# The Honey Badger of BFT Protocols

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# Timing assumptions considered harmful

- Weak Synchrony and Asynchronous BFT Protocol
- Why not weak synchrony
  - The liveness will fail when expected time assumptions are violated
  - Less throughput when network is unpredictable
- HoneyBadgerBFT guarantees liveness without making time assumptions

# Asynchronous networks are the “harsh climates” of distributed computing

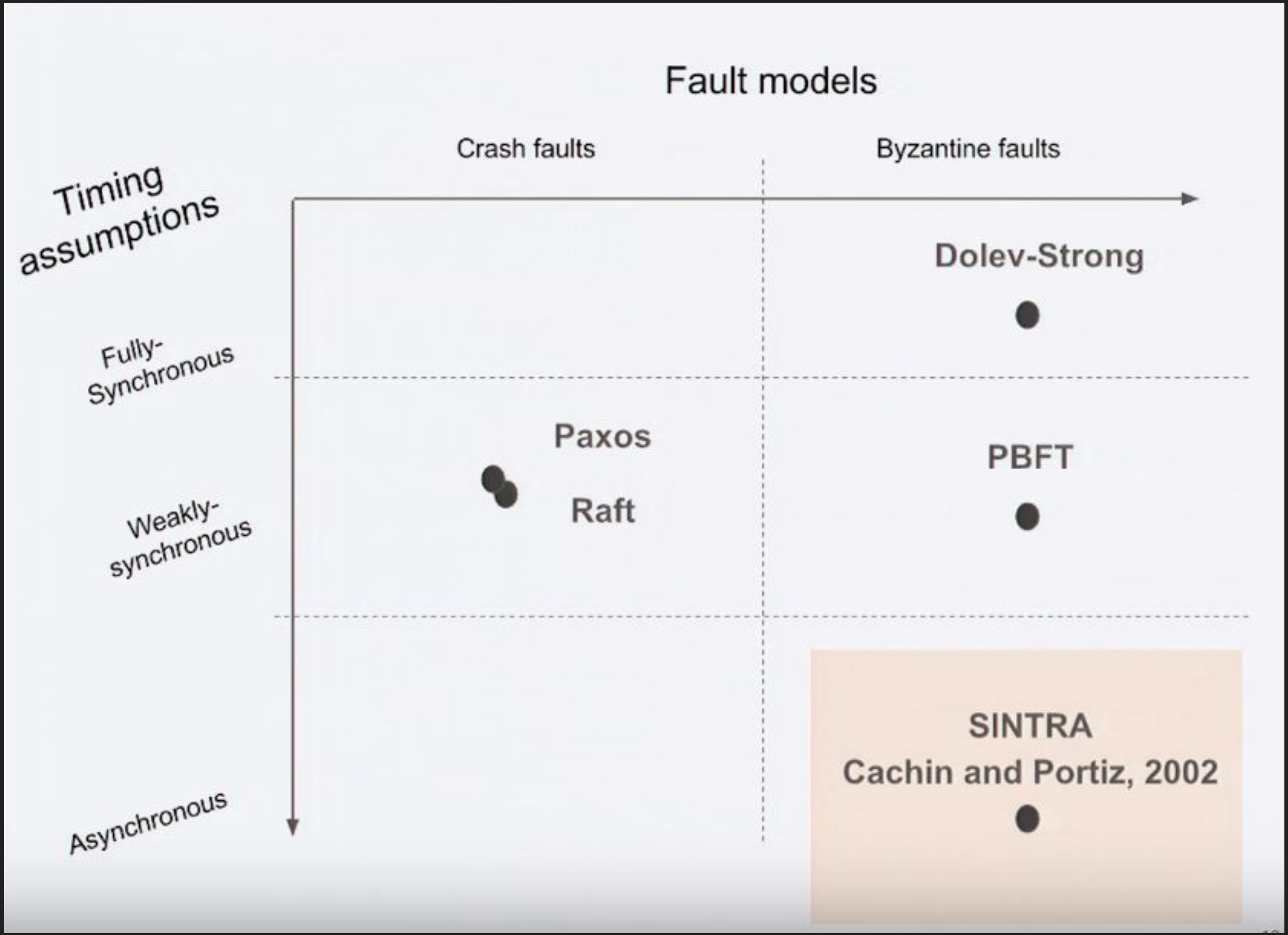
Full Synchrony: all messages are delivered within Δ time

Eventual Synchrony: after unknown time *GST*, all messages delivered within Δ

Partial Synchrony: Δ is unknown to the protocol

Weak Synchrony: $\Delta t$ is time varying, but grows polynomially in t

Asynchronous: all messages are eventually delivered


Fault models
Crash faults
Byzantine faults
Timing assumptions
Fully-Synchronous
Weakly-synchronous
Asynchronous
Dolev-Strong
Paxos
Raft
PBFT
SINTRA
Cachin and Portiz, 2002

# The Approach

Adapt synchronous BFT for efficiency in the batch setting

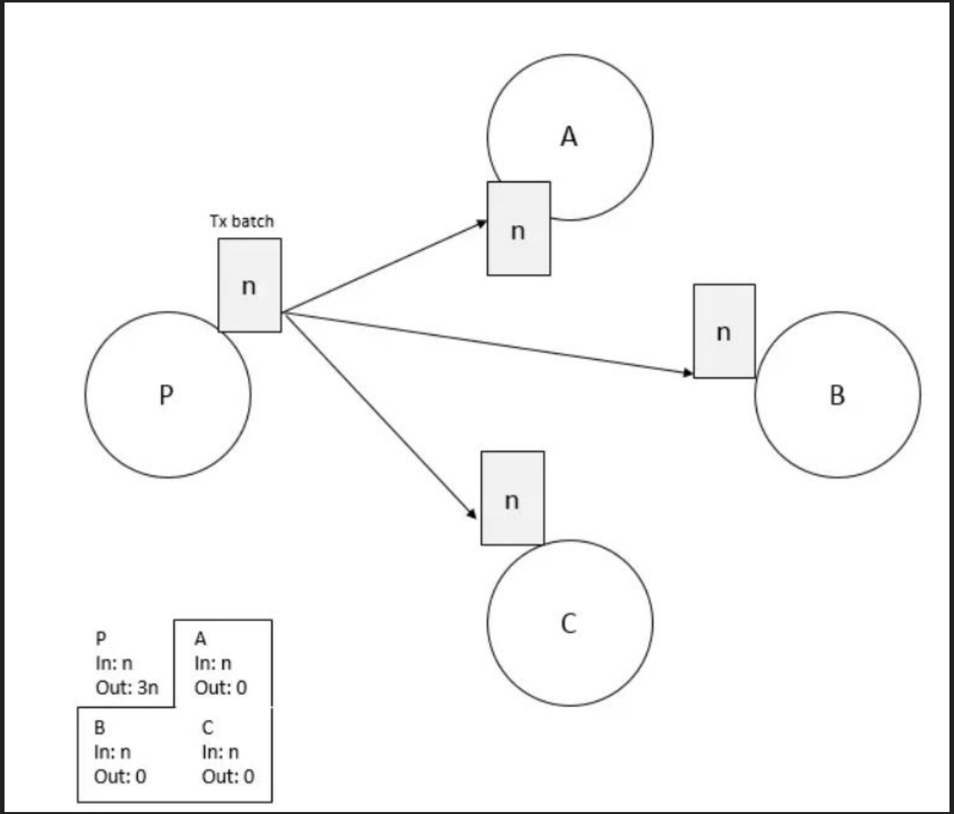
1. Improve by O(N) by “refactoring” with known(but overlooked) primitives
2. Improve by another O(N) by using random selection and threshold encryption

# Refactor of the transactions to mitigate node bandwidth bottleneck

PBFT broadcast standard way

P: leader

Leader bandwidthO(n*3)



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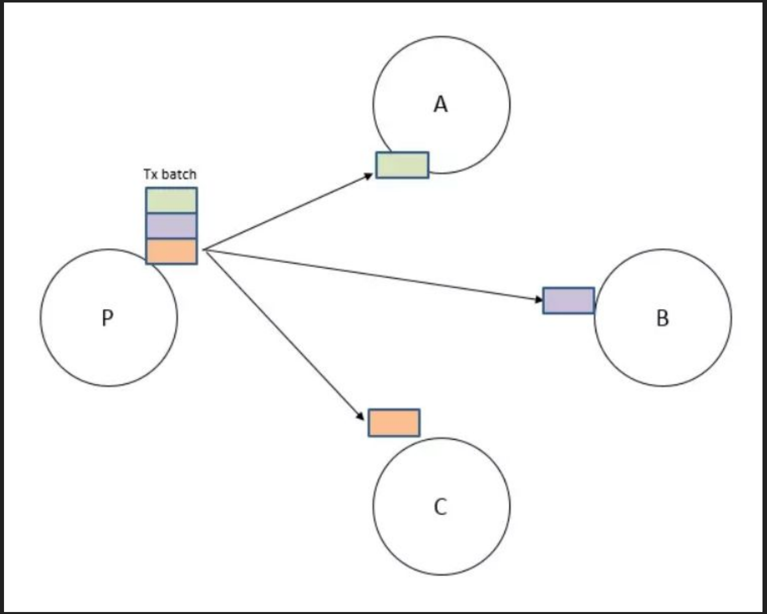
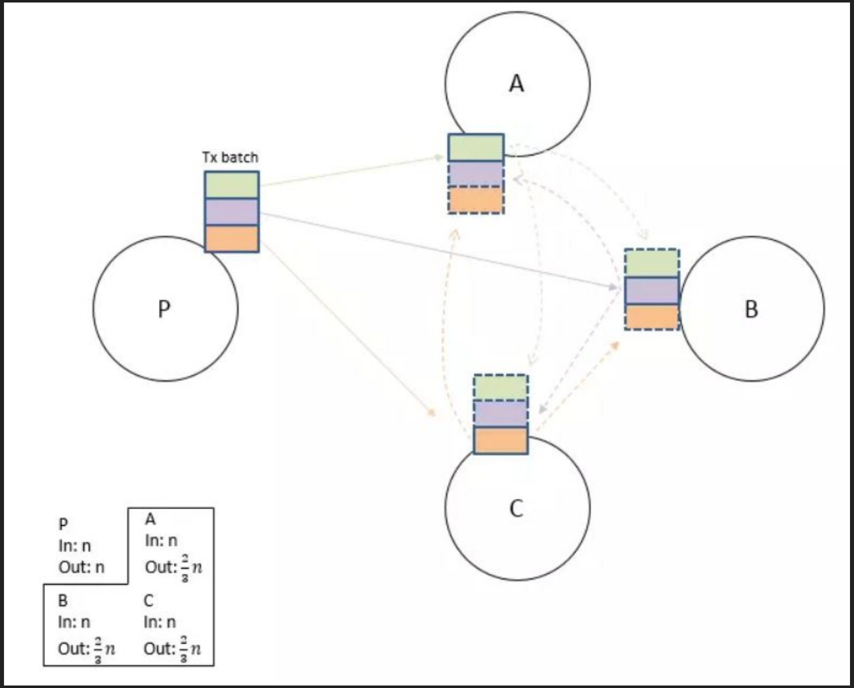
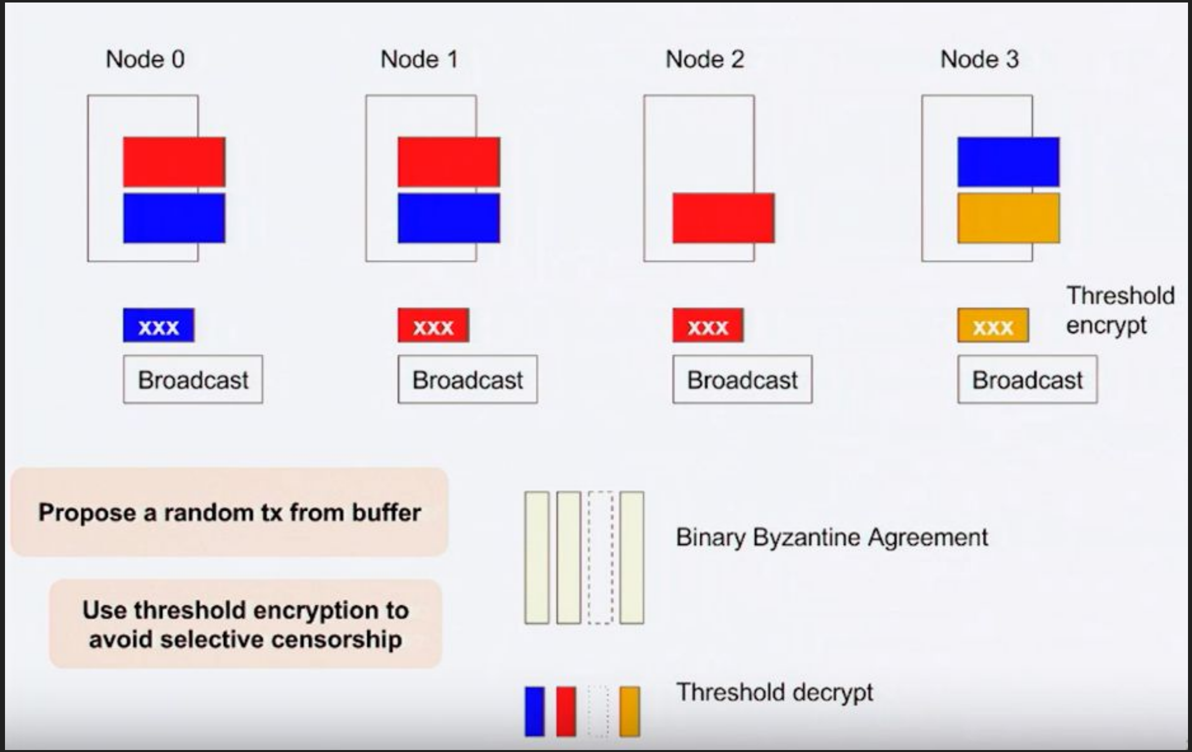



Improved broadcast way

Leader bandwidthO(n)

# Avoid sending redundant transactions-random selection and threshold encryption



# Results: Optimal resilience and efficiency

Choose a large enough batch size, of B = $\Omega(\boldsymbol{\lambda N^2 \log N})$.

Total Bandwidth per transaction (for each node) is O(1).

Expected # of rounds is O(LogN).

# Implementation

Python protocol implementation, using gevent

Threshold cryptography: Charm/PBC library

- Signature:Boldyreva ‘03
- Encryptions: Baek and Zhang ‘03

Experiments on local cluster, worldwide EC2, & over Tor

Thank you!