Introduction to IOTA – a feeless cryptocurrency

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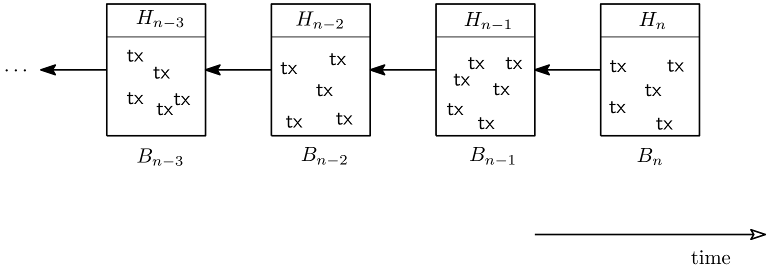
IOTA Foundation

Blockchain: decentralized consensus (Satoshi Nakamoto, 2008)



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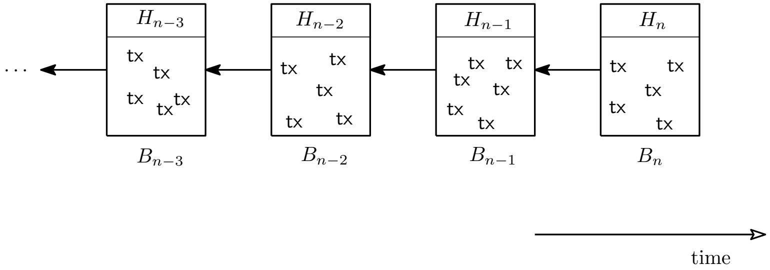

Bitcoin mining: find a *nonce* N_{n+1} such that

$$\mathtt{hash}(H_n, N_{n+1}) \leq 0.00\ldots01$$

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- so: “help the others, and the others will help you; however, if you don’t help the others, the others won’t help you”

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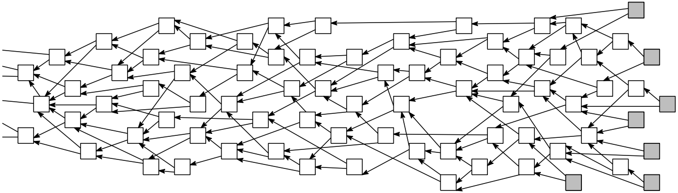

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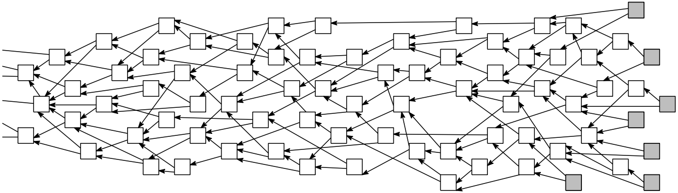

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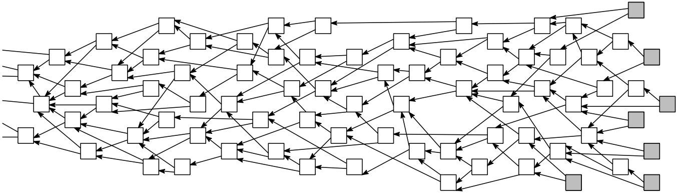

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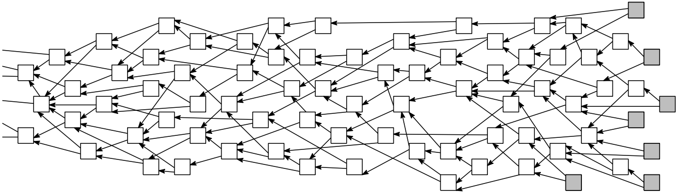

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- actors will behave in a “reasonable” way because it’s a good idea to do so, and the designer’s role is to propose a “good” set of rules (e.g. for tip selection)
- possible applications of AI in the future versions of the protocol — for example, to approach better reputation systems (i.e., one can think about using AI for detecting node’s malicious behavior)

Deeper look: consensus in IOTA Tangle

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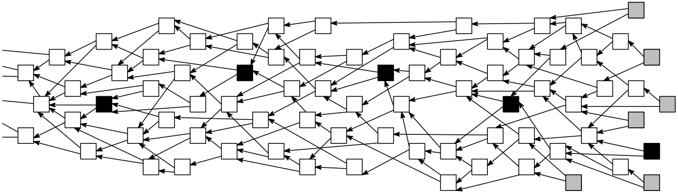

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- consensus as an attracting state

Coordicide, some implementation details:

- voting layer: nodes can resolve conflicts pro-actively. FPC-BI: `arxiv.org/abs/1905.10895`

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- test implementation: `github.com/iotaledger/goshimmer`

More about Fast Probabilistic Consensus (FPC).

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Majority dynamics (threshold Voter Models):

- there is a graph, each site of which has an “opinion”, 0 or 1
- at random moments, each site consults *some* (few) neighbors, and adopts a new opinion using a “majority” rule.

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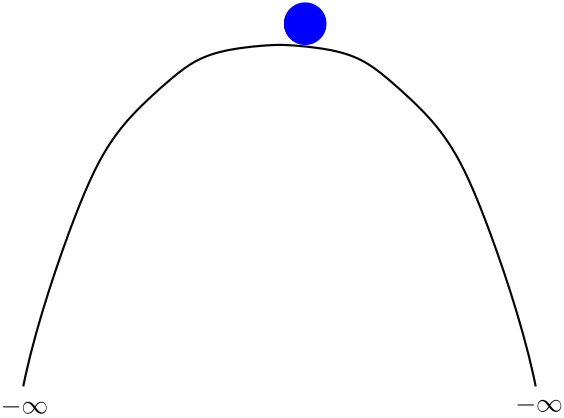
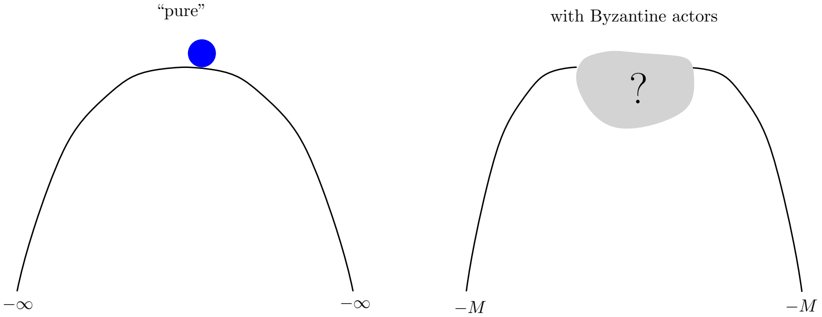
Properties:

- interesting and many (extensively studied since 70’s)
- in particular: only two extremal invariant measures (“all-0” and “all-1”), which are consensus states.

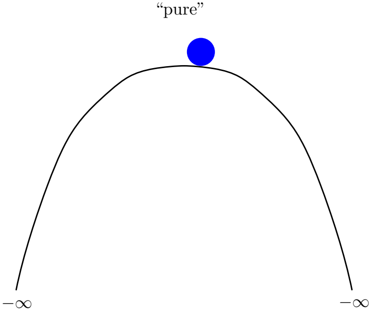
Majority dynamics as a RW on a potential:

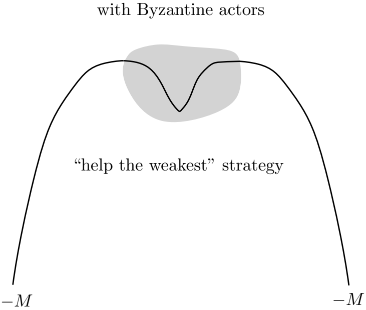


Majority dynamics with Byzantine actors:



Majority dynamics with Byzantine actors: the curse of metastability





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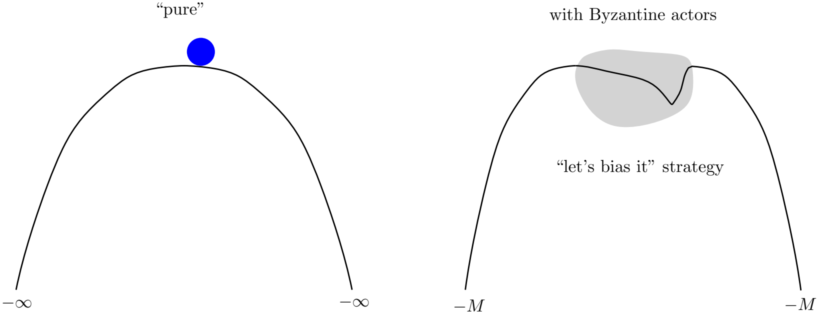
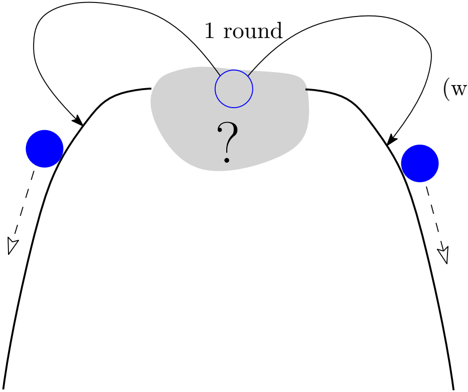


Fast Probabilistic Consensus (FPC): defeating the metastability with turn-based common random thresholds:



(with uniformly positive probability)

Questions?