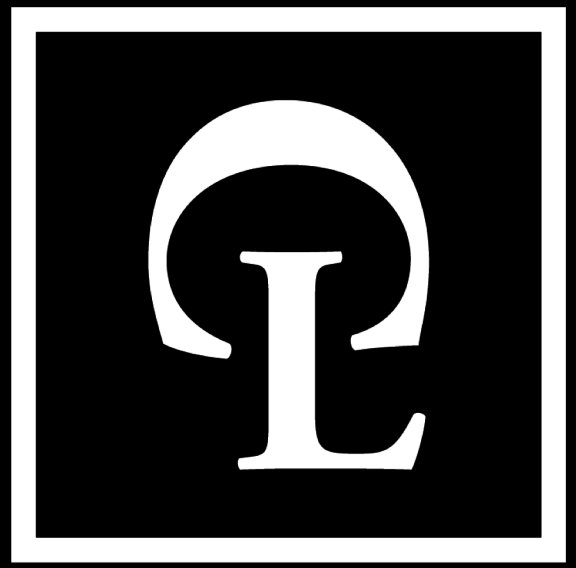



# Variants of Proof-of-Stake

@awasunyin

Salut, Paris!
A bit about myself…

- Founder @ **Cryptium Labs**
- Researcher @ **Cosmos**
- Data Scientist & Software Engineer @ **Chainalysis**

# About **Cryptium Labs**

- Proof-of-Stake Validator
  - Reasonable & Public PoS Networks
  - Tezos, Cosmos, Polkadot
- Based in Switzerland
- Protocol Development

# AGENDA

1. RE-visiting Basic Concepts
2. Some Variants of PoS
3. A Comparison of Consensus Mechanisms
4. A Comparison of Economic Mechanisms
5. Challenges for PoS Researchers
6. Conclusion
7. Q&A

# 1. **Re-Visiting** Basic Concepts

# Consensus Algorithm ≠ Proof-of-X

**Consensus Alg.**

Mechanisms that enable peers to agree on a specific state of values

**Proof-of-X**

Mechanisms that determine what peers are eligible to participate in consensus

**Nakamoto Consensus**

The chain with the largest pool of *work* or heaviest is the canonical one

**Byzantine-Fault Tolerant Consensus**

Latest block with more than 2/3 of the validator set's signatures

**Proof-of-Work**

Compete with other nodes to solve the computational puzzle or find the nonce for the next block

**Proof-of-Stake**

Allocate the required amount of value as a collateral, which can be lost when deviating from the protocol

# The **Nothing-at-Stake** Problem

*Nodes can cause and maintain forks at no cost*

# Example of NASP

- Present in PoS variants from commercial and academic projects
- Commercialised projects:
  - Delegated Proof-of-Stake (DPoS)
  - Used in e.g. EOS
- Assumes that if one of the active block producers (top 21 by votes) deviates, **it will not get voted again**
- Is it a fair assumption?

# Security of Your Application

*The risk of using NASP protocols as infrastructure for your dApp*

# Block Production ≠ Finality

*You might have one system for block production and an additional system for achieving finality*

# A Note on **Finality Gadgets**

*Beacon chain, layer on top of existing chain to enable finality*

# 2. **Some** Variants of PoS

# Variants of **Proof-of-Stake**

| **Liquid** PoS (LPoS) | **Bonded** PoS (BPoS) | **Nominated** PoS (NPoS) | **Casper FFG** |
| --- | --- | --- | --- |
| e.g. Tezos | e.g. Cosmos Hub | e.g. Polkadot | e.g. Ethereum |

# Variants of **Proof-of-Stake**

**Liquid** PoS (LPoS)

e.g. Tezos

**Bonded** PoS (BPoS)

e.g. Cosmos Hub

**Nominated** PoS (NPoS)

e.g. Polkadot

**Casper FFG**

e.g. Ethereum

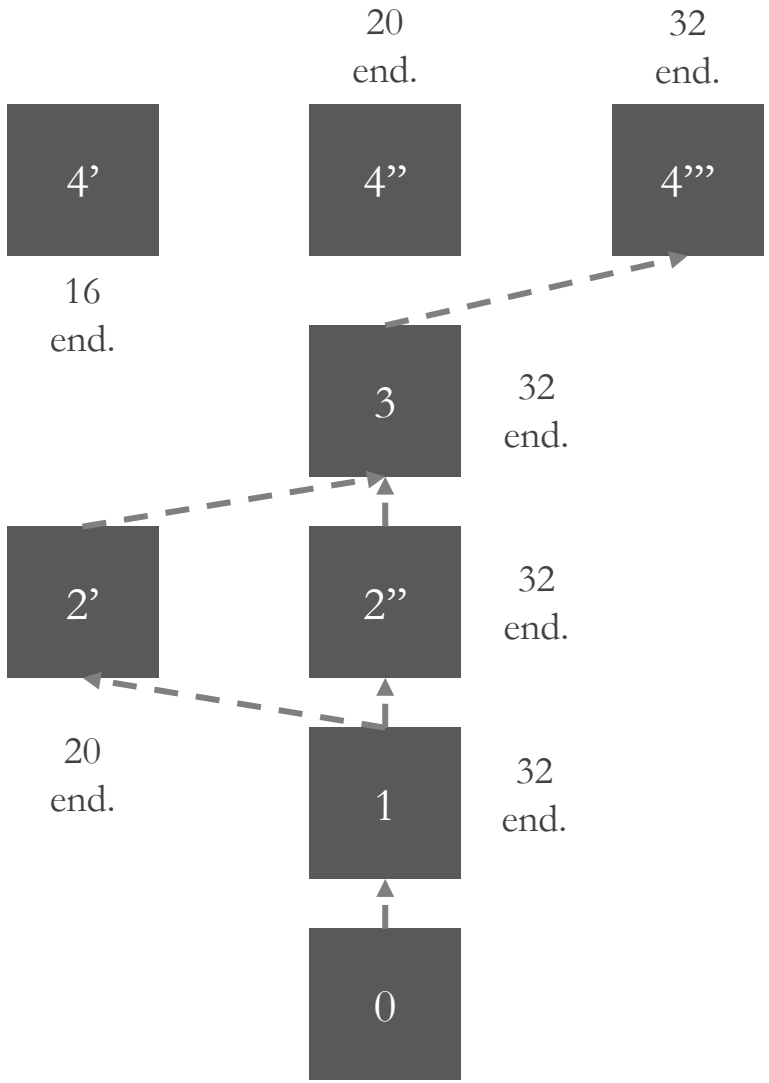
Nakamoto Consensus

BFT Consensus

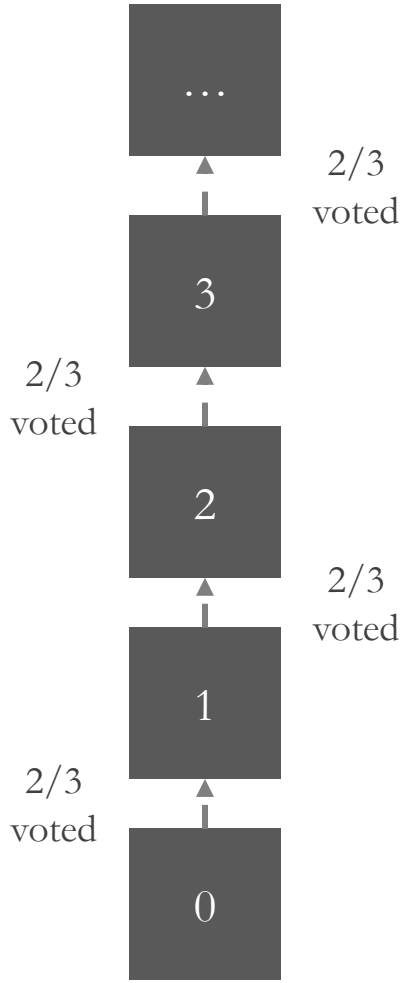
Hybrid Nakamoto + BFT Consensus

# 3. Comparing **Consensus**

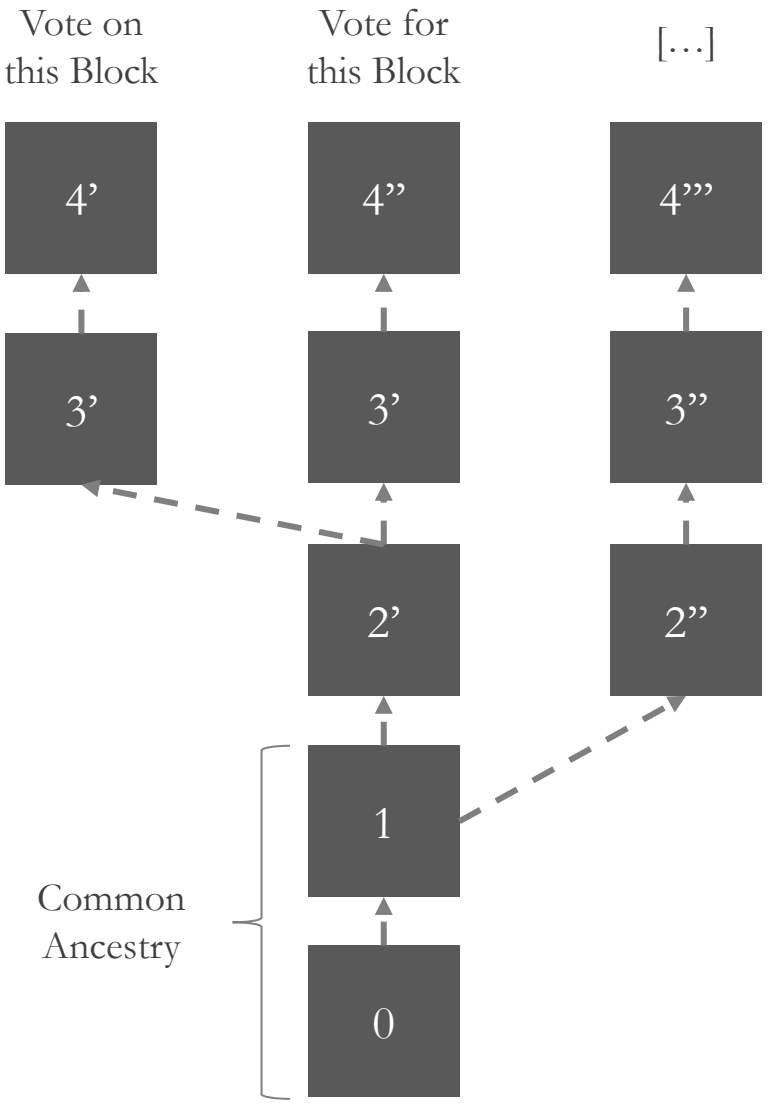
## **Tezos** (Nakamoto Consensus)



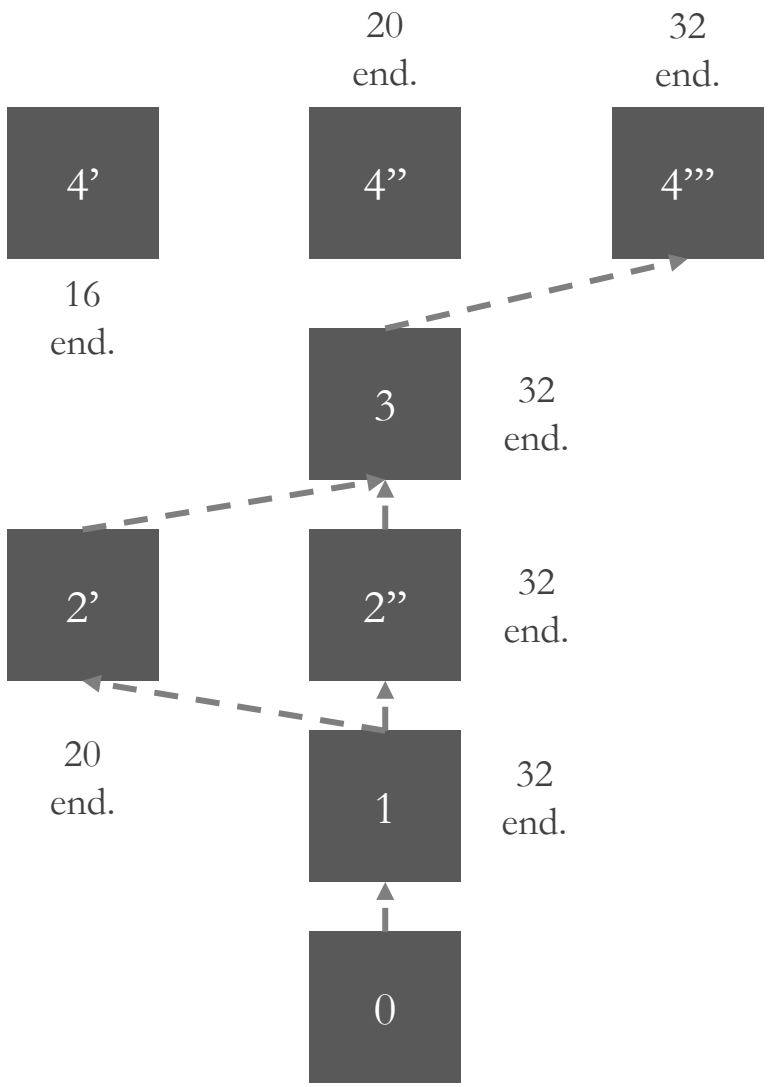
## **Cosmos** (Tendermint Consensus)



## **Polkadot** (Al's Finality Gadget)



**Tezos** (Nakamoto Consensus)

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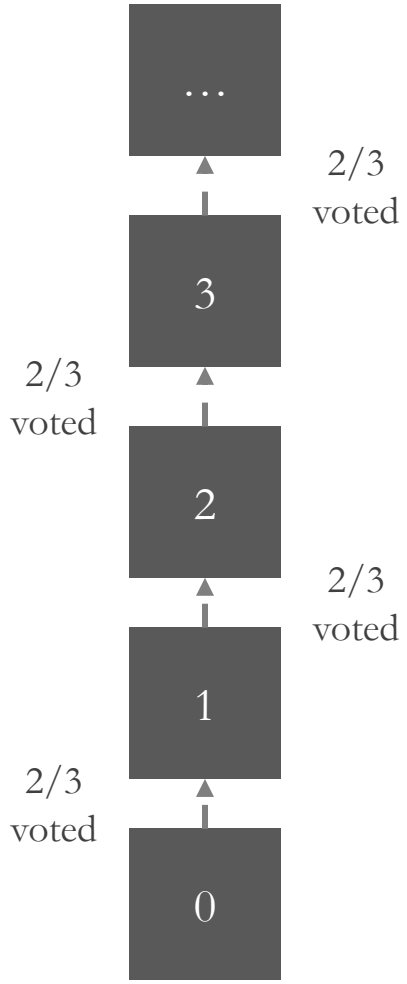


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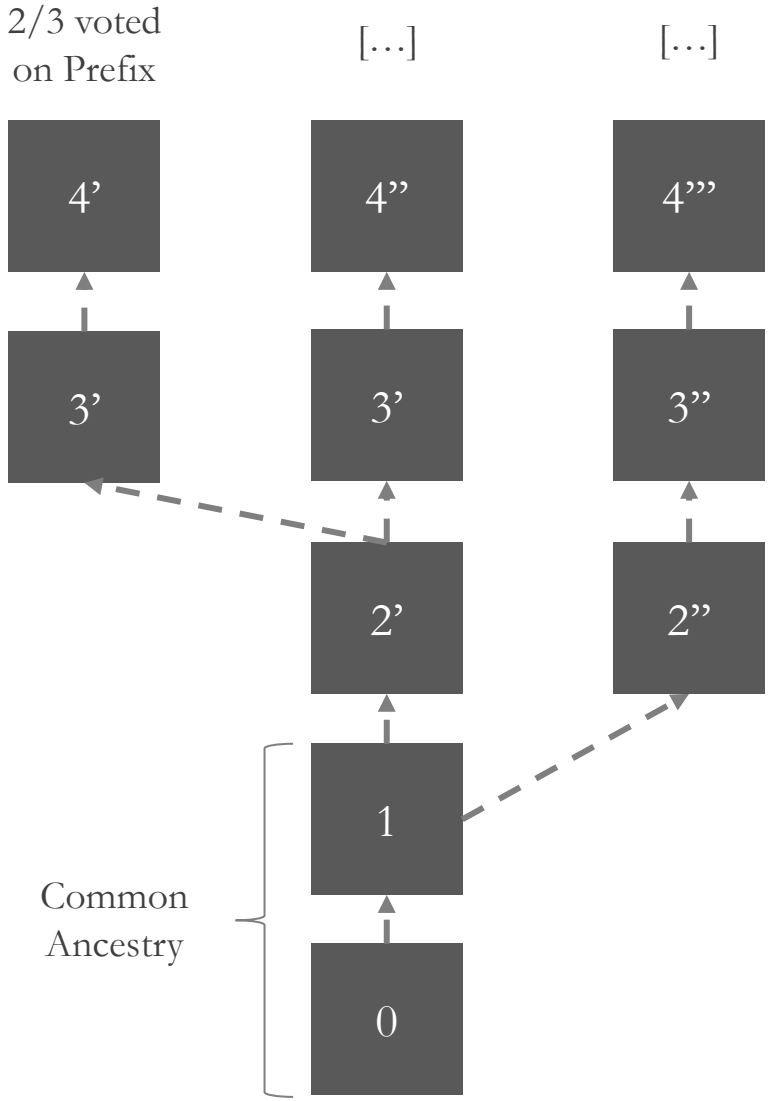

# 4. Comparing **Economic Models**

| | Tezos LPoS | Cosmos BPoS | Polkadot NPoS |
|---|---|---|---|
| **Requirement to Participate** | 10,000 XTZ (8,000 XTZ) | | |
| **Rights' Assignment** | Pseudorandom by Stake and Priority List | | |
| **Inflation** | 5.51%/Year when 60s. block times & all blocks in priority 0 | | |
| **Other Rewards** | Accusations<br>(50% of amount to validator) | | |
| **Safety Slashing Conditions** | Security Deposits for the entire cycle in the worst case | | |
| **Liveness Slashing** | Missing the Rewards | | |

| | Tezos LPoS | Cosmos BPoS | Polkadot NPoS |
|---|---|---|---|
| **Requirement to Participate** | | Top 100 by Stake | |
| **Rights' Assignment** | | Round-Robin by Stake | |
| **Inflation** | | 7-20% Adaptive to Global Stake | |
| **Other Rewards** | | Double-Voting evidences (rewards shared among all validators) | |
| **Safety Slashing Conditions** | | 5% of Total Stake (Self-Bond and Delegations) + Execution | |
| **Liveness Slashing** | | Jailing Time (~7 days) | |

| | Tezos LPoS | Cosmos BPoS | Polkadot NPoS |
|---|---|---|---|
| **Requirement to Participate** | | | - |
| **Rights' Assignment** | | | Pseudorandom and all validators have equal weights |
| **Inflation** | | | - |
| **Other Rewards** | | | Fishermen (not necessarily validators) |
| **Safety Slashing Conditions** | | | Self-Bond will be slashed before Delegations<br>1% for uncorrelated faults<br>100% for 1/3 same fault |
| **Liveness Slashing** | | | - |

| | **Tezos LPoS** | **Cosmos BPoS** | **Polkadot NPoS** |
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# What is Better?

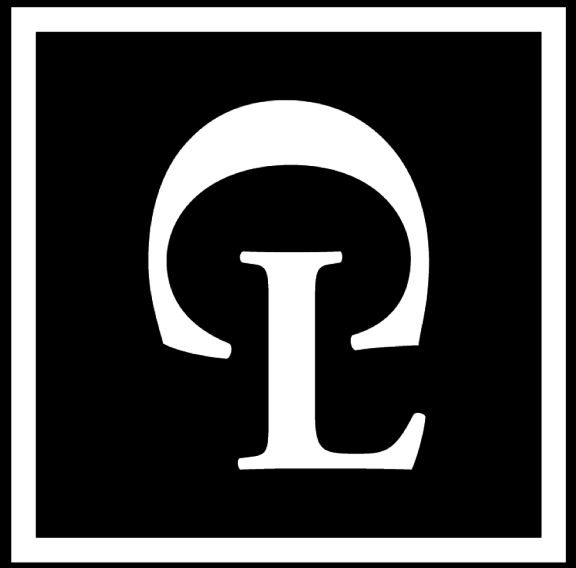
*It depends on what you are building, it might be interesting to do some research*

# Challenges for **PoS Researchers**

*Oblivious to Validators' Incentives*

# There is still a lot of work to do

*It might take a couple of years until a variant of PoS is secure enough*




# Questions?

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