Ethereum Overview

Agenda

11:30-11:45 Check-In, networking

11:45-12:45 Ethereum Overview

12:45 Announcements, Networking

Active Planning Committee

John Lindsay, Patent Attorney

Tony Schuman, Investment Advisor

Todd Russell, Gov't Contract Opportunities

See me to become more active in this or other chapters
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Ethereum Overview

Ethereum

Blockchain-based distributed computing platform and operating system featuring “smart contract” (scripting language) functionality.

“A virtual machine for programs on a blockchain”

John Lindsay

Blockchain Series

- Loose Plan
  - ~~1st Presentation - Blockchain Basics~~
    - ~~Mile wide/inch deep~~
    - ~~At least not wholly conflate Bitcoin and Blockchain~~
  - 2nd Presentation - Ethereum overview
    - Overview of Ethereum, “Smart Contracts,”
  - 3rd Presentation - Code along
    - Bring laptop and follow along

Ethereum Overview

- Cryptocurrencies
  - 2008: Bitcoin whitepaper from “Satoshi Nakamoto”
  - 2009: Bitcoin client released
  - 2011: Litecoin (first “altcoin”)
  - 2014: Ethereum whitepaper released, crowdsale
- Ether
  - Cryptocurrency generated & used in the Ethereum platform
  - ~$525 : 1 ether (4/18/18)
  - Units
    - Ether 1.0
    - 1 Wei = 10^{-18} Ether

Ethereum Overview

- Bitcoin (decentralized currency)
    - Designed to transfer cryptocurrency between users
- Ethereum (decentralized currency with associated complex scripting language)
    - Executes “Smart Contracts”
        - Programs executed in the Ethereum Virtual Machine
    - Classic contract: “I promise to send you $100 if my presentation is rated 5 stars”
    - Smart contract: “I send cryptocurrency into a program executed on the blockchain which sends cryptocurrency to you for the 5 star rating, otherwise return to me ” ***

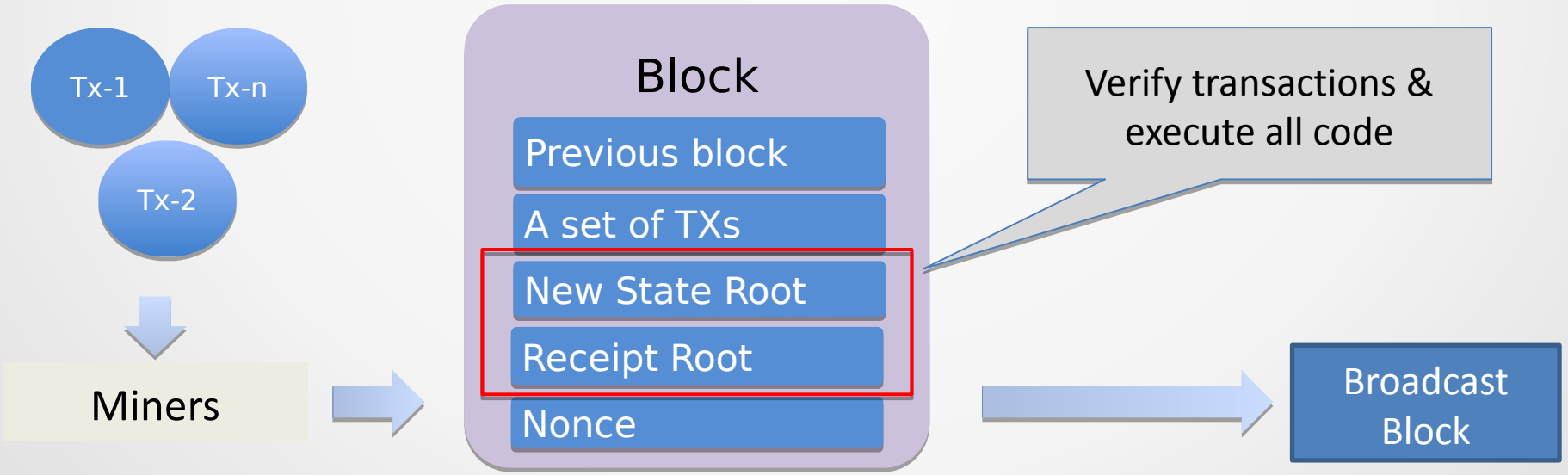
Ethereum Overview

- Ethereum – Use: “Smart Contracts”
  - White papers – “A Next-Generation Smart Contract and Decentralized Application Platform”
    - “Yellow Paper” provides further detail
  - Platform vs application
    - Smart Contracts, Dapps, tokens, ICOs, ... platform
  - Data
    - Ether transactions, smart contracts code
  - Actors
    - Ether holders, parties/actors in contracts
  - Interface
    - Miners, “Wallets”, JSON-RPC/Solidity

Ethereum Overview

Block Mining

Nodes on the blockchain process every transaction and stores the state
Every 15 seconds

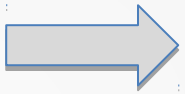


Ethereum Overview

Smart Contract Code

```
contract Greetings {
    string greeting;
    function Greetings (string _greeting) public {
        greeting = _greeting;
    }

    /* main function */
    function greet() constant returns (string) {
        return greeting;
    }
}
```



Bytecode seen on the blockchain

```
6060604052604051610250380380610250833981016040528.....
```

```
PUSH 60
    PUSH 40
    MSTORE
    PUSH 0
    CALLDATALOAD
.....
```

What people get from a disassembler

Ethereum Overview

- Programs executed in the Ethereum Virtual Machine
  - Transactions are more than just values, also programs that run when blocks are processed by nodes.
- if HAS_EVENT_X_HAPPENED()
  send(party_A, 1000)
  else:
  send(party_B, 1000)

Ethereum Overview - Applications

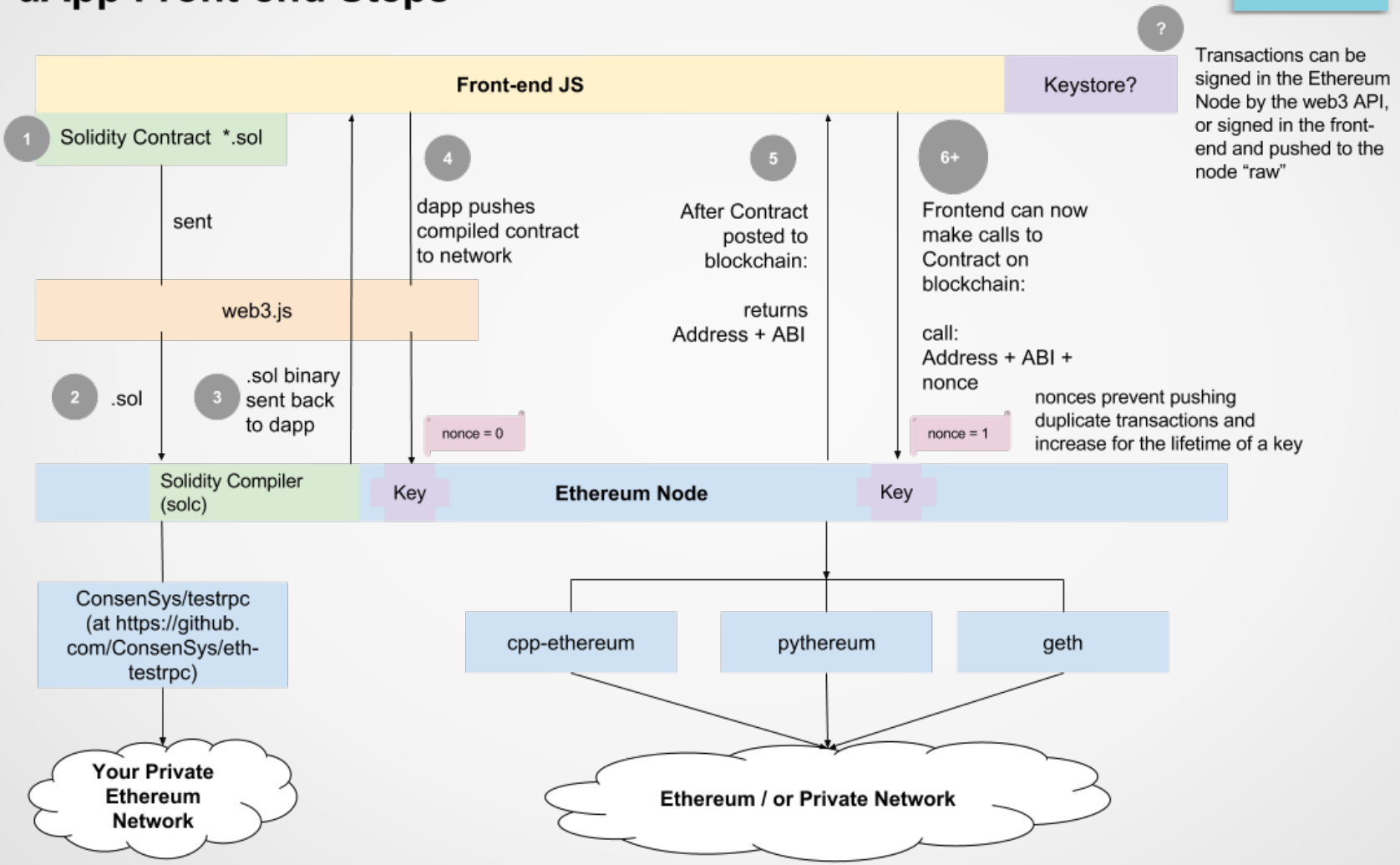
- Sample Applications
  - Multi-signature (Require M of N “owners” to agree in order to transfer)
  - Prediction markets (contributors predict events)
  - Crowdfunding
  - Etherian World (Minecraft-ish)
  - EtherTweet
  - Tokens/Initial Coin Offerings
  - Smart Locker
- Today’s applications
  - Cryptokitties
  - Selling/buying IoT sensor data
  - Toll tag logging and payment

Ethereum Overview – Language/API

- General Application Architecture
- “Smart Contract” (Ethereum Clients)
  - Solidity (Javascript-ish)
  - LLL (Lisp Like Language)
  - Serpent (Python-ish)
  - Mutan (C-ish) (deprecated)
- User/device facing (Connecting to Ethereum Clients)
  - Web3 (Javascript)
  - Web3j (Java/Android)
  - Nethereum (.NET)
  - Ethereum.rb (Ruby Gem)

Ethereum Overview

dApp Front-end Steps



A **Contract Creation Transaction** is shown in steps 1-5 at above.

An **Ether Transfer** or **Function Call Transaction** is assumed in step 6.

Ethereum Overview - Solidity

- Solidity Language
  - Variable Types
    - Common
      - bool, int, uint, uint[]
    - Unique
      - Address sender = 0x6414cc08d148dce9e...;
      - Struct Trade
        { uint quantity;
        uint price;
        string trader;}
      - mapping (address => uint) offers;

Ethereum Overview - Solidity

- Solidity Language (Inside → Outside)
  - Events
    - Events in solidity can be used to log certain events in EVM logs. These are basis for external interfaces (“Flag for external programs/devices”)
    - contract valueChecker {
      uint8 price=10;
      event valueEvent(bool returnValue); *********
      function Matcher(uint8 x) returns (bool) {
      if (x>=price) {
      valueEvent(true);
      return true;
      }
      }
      }

Program Execution Cost

- Solidity Language (Outside → Inside)
  - No simple, native internet retrieval
    - All nodes need to be able to independently validate output state of contract execution
    - oraclize.it

```
import "dev.oraclize.it/api.sol";

contract KrakenPriceTicker is usingOraclize {
    string public ETHXBT;

    function PriceTicker() {
        oraclize_setNetwork(networkID_testnet);
        oraclize_setProof(proofType_TLSNotary | proofStorage_IPFS);
        oraclize_query("URL", "json(https://api.kraken.com/0/public/Ticker?pair=ETHXBT).result
    }

    function __callback(bytes32 myid, string result, bytes proof) {
        if (msg.sender != oraclize_cbAddress()) throw;
        ETHXBT = result;
        // do something with ETHXBT
    }
}
```

Ethereum Overview - Solidity

- Solidity Language

browser/ballot.sol

```
1  pragma solidity ^0.4.0;
2  contract Ballot {
3
4      struct Voter {
5          uint weight;
6          bool voted;
7          uint8 vote;
8          address delegate;
9      }
10     struct Proposal {
11         uint voteCount;
12     }
13
14     address chairperson;
15     mapping(address => Voter) voters;
16     Proposal[] proposals;
17
18     /// Create a new ballot with $(_numProposals) different proposals.
19     function Ballot(uint8 _numProposals) public {
20         chairperson = msg.sender;
21         voters[chairperson].weight = 1;
22         proposals.length = _numProposals;
23     }
24
25     /// Give $(toVoter) the right to vote on this ballot.
26     /// May only be called by $(chairperson).
27     function giveRightToVote(address toVoter) public {
```

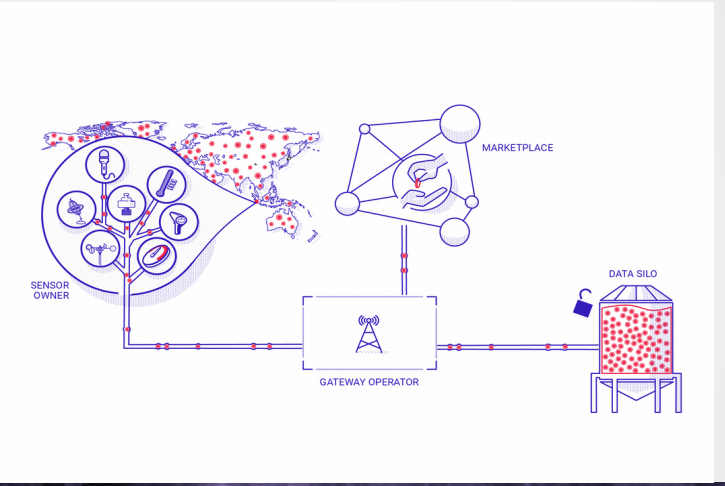
Program Execution Cost

- Gas
  - Transactions on the Ethereum blockchain are required to cover cost of computation they are performing
    - 3 gas - <, >, =
      5 gas - *, /
      50 gas – SHA3
      53000 – contract creation
  - Gas : Gwei
  - Transaction fee = gasprice * consumedgas
  - If startgas is less than needed
    - Out of gas exception, revert the state as if the transaction has never happened
    - Sender still pays all the gas

Ethereum Overview

- Today's applications
  - Cryptokitties

  - Selling/buying IoT sensor data



  - Toll tag logging and payment

Ethereum Overview

Questions?

John Lindsay
Patent Attorney
Coaster, Smooth Driver Application