.com/>)
- Distributed Encrypted Cloud Storage (<https://storj.io> & <https://maidsafe.net>)
- Basic Attention Tokens (BAT)

Blockchain Use Cases: Comprehensive Analysis & Startups Involved



Solidity

- High level contract-oriented language with similarities to Java & JavaScript.
- Allows you to develop contracts and compile to EVM bytecode
- Turing complete language

Let's Play With Ethereum

- Ethereum Wallet Software (<https://ethereum.org>)
- Generate your own wallet online (<https://www.myetherwallet.com/>)
- Install MetaMask plugin
- Connecting to Ethereum Testnet & Mainnet
- Get some test Ethers
- Send and receive Ether
- Create/Deploy/Test a Smart Contract using Remix online Solidity compiler
 - Deploy Smart Contract
 - Call its methods
- Integration of Ethereum with Java using Web3j library

Web3j API

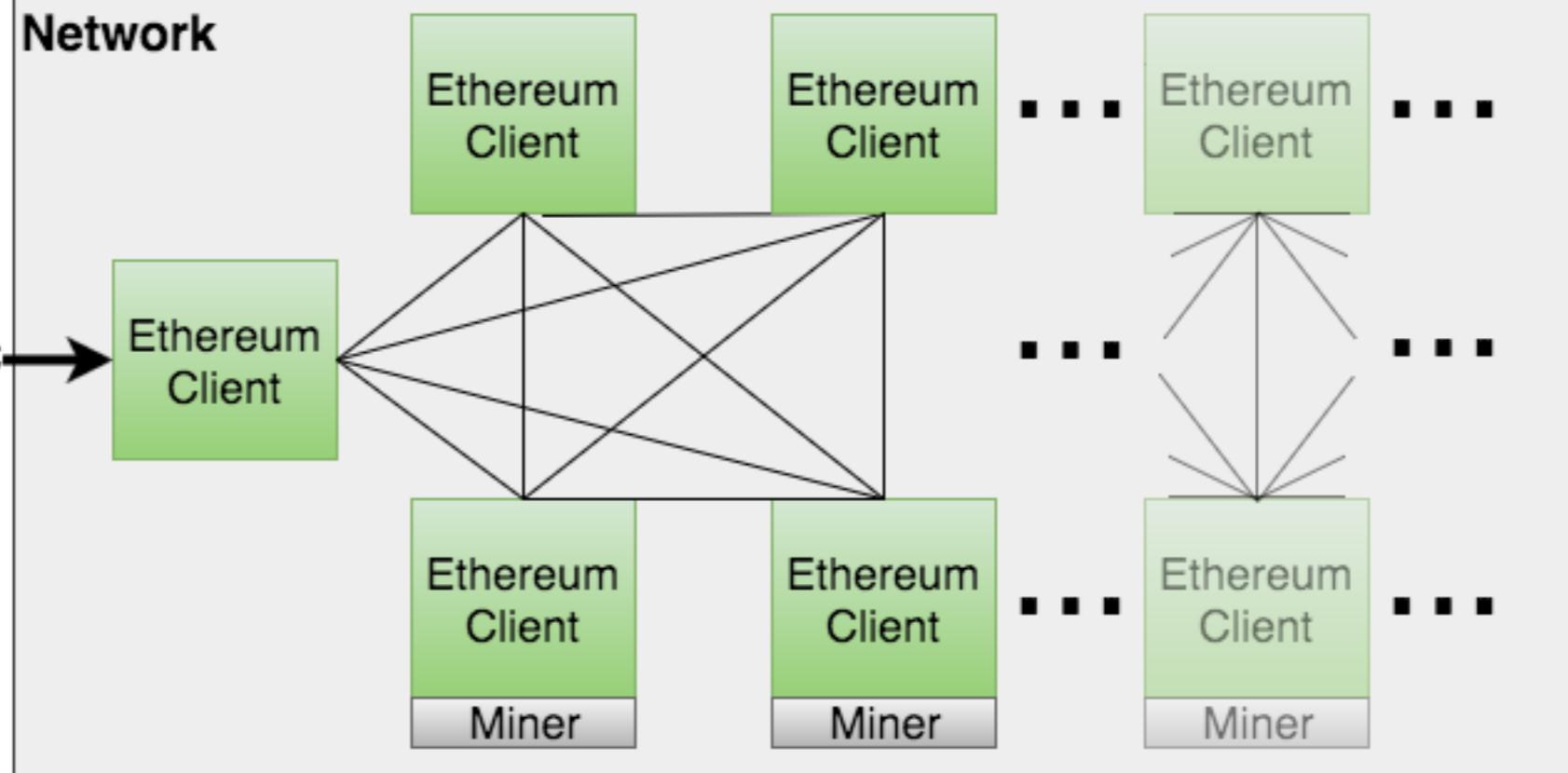
- Library for integration with Ethereum nodes
- Generate/Send transactions from Ethereum wallets
- Create/Deploy/Transact with Smart Contract
- <https://web3j.io/>



Network



JSON-RPC





Thank you