

# Approximate Consensus Under Network Partition



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# Abstract

This thesis studies how approximate consensus protocols degrade under partial network partition, and proposes a protocol that trades a small latency overhead for improved throughput.



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# 1

## Introduction

### 1.1 Motivation

Large-scale distributed systems increasingly rely on approximate consensus protocols to balance latency and consistency [Lamport, 1998]. This work studies how such protocols degrade under network partition.

### 1.2 Contributions

The main contributions are:

1. A formal model of partial-partition tolerance.
2. An empirical evaluation summarised in Table 2.1.
3. A reference implementation used to produce Figure 2.1.

### 1.3 Related Work

Classical consensus protocols such as Paxos [Lamport, 1998] and Raft [Ongaro and Ousterhout, 2014] assume a fully connected network. This thesis relaxes that assumption.



# 2

## Evaluation

### 2.1 Experimental Setup

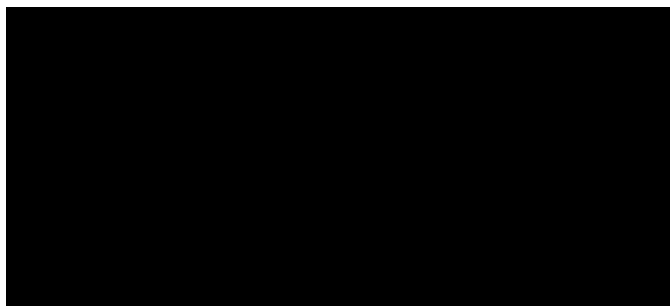
Experiments were run on a five-node cluster. Table 2.1 summarises throughput under increasing partition rates.

**Table 2.1:** Throughput (requests/s) under simulated partition rates.

| Partition rate | Baseline | Proposed |
|----------------|----------|----------|
| 0%             | 12,400   | 12,100   |
| 5%             | 9,800    | 11,600   |
| 10%            | 6,200    | 10,900   |

### 2.2 Latency Under Load

Figure 2.1 shows median request latency as the partition rate increases.



**Figure 2.1:** Median latency versus simulated partition rate.

## 2.3 Discussion

The proposed protocol maintains throughput more effectively than the baseline once the partition rate exceeds 5%, at the cost of a small constant latency overhead [Ongaro and Ousterhout, 2014].

# Bibliography

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Diego Ongaro and John Ousterhout. In search of an understandable consensus algorithm. In *USENIX Annual Technical Conference*, pages 305–319, 2014.