Chapter 2

What is Ethereum?

Episode 2.01

Introduction to Ethereum

Bitcoin vs. Ethereum

- Bitcoin
  - Implementation of blockchain
  - 1st generation blockchain
  - Primarily for cryptocurrency
  - Little support for autonomy
- Ethereum
  - 2nd generation blockchain
  - Native cryptocurrency
  - Smart contracts
    - More autonomy

Episode 2.02

Ethereum in Financial Services

Ethereum Features

- Transparent transactions
  - No entity “owns” transactions
  - Easy auditing
- Traceable history of all data
  - Provenance – assurance of ownership
  - Trace digital assets

Ethereum Features

- Reduce overhead
  - Eliminate middlemen
    - Disintermediation
  - Automate decisions
- Lower cost
  - Reduce human interaction

Ethereum in Financial Services

- Pure currency exchanges
  - Original use for blockchain
  - Easy transfer of digital currency
- Banking
  - Fiat currency
    - “Real” currency
    - Must be backed by government
  - Cryptocurrency
    - No government backing
    - Ex: Bitcoin, Ether (ETH)
    - Can create your own tokens (new in Ethereum)

Ethereum in Financial Services

- Real estate
  - Blockchain works well transferring assets
  - Write out legal and financial rules
    - If rules are met, transfer the asset (real estate)
  - Automate escrow

Episode 2.03

Ethereum in Digital Identity Management

Identity Management

- Identification
  - Claiming an identity
  - Individuals and devices can have identities
- Authentication
  - Proving you are who you say you are

Ethereum in Digital Identity Management

- Create an account
  - Unique pair of keys
    - Public and private key
    - Encrypt and access data
    - Sign data
    - Your account address based on your public key
  - No connection with real-world identity
- Link real-world and Ethereum account

ERC-725 Standard

- Smart contract interface
  - Associate Ethereum accounts with real-world identities
  - Establish an account
  - Make a claim against that account

Episode 2.04

Ethereum in Industry Applications

Ethereum in Industry Applications

- Healthcare
  - Electronic health record (EHR)
  - Encrypt health data
  - Patient can authorize practitioners
  - Treatment records
  - Medical history

Ethereum in Industry Applications

- Energy
  - Usage tracking
    - Analyze large-scale usage
  - Production procurement
    - Where to send energy
- Supply chain
  - Tracking products from producer to consumer

Episode 2.05

Ethereum in Government

Ethereum in Government

- Tax payment
- Government spending
- Voting
- Policy development
- Notary

Episode 2.06

Ethereum Smart Contracts

Smart Contracts

- Rules to register a transaction in the blockchain
- Ethereum creates special runtime environment for smart contracts
- Program that can only run in a specialized environment
  - The Ethereum Virtual Machine (EVM)
  - Virtual machine means it runs within another operating system

Smart Contracts

- The EVM executes smart contract bytecode
  - Implements the rules
- Summary: smart contract enforces rules to access the blockchain

Smart Contracts

- Every node runs every smart contract
- Smart contracts are deterministic
  - Output is the same on all nodes
- Only way to write to the blockchain

Episode 2.07

Ether and the Initial Coin Offering (ICO)

What is Ether (ETH)?

- Ethereum’s cryptocurrency
- Buy
  - Exchange currency for ETH
- Sell
- Trade
- Exchange account
  - Exchange fiat currency for cryptocurrency
  - Trade Ether using Ethereum address

Creating an Ethereum Address

- Creating an Ethereum address means creating keys
  - Private and public key
  - Public key provides your account address
  - Private key must stay secure
- A wallet stores private keys securely
- Use private key to access cryptoassets

Initial Coin Offering (ICO)

- Similar to an Initial Public Offering (IPO)
- Describes the business
- Asks for investments
- The way most new blockchain companies offer their cryptocurrency to raise funds

Episode 2.08

Decentralized Autonomous Organization (DAO)

Decentralized Autonomous Organization (DAO)

- A business with little or no human interaction
- All business decisions are made by smart contracts
- Removes the need for humans to participate in business decisions

Episode 2.09

The Ethereum Ecosystem

The Ethereum Ecosystem

- Blockchain
  - Data
  - Transactions
  - Smart contract code
- EVM
  - Ethereum Virtual Machine
  - Executes smart contracts
  - Allows us to interact with blockchain data

The Ethereum Ecosystem

- Wallet
  - Software
  - Hardware
  - Paper
  - Stores your private keys
- Exchange
  - Connect real-world money to Ether

Ethereum Development Tools

- Development environment
  - Write and compile smart contract code
- Testing environment
  - Ensure it works as intended
- Client interface

Ethereum Development Tools

- Blockchain client
  - EVM
- Development and testing blockchains
  - Develop apps using local blockchain
  - Test apps using test blockchain
    - Doesn’t use real money
    - Ex: Ropsten, Kovan, Rinkeby
- Live blockchain
  - Mainnet

Ethereum Development Tools

- Compiler
- Testing framework
  - Tools to compile smart contract bytecode
  - Push code to test network
  - Invoke functions
- Source code editor or IDE (integrated development environment)
  - GUI (graphical user interface)
  - Write and compile code
  - Show errors

Episode 2.10

Building Blockchain Apps

How Blockchain Apps are Different

- Decentralized storage
  - Cost of accessing data
- Decentralized processing
  - Runs on multiple nodes
- Append-only data
  - Avoid unnecessary updates
- Built-in integrity
- Trust in the technology

Test/Deploy/Maintain

- Blockchain data is effectively immutable
  - That includes smart contract code
- Bugs will always be there
- Find bugs before deployment
- Testing is more important than ever