Exploring the Feasibility of Reputation Models for Improving P2P Routing under Churn⋆

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Abstract. Reputation mechanisms help peer-to-peer (P2P) networks to detect and avoid unreliable or uncooperative peers. Recently, it has been discussed that routing protocols can be improved by conditioning routing decisions to the past behavior of forwarding peers. However, churn — the continuous process of node arrival and departure — may severely hinder the applicability of rating mechanisms. In particular, short lifetimes mean that reputations are often generated from a small number of transactions.

To examine how high rates of churn affect rating mechanisms, this paper introduces an analytical model to compute at which rate transactions has to be performed so that the generated reputations are sufficiently reliable. We then propose a new routing protocol for structured P2P systems that exploits reputation to improve the decision about which neighbor choose as next hop. Our results demonstrate that routing algorithms can extract substantial benefits from reputations even when peer lifetimes are short.

1 Introduction

Resilience of structured Peer-to-Peer (P2P) networks under churn has attracted significant attention during the last few years. One of the fundamental problems of these systems is the ability to locate resources as peers join and fail at a high rate of churn. Churn may cause the staleness of immediate neighbors, and hence importantly deteriorate the performance of the underlying routing protocol. This has led to the development of reputation models such as the Feedback Forwarding Protocol (FFP) [1] and the model of Artigas et. al. [2] to detect reliable message forwarders. In these models, each peer captures evidence to quantify the behavior of its immediate neighbors. Based on this evidence, which corresponds to either success or failure of message delivery, each forwarder can evaluate whether it did a satisfactory routing job or not, and select as next hop the neighbor more likely to deliver the message.

Unfortunately, yet, existing models suffer from the same syndrome they want to ameliorate. Since reputations assess trustworthiness using historical feedback, short peer lifetimes mean that reputation values may not be sufficiently accurate,