ONet Implementation of Gossip-based Signature Aggregation

Master Semester Project

DEDIS lab

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Introduction

Decentralized cosigning protocols have the main purpose of collecting digital signatures of a message from many peers.

There are two existing implementations:

- BLS CoSi which uses trees.
- Gossip protocol.

Introduction

Project has 2 parts:

- Develop and compare alternative implementations of gossip-based aggregation. Be more efficient.
- Add an implementation inside Cothority's ONet library.

Background – Existing implementations

BLS CoSi

- Arranges participating nodes in a tree of depth 3.
- Rumors propagated following the tree structure.
- Earlier aggregation is done in intermediate nodes.
- Root does final aggregation of multi-signatures received from its children, who aggregated the signatures they received from their children.

Background – Existing implementations

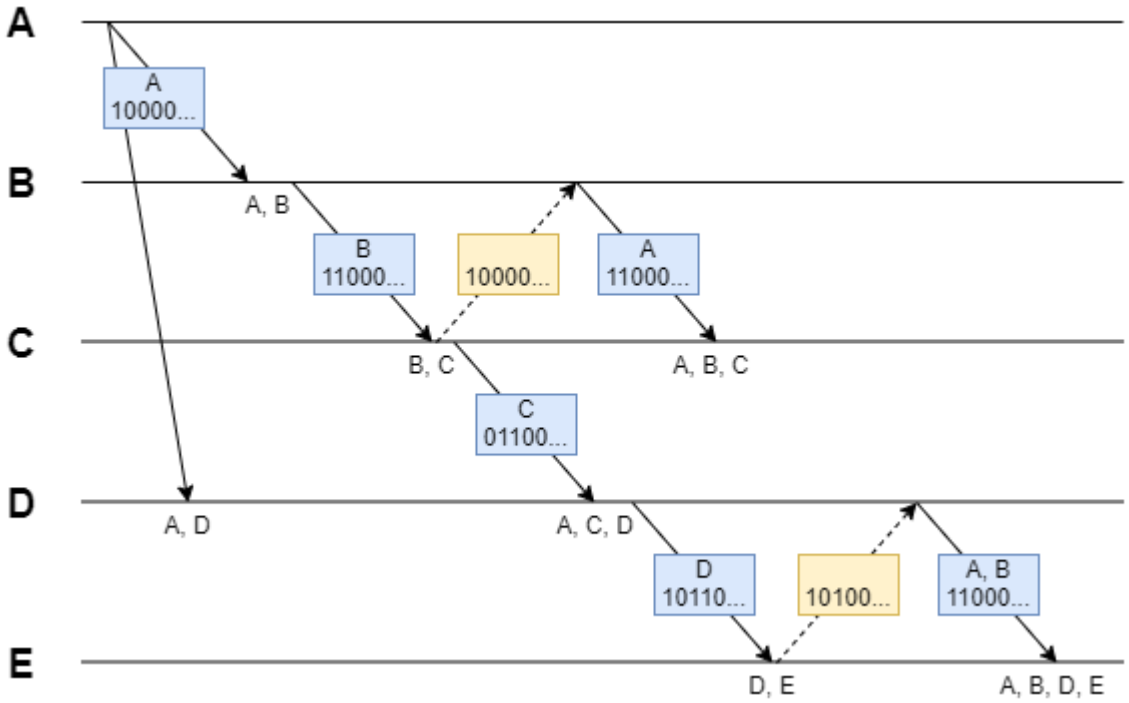
Existing Gossip aggregation protocol

- Two variations:
  - Simple aggregation at the root after gossiping and collecting enough signatures.
  - During gossiping, aggregation is done using a binary tree.
- Rumor messages are push-messages only. Randomly selected recipients of rumor.

- **Part 1 – Alternative Gossip-based aggregation implementations**
- **Part 2 – Hybrid protocol in ONet**

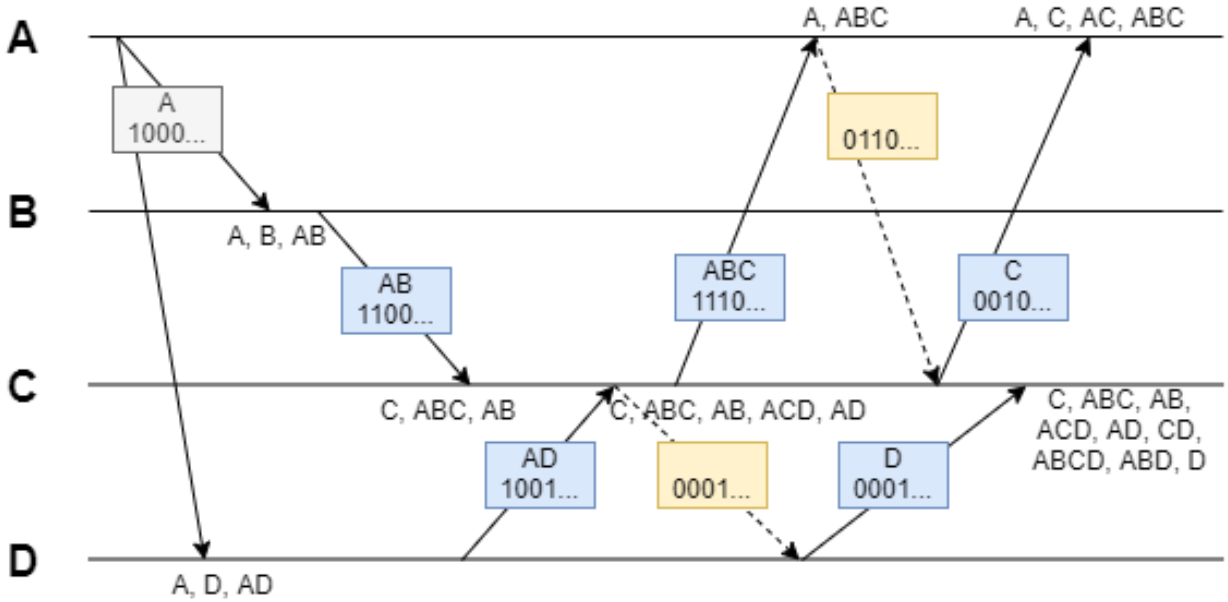
Design and implementation

Mask gossip

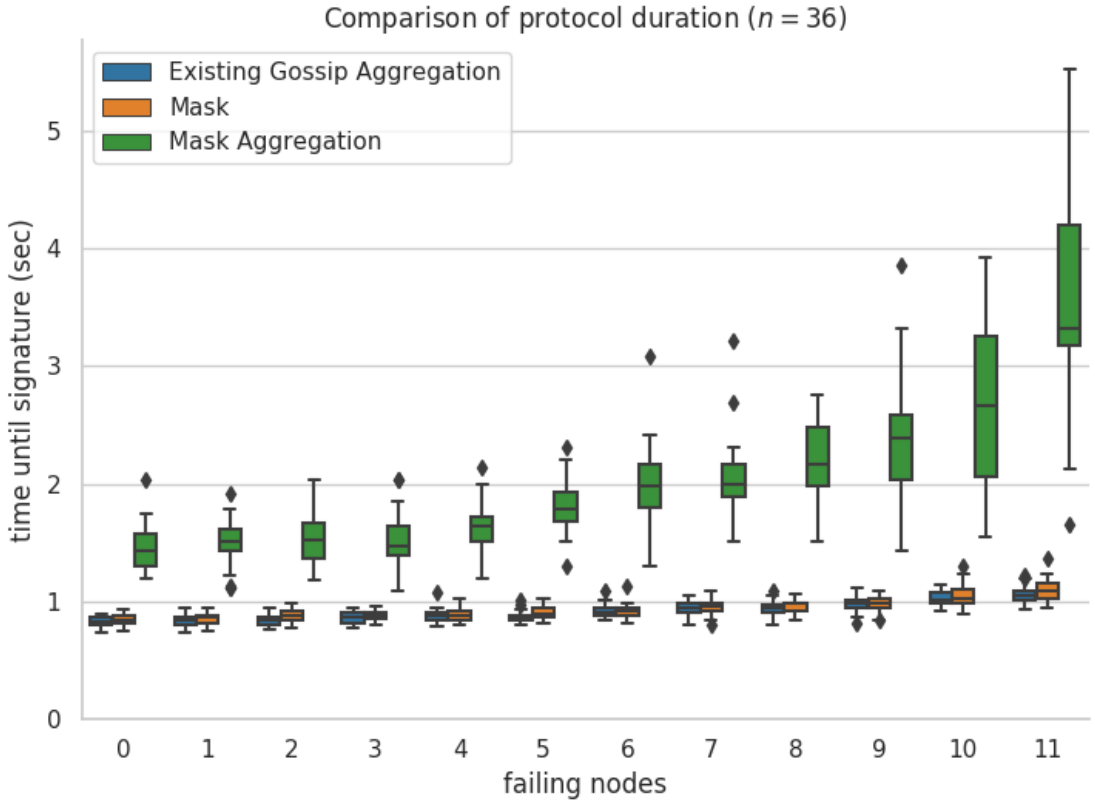


Design and implementation

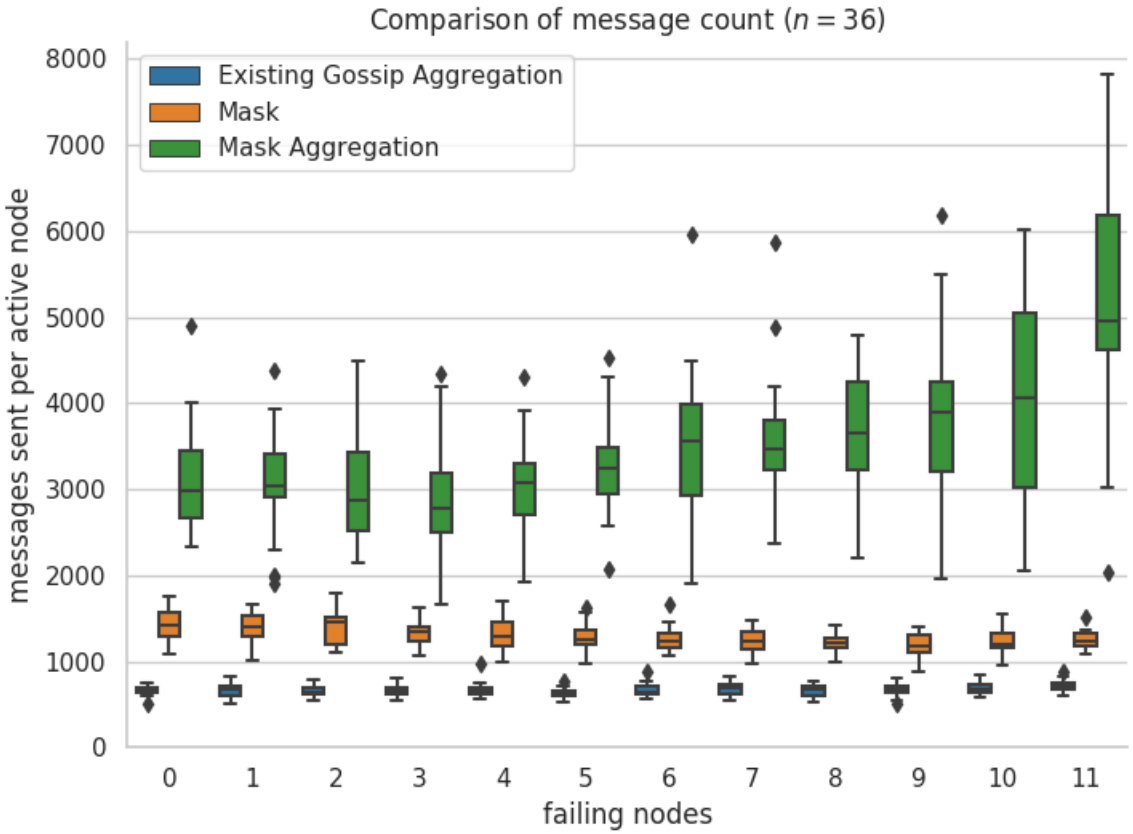
Mask gossip with early aggregation



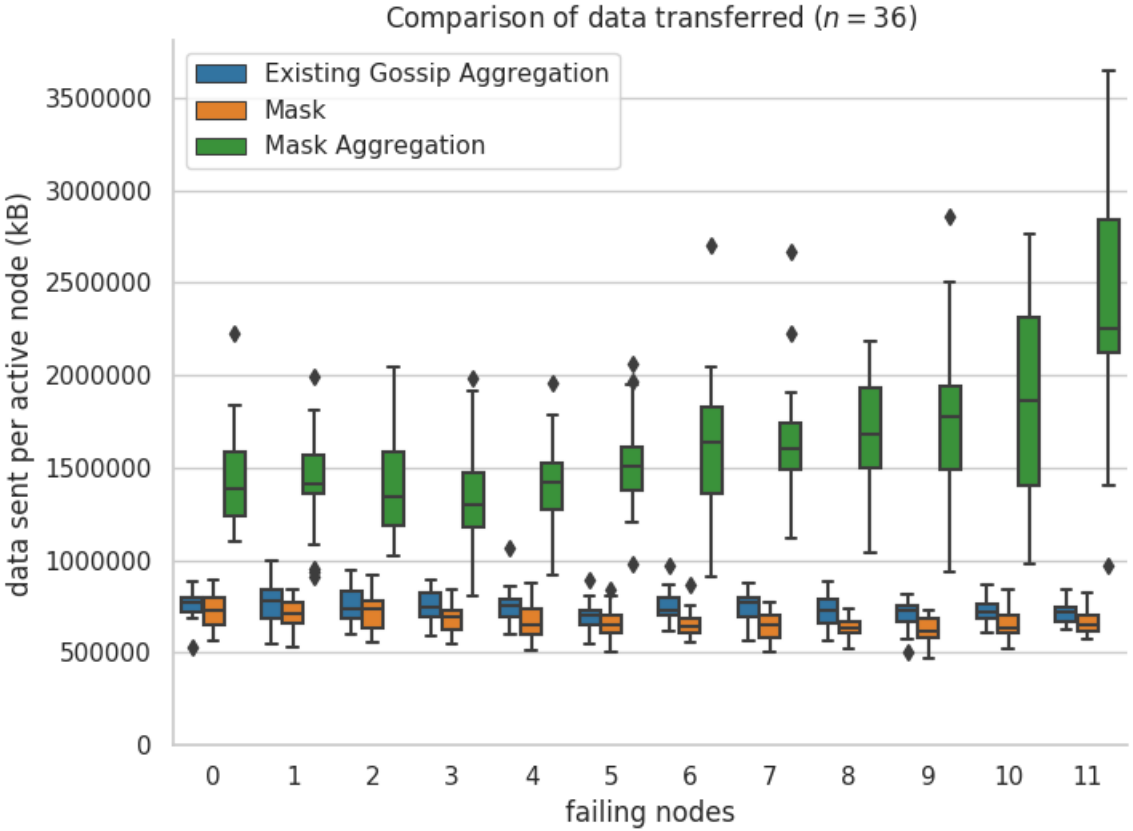
Evaluation and results



Evaluation and results



Evaluation and results



- Alternative Gossip-based aggregation implementations
- **Part 2 – Hybrid protocol in ONet**

Design and implementation

Hybrid implementation in ONet

- Hybrid to get the best of both worlds, each propagation round has 2 parts:
  1. Using a *n*-ary tree of depth 2
  2. If signatures are missing after some time, send a gossip rumor among the nodes needed.
- Implementation of HybridRumor is done in the overlay layer of ONet.

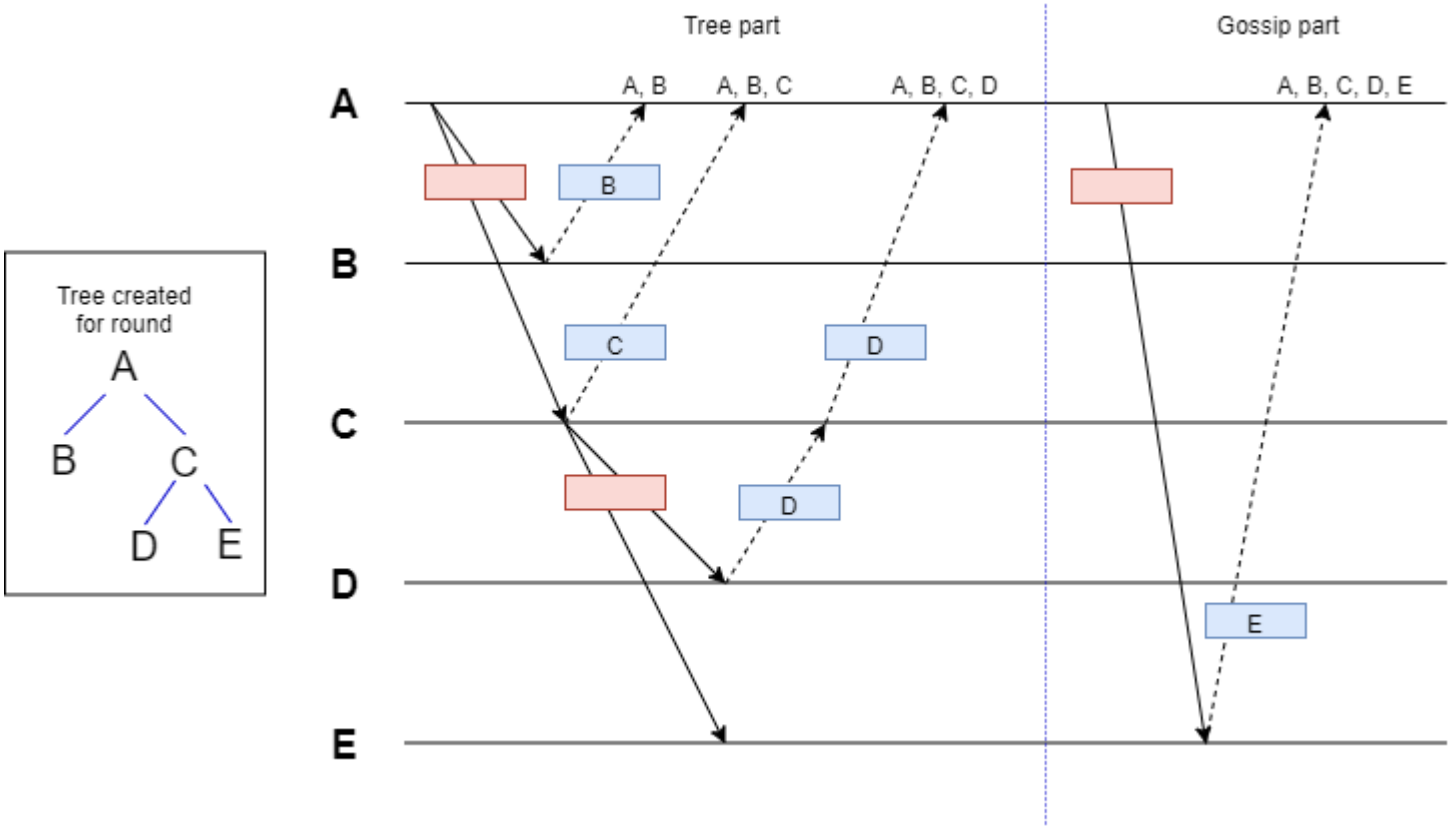
Design and implementation

Hybrid implementation in ONet

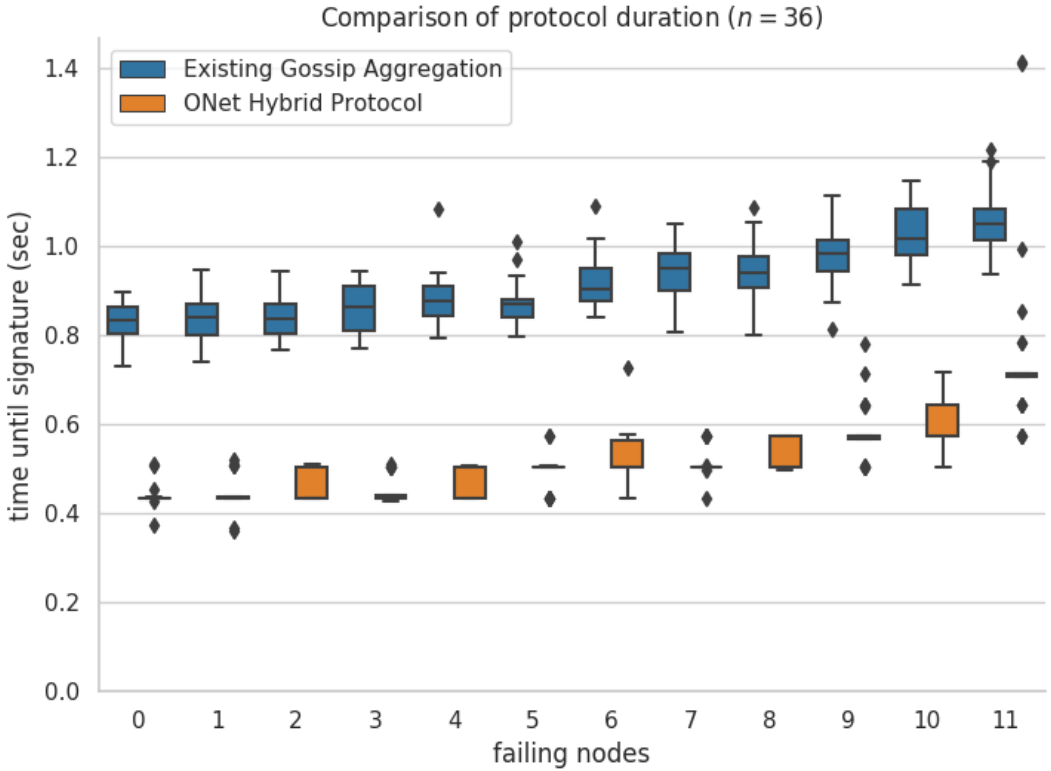
- Evaluation is done with Cothority simulations.
- For cosigning, created a protocol that runs many rounds of HybridRumors until enough signatures are collected, then aggregates them.

Design and implementation

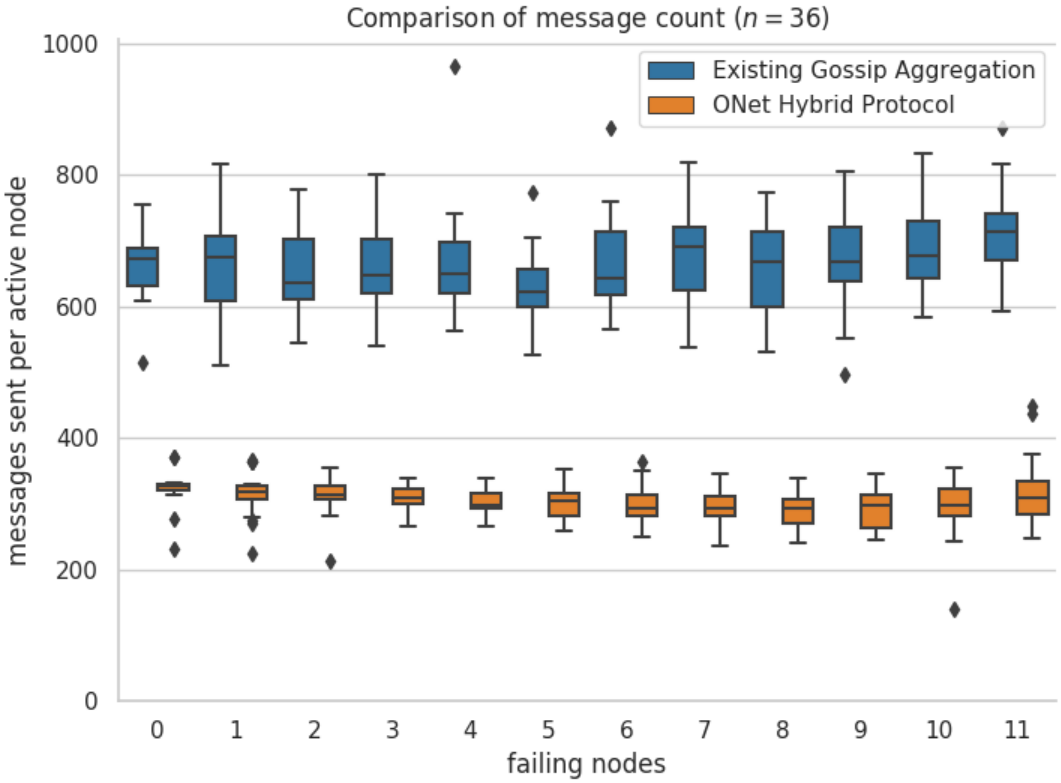
Hybrid implementation in ONet



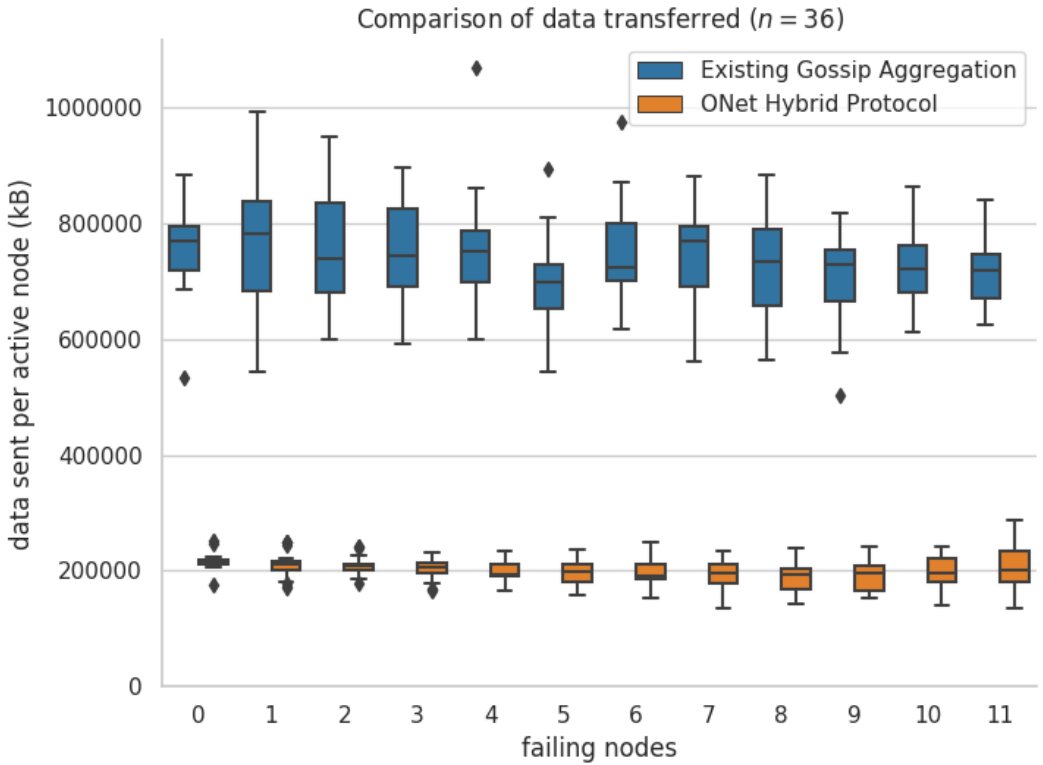
Evaluation and results



Evaluation and results



Evaluation and results



Conclusions

- Mask gossip protocol had slightly better performance among the gossip-based aggregation implementations.
- Hybrid ONet implementation has a significant improvement in efficiency compared to existing gossip-based implementation.
- Future work: adapt to the properties of the network, use homomorphic subtraction of signatures to do earlier aggregation.

Questions?