Introduction to Ethereum

OBJECTIVES AND OVERVIEW

The objective of this lecture is to review the underlying principles of blockchain, previewed in the CBA course. Ethereum will be reintroduced, and studied in depth in the following course.

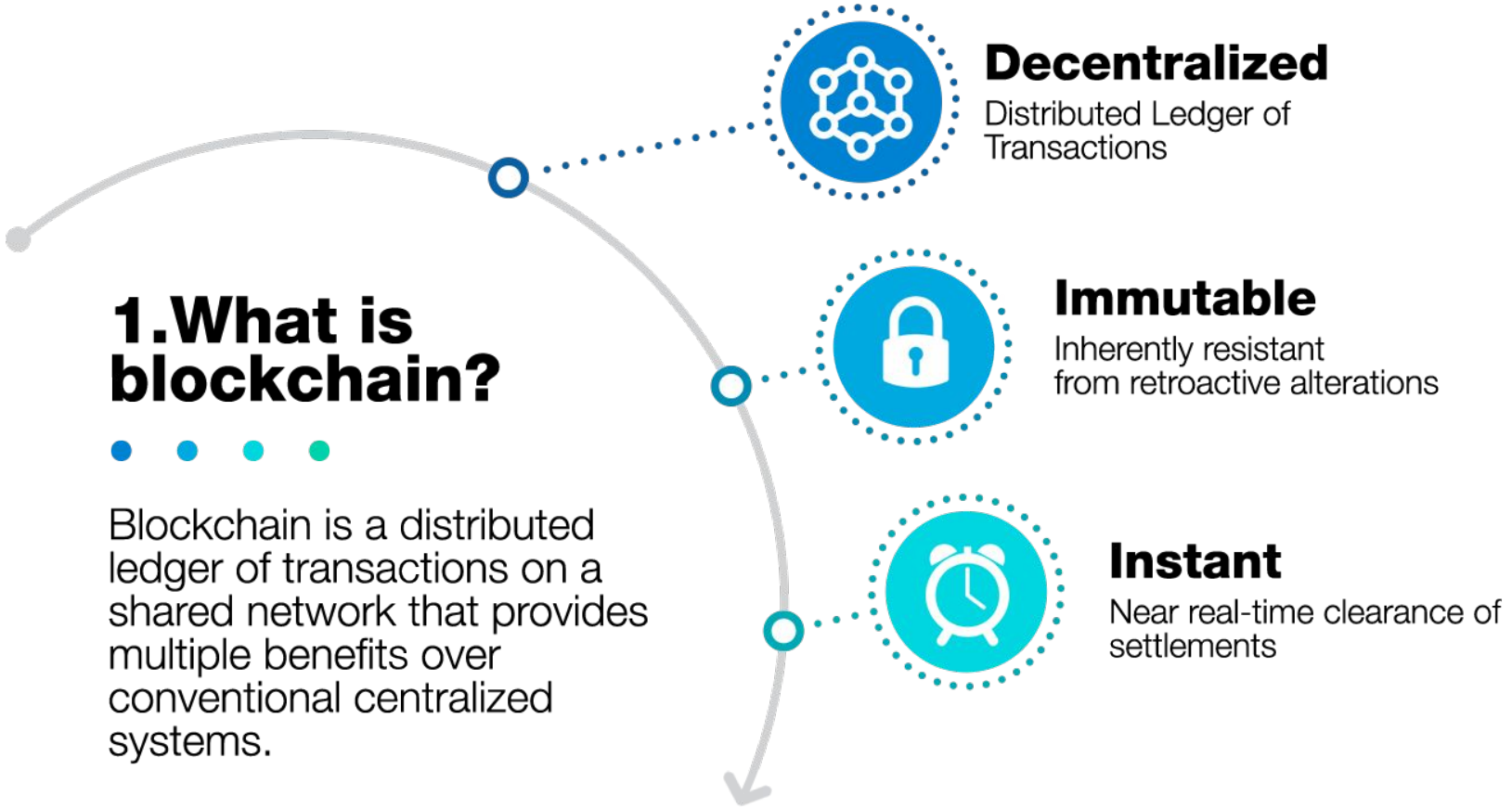
By the end of this lecture, students will have refreshed their understanding on CBA and furthered their knowledge on Ethereum:

- What is Ethereum
- What is Ethereum doing now?
- Ethereum vs Bitcoin
- How does Ethereum work?

CBA Review

Certified Blockchain Associate

Blockchain Review

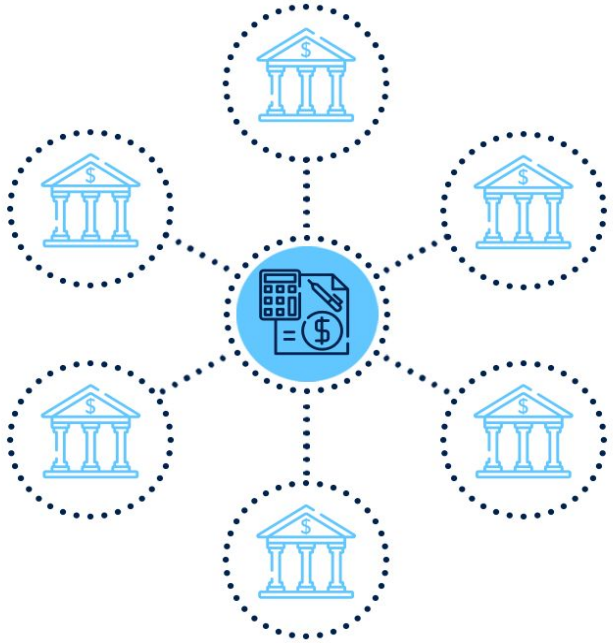


TRANSPARENCY | SECURITY | SPEED | LOW COSTS

Blockchain Systems Review

MODEL 1

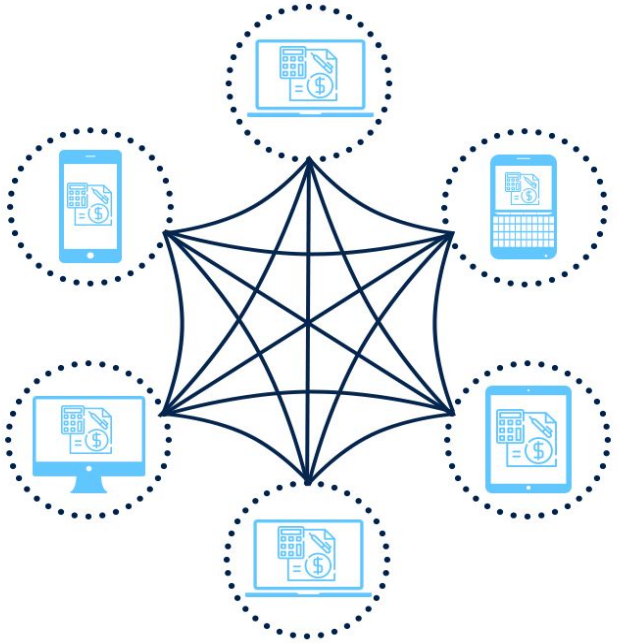
Current System



All banks check with central electronic ledger

MODEL 2

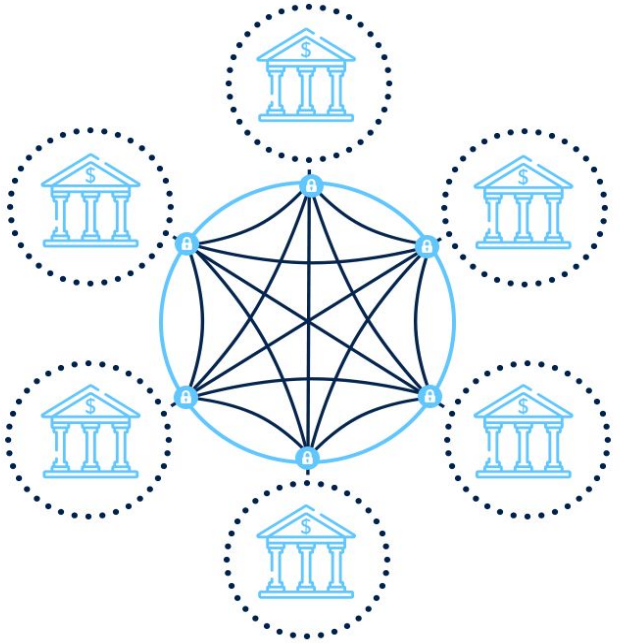
Public blockchain (permissionless)



An open network that anybody can access like the bitcoin model. The digital ledger of transactions is shared, transparent and run by all participants.

MODEL 3

Private blockchain (permissioned)



The preferred option of most banks. It is a closed system checking all details and controlling access invitation

Mining & Block Creation Review

Miners are computers, or more generally processing units, that are tasked with running complicated algorithms to verify new blocks in return for a bitcoin reward.

The probability of successfully ‘mining’ a block is dependant on the processing power and energy usage of the miner.

As the bitcoin network grows, the payout for each new successfully mined block becomes smaller.

While the community of miners is strong, eventually the cost of mining tends to result in a more centralized network.

Decentralized Application Framework

Step 1 Problem & Goal Identification

Step 2 Suitable Consensus Mechanism

Step 3 Blockchain Platform

Step 4 Architecture

Step 5 Application Configuration

Step 6 APIs

Ethereum

Introduction to Ethereum

What is Ethereum?

- Open-source Public Blockchain Platform
- Aims to "decentralize the web" by introducing static content publication, dynamic messages, trustless transactions and an integrated user-interface
- Enable powerful programming through “Smart Contracts” and development of “Decentralized Applications” (DApps)
- Peer to peer network protocol, with all nodes running the EVM
- Ethereum can be used for virtually any kind of transaction or agreement that has an economic or governance aspect

BACKGROUND

ethereum

$18.4
Million

Blockchain Development

- White paper released 2013.
- Written in C++, Go & Rust.
- Initial development under Ethereum Switzerland GmbH
- Ethereum Foundation was founded in June 2014.

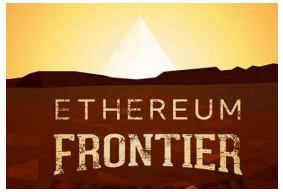
Crowdfund Raise

- In July-August, 2014
- 11.9 million Ether were sold in crowd funding.
- Third highest crowd-funded project of all time.

Founders

- Vitalik Buterin, Mihai Alisie, Anthony Di Iorio, and Charles Hoskinson
- Dr. Gavin Wood
- Joseph Lubin

Release History & Roadmap



May 2015
Olympic
(Testnet)
Version 0

30 July 2015
Frontier (Beta)
Version 1

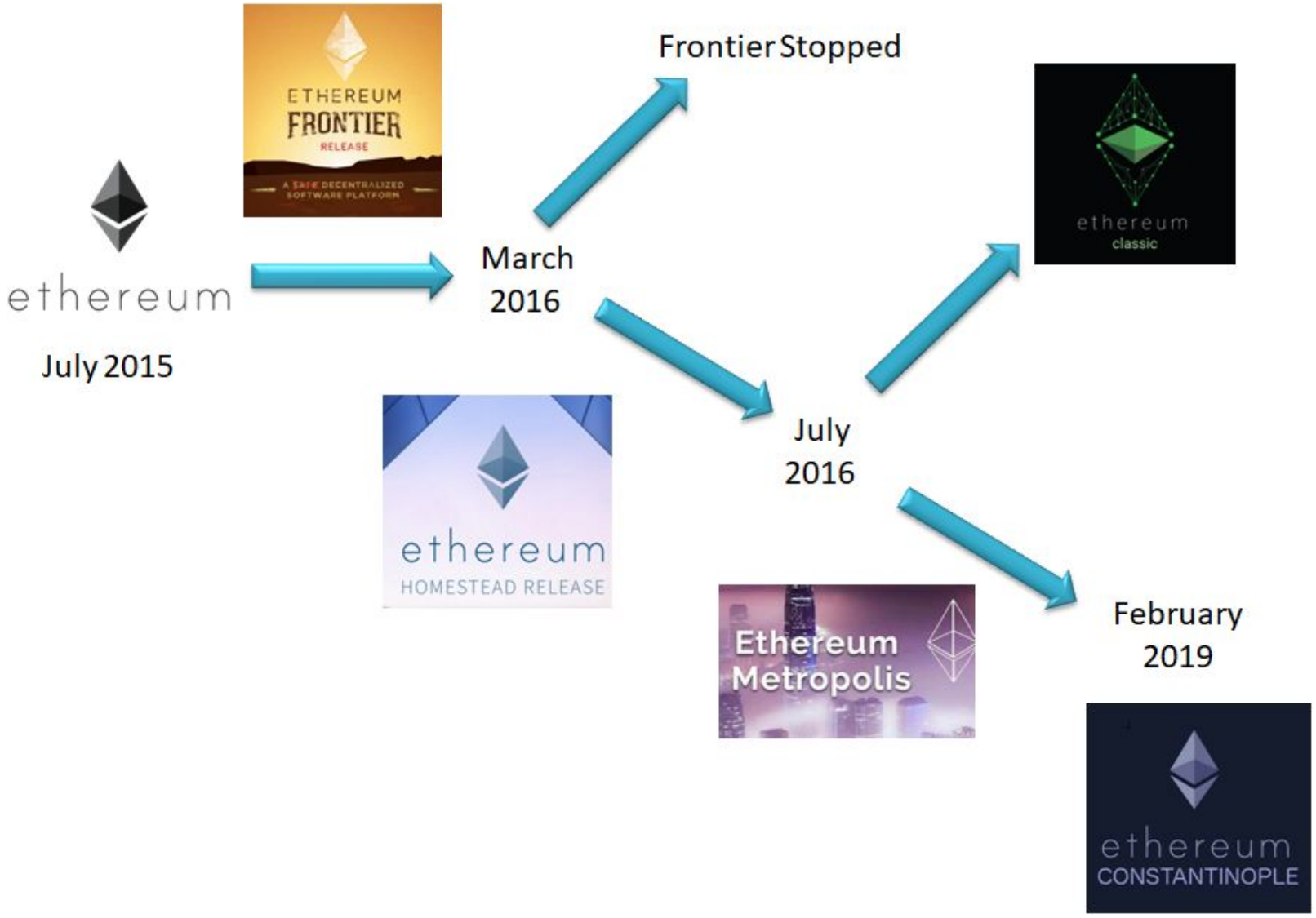
14 March 2016
Homestead
Version 2

16 October 2017
Metropolis
(v. Byzantium)
Version 3

28 February 2019
Metropolis
(v. Constantinople)
Version 3.5

TBA
Serenity
Version 4

Ethereum Fork History



Latest Release

- Metropolis - v.Constantinople (On block 7,280,000)
- Decrease Block Reward from 3 to 2 ETH.
- Delay the “Difficulty Bombing” to at least 12 months
- Block time reduced to 12 seconds (previously ~21 sec.)
- Reduction of Ethereum inflation to a low of 4.24 percent.
- Expected to reduce gas cost and cost on EVM.
- St. Petersburg upgrade to delete EIP 1283.

Bitcoin vs Ethereum

Computational Comparison

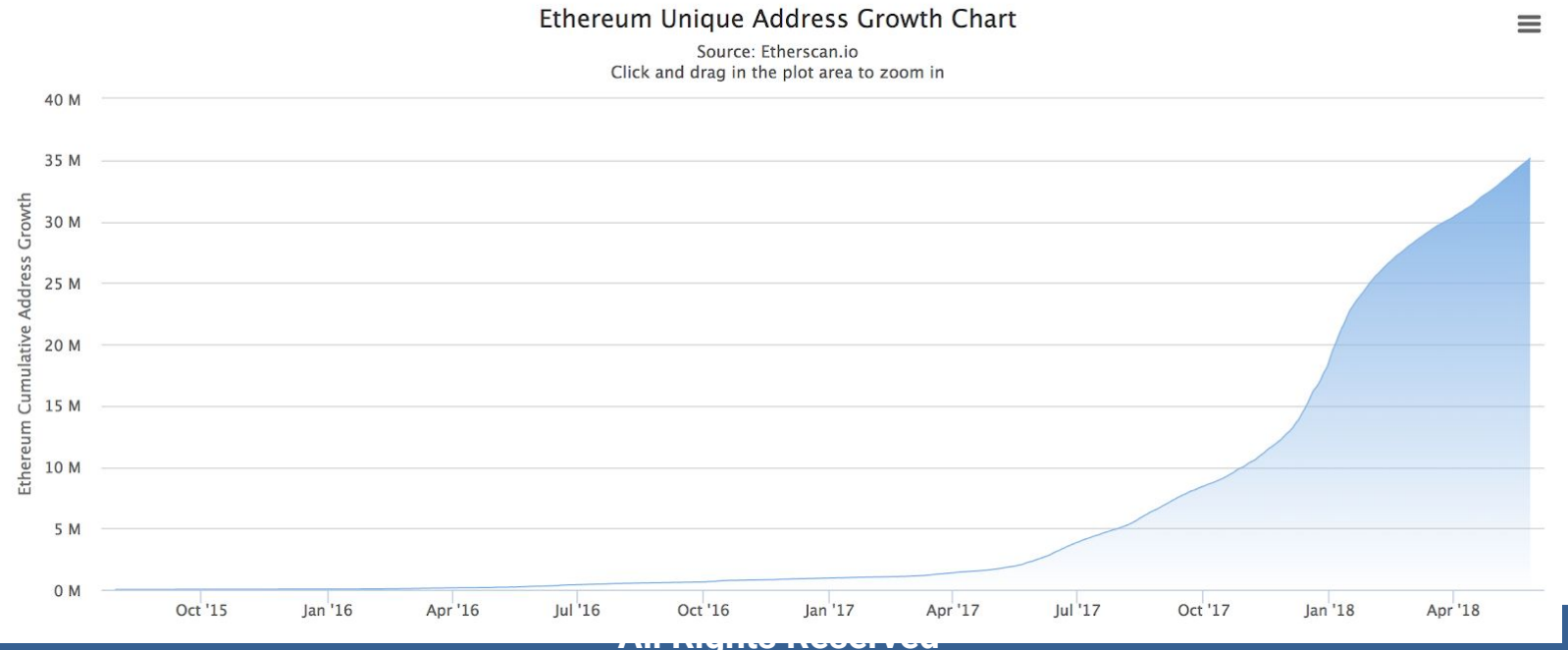
Bitcoin:
Jade sends 10 BTC to Pete

Ethereum:
Send 10 ETH from Jade to Pete if Jade's balance is 15 ETH and the date is after 12.01.2019

	Distributed Data Storage	Distributed Data Storage + Computing
Value Token	Bitcoin (BTC)	Ether (ETH)
Block Time	10 Minutes	14 Seconds
Block Size	Maximum 1MB	Depends (~2KB)
Scripting	Limited	Smart Contracts
Economic Model	Shrinks ¼ every 4yrs	Fixed
Mining Rewards	50 >25 >12.5 >6.25	5 > 3 > 0.6
Transaction Fees	Simple	Complex
Computational Power	Distributed Storage	Turing Complete

Ethereum Growth

- Most active platform = 94% of top 100 coins built on it, 87% of top 800
- ERC-20 tokens
- $5.5 billion raised through token sale in 2017
- $6.5 billion raised in Q1 2018
- First ICO on Ethereum - Augur Project (August, 2015)



Ethereum Developers

250,000	14,000	220,000
Developers	**repos**	**github commits**

Groups:

- Ethereum GitHub
- Ethereum Reddit
- Enterprise Ethereum Alliance

ethereum

Soon to be all of you!

Ethereum Ethereum Alliance

385 +
Member Companies

1650 +
Individual Members

ENTERPRISE ETHEREUM ALLIANCE

19
Technical, Industry And Legal Advisory Groups

45 +
Countries

EEA:

- Global community of blockchain leaders, adopters, innovators, developers, and businesses from around the globe collaborating to bring about solutions for the benefit of everyone.

Summary

- Applications that run on a Blockchain network are known as “DApps” because they can be automatically authorized and executed in response to the state of the network.
- Bitcoin laid the framework for decentralized storage; Ethereum set the precedent for decentralized computing
- This blockchain has grown significantly in the last few years as a platform for automatic business functions on the decentralized web.

How Does Ethereum Work?

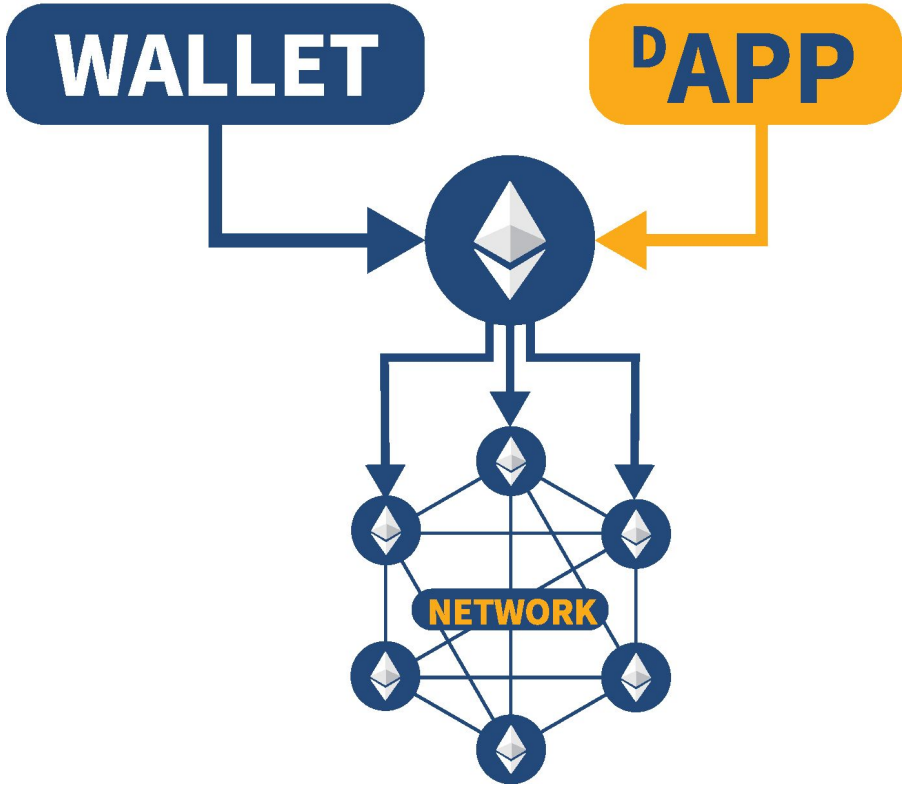
Segway into Ethereum Virtual Machine

How Ethereum Works: part 1

Wallet for managing Ether: Smart Contracts/Keys to speak to network

Node: Connects to network

dApp: Interacts with Contracts on the Network for a fee



How Ethereum Works: Part 2

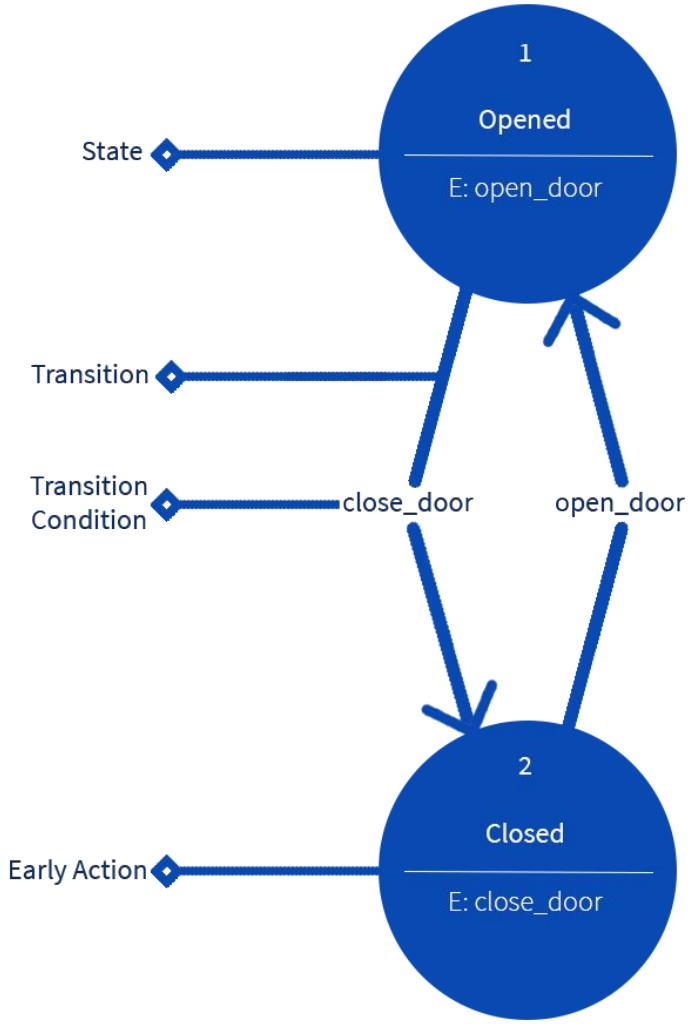
States: Unique configuration of information in a machine

Transitions: Transition Between State

Transition Conditions: Condition for State Change

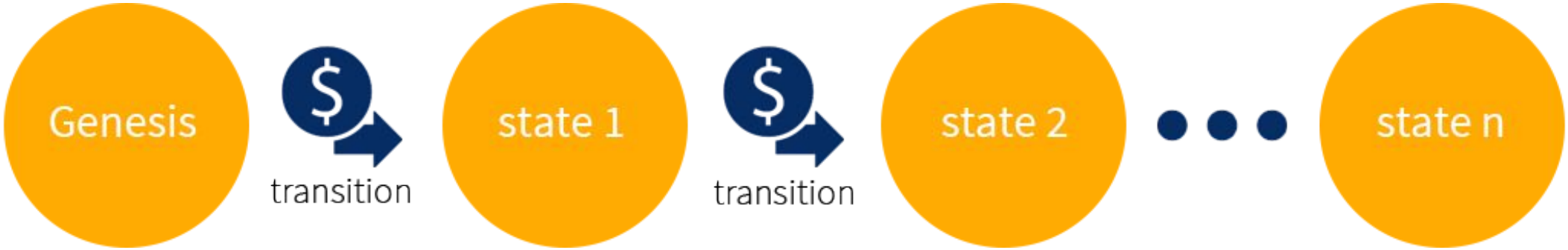
Transition Actions: Action associated with transition

State Actions: Actions associated with given state



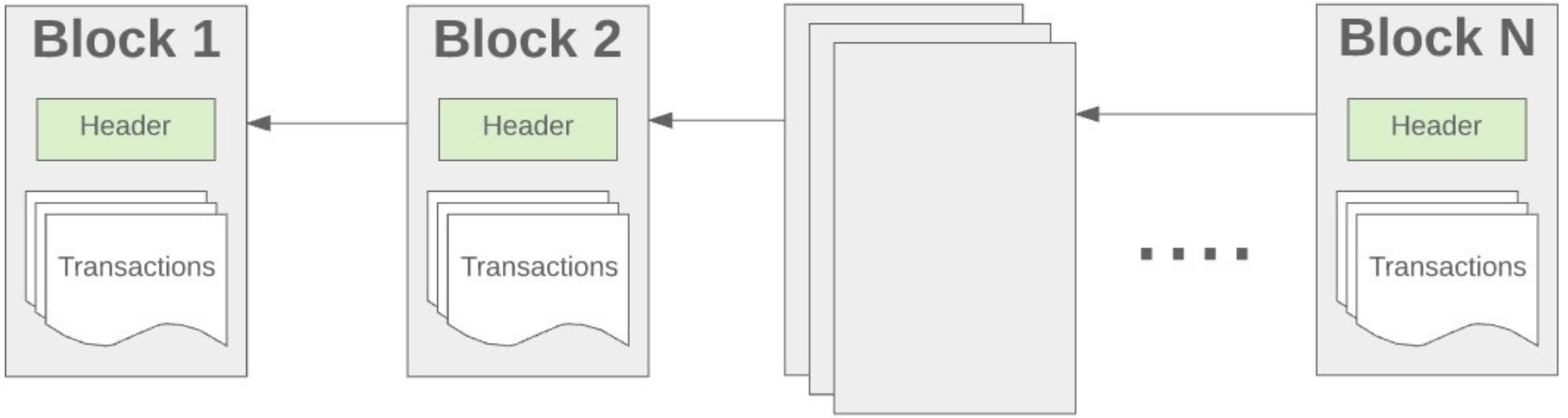
How Ethereum Works: Part 3

- When blockchain is created, genesis block is the first state
- ”blank state” - no transactions yet
- Transactions execute and move into final state
- Final state = current state



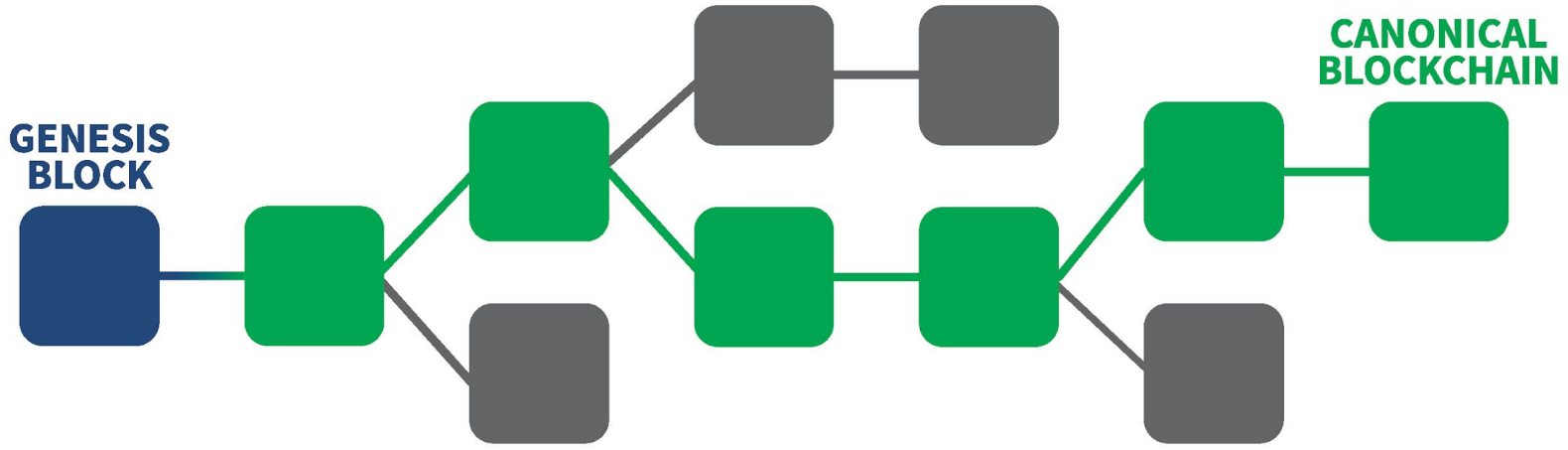
How Ethereum Works: Part 4

- These transactions of state, along with related data is grouped into blocks and chained together



How Ethereum Works: Part 5

- State transition through transactions only occur when valid
- Currently validated through Proof of Work
- Forks can appear, but to determine which path is most valid ETH uses
- GHOST protocol (Greedy Heaviest Observed Subtree)



Summary

- State Machine
- Transactions initiate state change
- GHOST protocol ensure longest chain is the main chain

Next lecture we dive into the EVM and break it down to its smallest components!

THANK YOU