MASARYK UNIVERSITY

FACULTY OF INFORMATICS

Approximate Consensus Under Network Partition

Bachelor's Thesis

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Declaration

Hereby I declare that this paper is my original authorial work, which I have worked out on my own. All sources, references, and literature used or excerpted during elaboration of this work are properly cited and listed in complete reference to the due source.

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Abstract

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

Keywords

distributed systems, consensus, network partition

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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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