Arc

ARC

Two Recent Advances in Decentralized Networks Design

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My Journey

2019

Research in BFT Consensus

2022

ComeBFT is born

2024

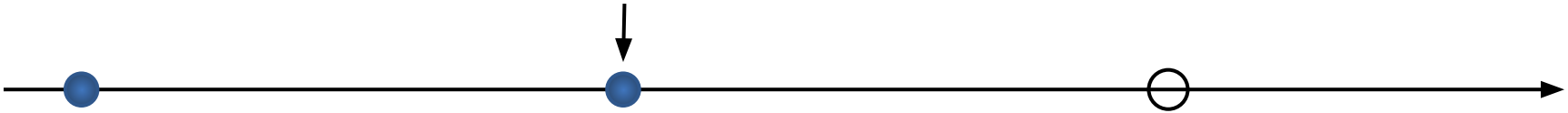
Malachite is born

2025 August

Joined Circle via Malachite acquisition

Arc Public Testnet is here

https://arc.network



SEPTEMBER

Private Testnet

OCTOBER

Arc Public Testnet went live

2026

Mainnet

Note: Dates are subject to change

Join us at Circle!

- Circle is a public 🇺🇸 company (IPO Q2 ‘25)
- Arc is a flagship platform, besides USDC and EURC stablecoins
- Significant portion of our team are EPFL alumni

careers.circle.com → “intern”

Two Recent Advances

in Decentralized Networks Design

{1} {System Design}

Predictable Costs & Settlement

{2} {Protocol Engineering}

Multi-Proposer

Two Recent Advances

in Decentralized Networks Design

{1} {System Design}

Predictable Costs & Settlement

From First Principles

Predictable costs & settlement

1. Predictable fees
2. Deterministic settlement
3. Predictable latency

Stable fees

Importance

Reduce volatility

Mechanism

USDC as Gas
+ others also

Deterministic Settlement (1/2)

Malachite consensus engine

- Implements Tendermint
- The most battle-tested BFT consensus protocol
- Proven in production via CometBFT since 2019
- Well-studied in literature

Tendermint

CometBFT lessons → Malachite design

- Modular design, especially at p2p level
- Rust for type safety & performance

CometBFT

Deterministic Settlement (2/2)

Tendermint Characteristics

- Well-known trade-offs vs. other BFT consensus protocols
- Scalability O(100) validators; up to tens of 1000s
- Latency > Throughput
- Can evolve in both Throughput and Latency dimensions

Measurements ~August 2025

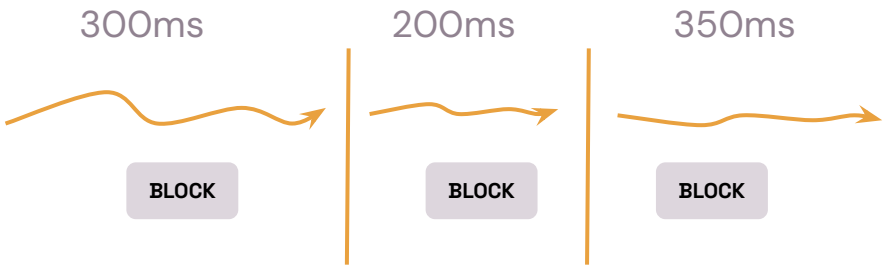
- ~330ms block time
- 3'000tps (->100'000 tps+ in the future)
- In a 20-node geo-distributed network

Why "Deterministic?"

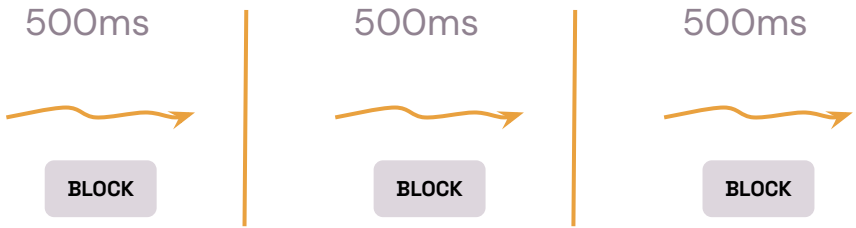
- Known validator set (replicas)
- Prioritizes Safety > Liveness
- Avoids reorgs ("eventual consistency")
- Institutions don't want to deal with poorly defined properties

Predictable Latency

Via Stable Block Times



- Follow the speed of the geo-distributed network
- Natural variations due to block proposer placement & latencies



- “Throttling” algorithm
- Wait at end of block production
- In practice, ~99.99% of block finalize in ~500ms

https://testnet.arcscan.app/

From First Principles

Predictable costs & settlement

✓ 1. Predictable fees
✓ 2. Deterministic settlement
✓ 3. Predictable latency

Bonus, two other system design choices:

4. Opt-in Privacy
5. Permissioned validator set

Johnny Depp in Pirates of the Caribbean

Permissioned validator set

- Institutional-grade
- Professional
- Independent in their judgement
- Wide geographic reach
- Wide jurisdictional reach
- Compliance focused

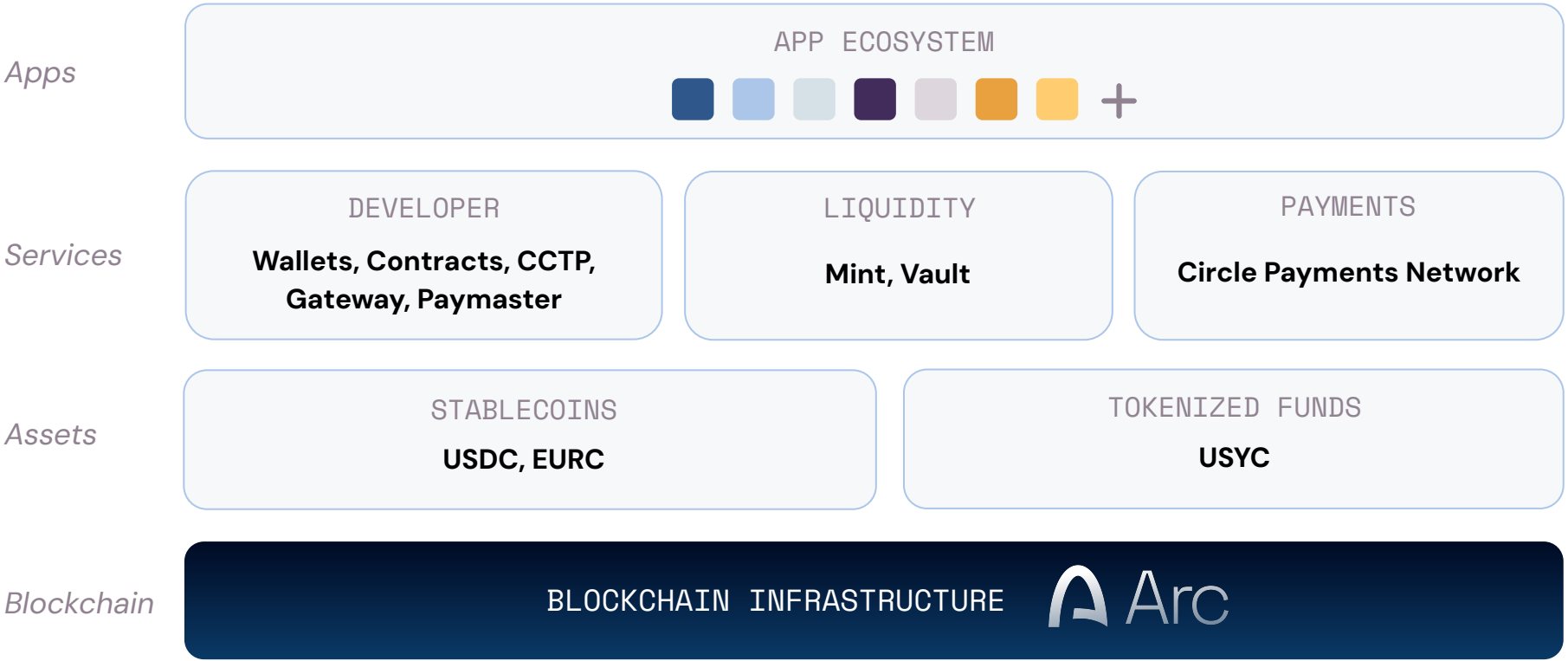
Predictable Costs & Settlement

Why is this important?

Ferdinand Magellan (1519–22) portrait
Encyclopædia Britannica, Inc.

Voyages of Ferdinand Magellan (1519–22) and Francis Drake (1577–80) across the Atlantic Ocean and around the globe.
Encyclopædia Britannica, Inc.

Arc is the foundational layer of Circle's full-stack platform[1]



1. Please see slide 22 for important product disclosure

Two Recent Advances

in Decentralized Networks Design

{2} {Protocol Engineering}

Multi-Proposer

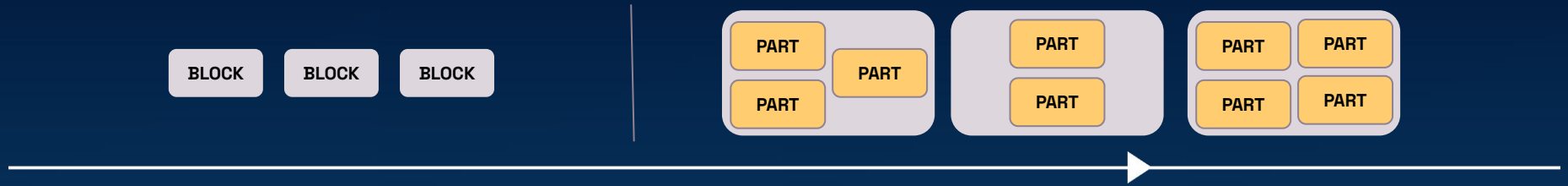
Multi-Proposer

Motivation

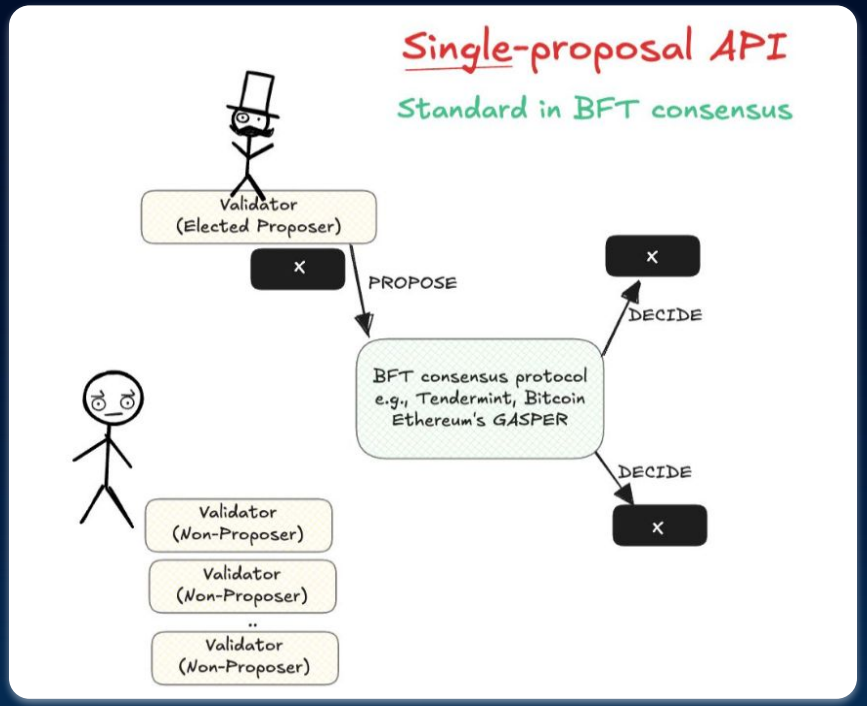
- *How to enable block construction out of multiple proposals?*
- Prompted by anti-censorship motivation
- Avoid rabbit holes with risky new designs
  - Use Tendermint as a black box
  - Build on top of a solid foundation

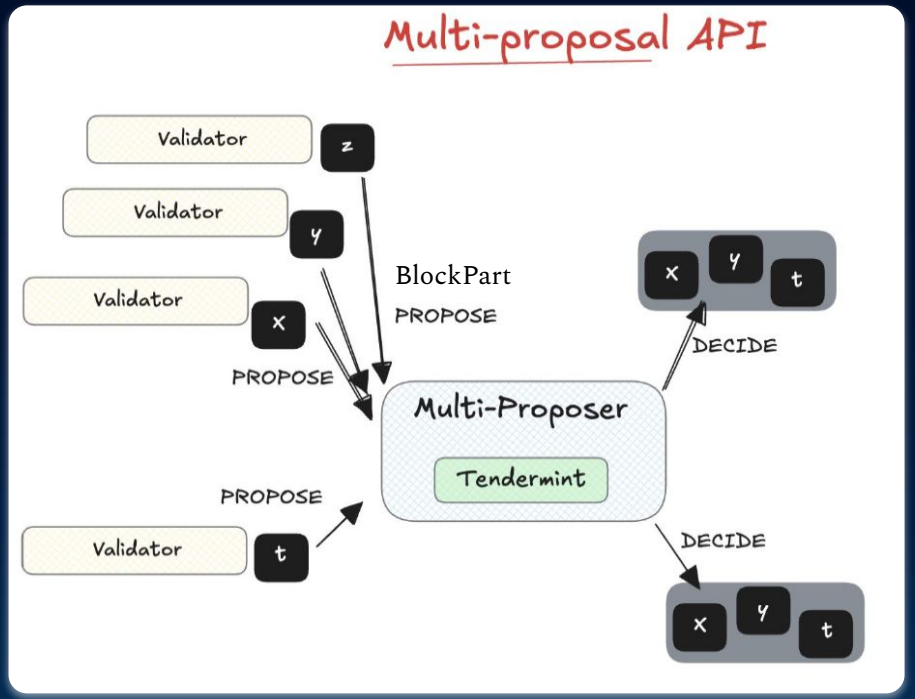
Intuition

- Allow *all* validators to propose
- Proposals happen at *any* time
  (not only when a validator is the proposer)
- Each proposal represents a BlockPart
  (not the full block itself as it used to be)
- Blocks are created out of *BlockParts*



Single- vs. Multi-Proposer API

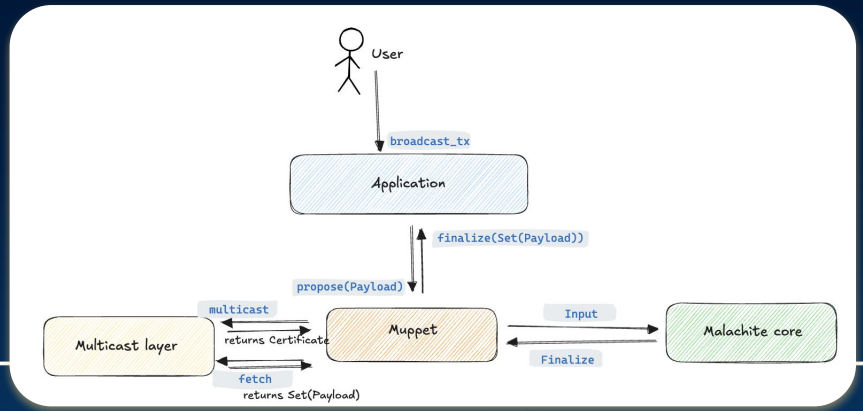




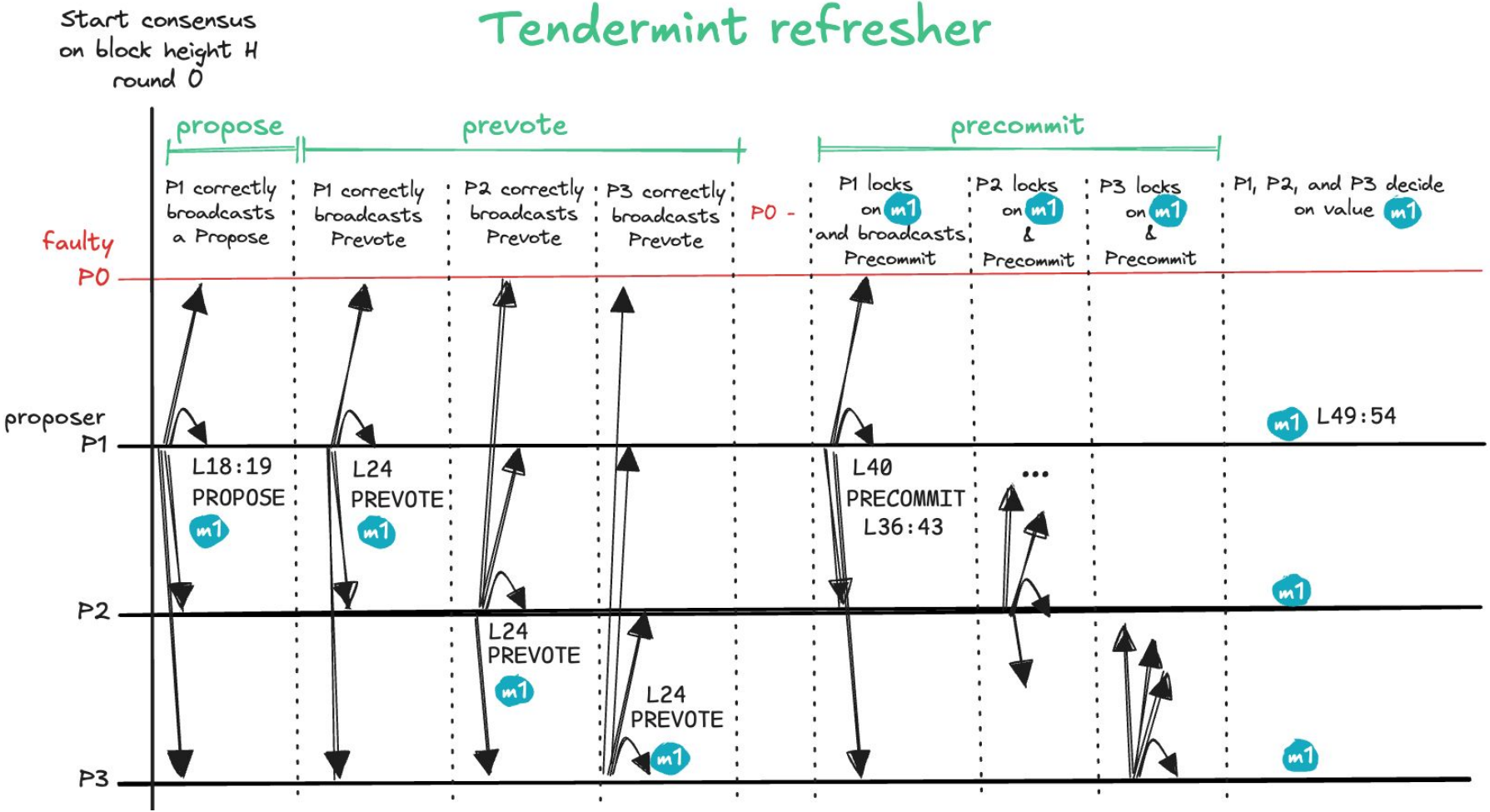
Multi-Proposer

Technical approach

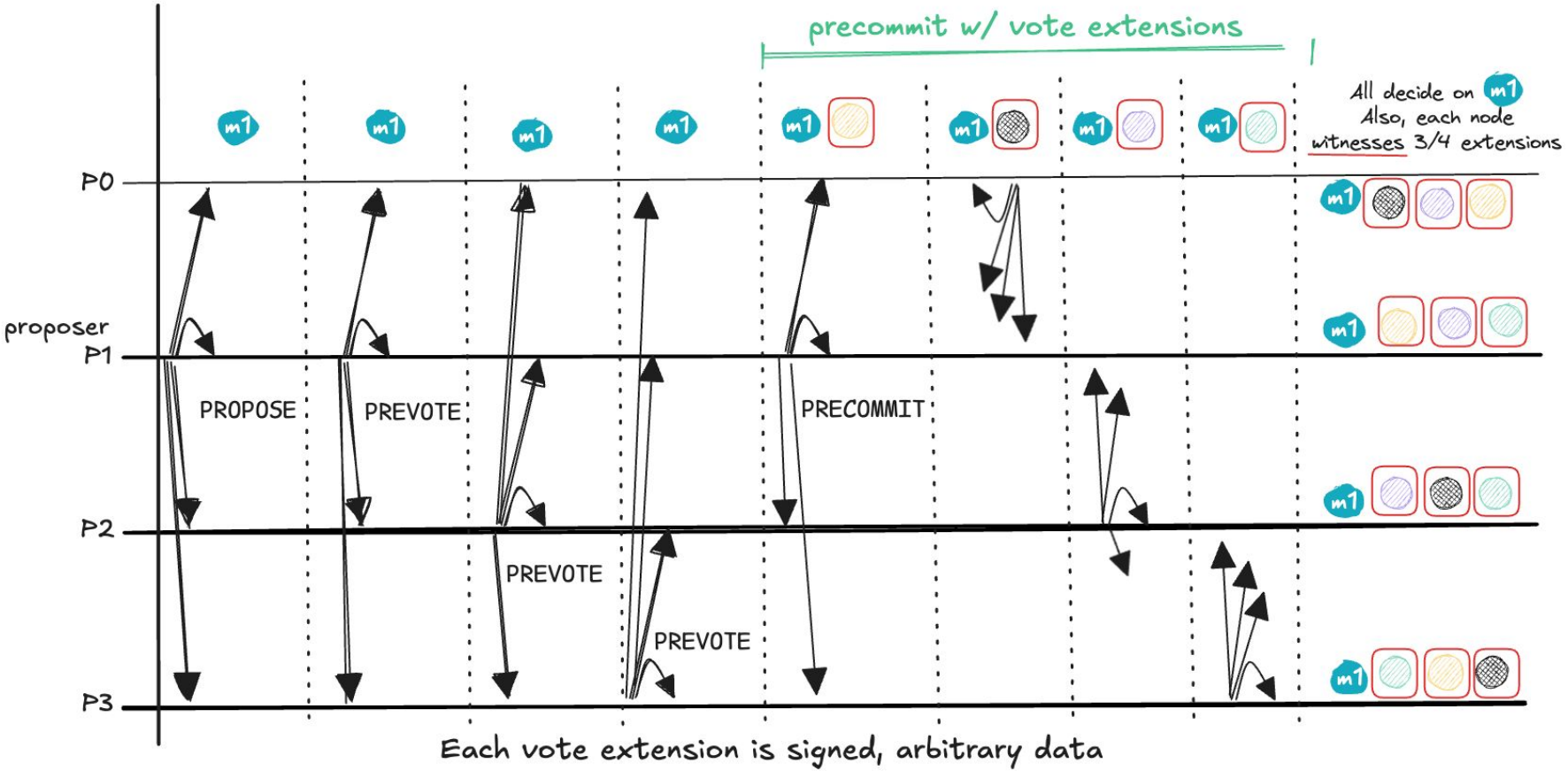
- Leverage Vote Extensions (VE) – messages piggybacked on Tendermint Precommits
- Put each BlockPart in a VE
- Precommits are necessary for liveness & safety -> Make VEs “un-ignorable”
- BlockPart dissemination happens off-the-critical path of consensus via a separate secure multicast protocol



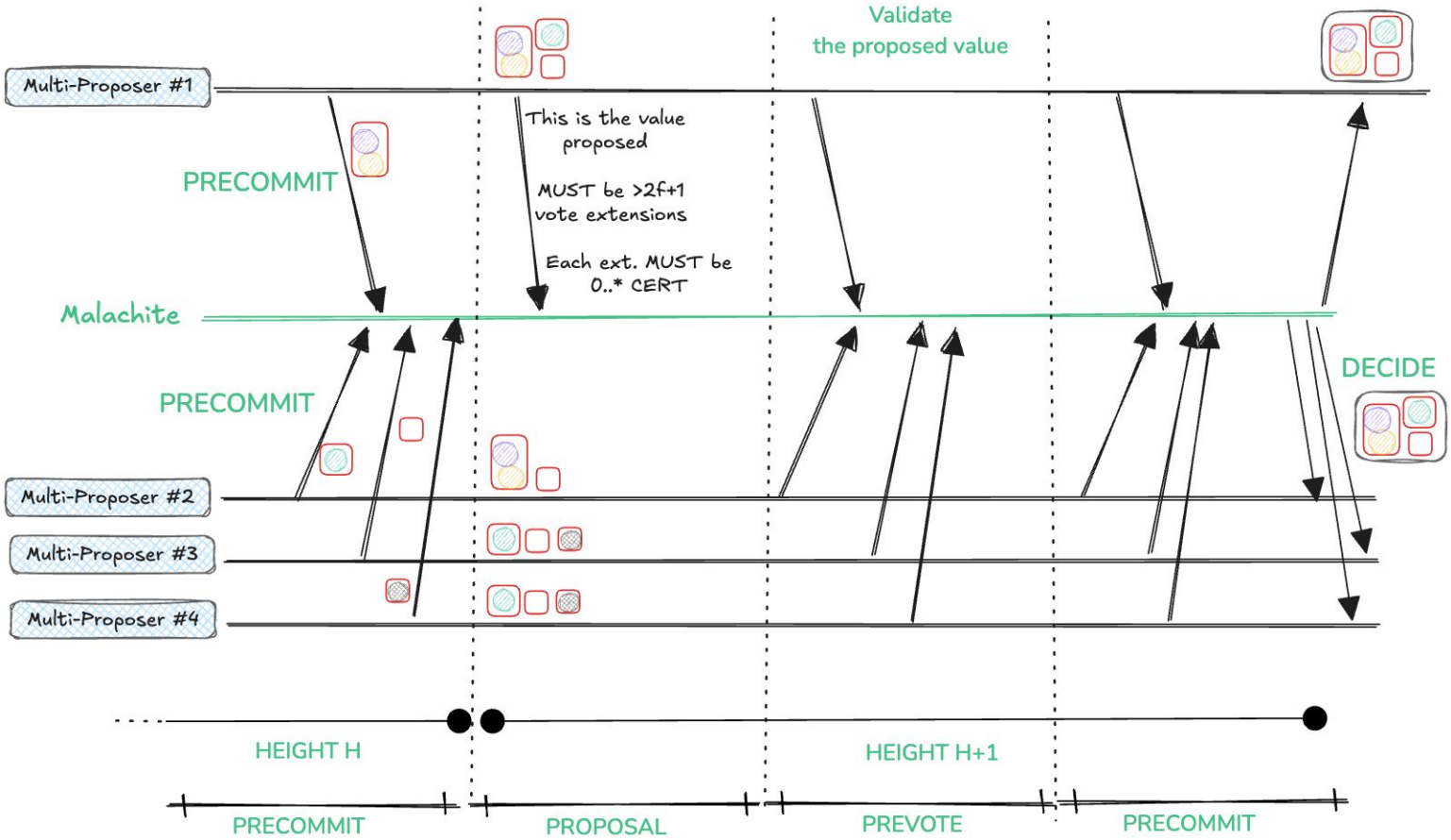
Tendermint refresher



Vote Extensions



Multi-Proposer Design



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