

AD-SHARE: AN ADVERTISING METHOD IN P2P SYSTEMS BASED ON REPUTATION MANAGEMENT

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(Extended Abstract)

I. INTRODUCTION

Peer-to-peer (P2P) networks are distributed systems that allow the direct communication of participating peers without the necessary mediation of a server. An extensive survey on P2P networks can be found in [1]. The main characteristic of P2P networks is the absence of central control over the users. In P2P networks emerge the problem of free riding. The users mainly act as consumers and lack motivation to contribute. Extensive research has been conducted in this area and many models have been proposed to motivate the users' contributions. The research is focused on applications of reputation and incentive-based mechanisms in P2P networks. A comprehensive survey on online reputation mechanisms is [4] and on P2P reputation systems is [5]. The reputation problem in P2P has been studied extensively using game theoretic framework and many models have been proposed. ([2], [8], [9]).

In this paper, we deal with the problem of designing a distributed advertising method for P2P systems lacking any payment scheme. Our method is decentralized in the sense that there is not central authority responsible for the advertisements (ads) assignments but the companies themselves and is a first approach for the designing a P2P incentive-based advertising mechanism. We apply two reputation mechanisms, an incentive-based scheme [9] and the EigenTrust algorithm [10]. We evaluate Ad-Share extensively in environment in which a group of participating organizations is heterogeneous with regard to their quality and services and we show that our method can effectively provide fair and robust advertisements assignments.

II. THE ADVERTISING METHOD

We develop an advertising method for mutual advertisement hosting in a group of participating companies, where each company owns a web site. We assume that the firms have been clustered in semantically coherent groups according to their services and products classification. These semantically related peers-companies are grouped into a semantic overlay network (SON) ([3], [6]). In each semantic category peers are evaluated with regard to the quality of their services and products and are grouped into relevant quality categories. The advertising process starts at each semantic category of SON and at each quality category independently. The Ad-method is based on the combination of two reputation methods: the EigenTrust algorithm [10], and an incentive-based scheme [9]. Each peer has a dual role, act as advertiser (i.e. host advertisements on its web site) and as advertisee ("pay" for having an advertisement hosted). We have developed two versions of the EigenTrust algorithm, the Eigen-Clustering and Eigen-Test. The first version computes the reputation of the companies in the market. Eigen-Clustering clusters the peers in quality categories (Low, Medium, High) according to their reputation in the market. The second version of EigenTrust, the Eigen-Test, is used periodically, evaluating the homogeneity of the quality categories. Similarly to

the service game G^∞ presented in [9] we define the *advertising game Ad-Game*. We assume infinite consecutive advertising periods. In every period each peer has to decide if it will make available for advertisement K slots (at its website) or not.

Briefly the steps of the method are as follows: After the end of Eigen-Clustering the main advertising process starts in every quality category independently. The time is modeled by an infinite number of advertising periods (Ad-periods). In each Ad-period, every peer has a reputation value Φ . The reputation values are measured by a recursive function Φ_t . The reputation values are increased each time the peer acts as advertiser. We apply an incentive in order to motivate the peers to act as advertiser. The incentive is that the request of peer i as advertisee (i.e. asking for some other peer to host its advertisement) will be served with a probability equal to its reputation value. Following an analysis similar to [9] we detect the Nash Equilibria of the Ad-Game. The mixed Nash equilibrium for the Ad-Game is the strategy $(p, 1-p)$ where p is the probability of peer to act as advertiser.

We evaluate the method extensively and the experimental results show that Ad-Share can effectively provide fair and robust advertisements assignments. Fig. 1 (a) depicts the average number of Ads for the advertisers (we set $K=4$). The experiment shows that the peers who are willing to accept to host K -Ads they host eventually almost 4 Ads per ad-period. In Fig 1 (b) we present the average number of Ads for the advertisees. The method must ensure that the participating entities eventually will be advertised at every ad-period. The experimental results shows that in every ad-period each peers will be advertised at least in one web site.

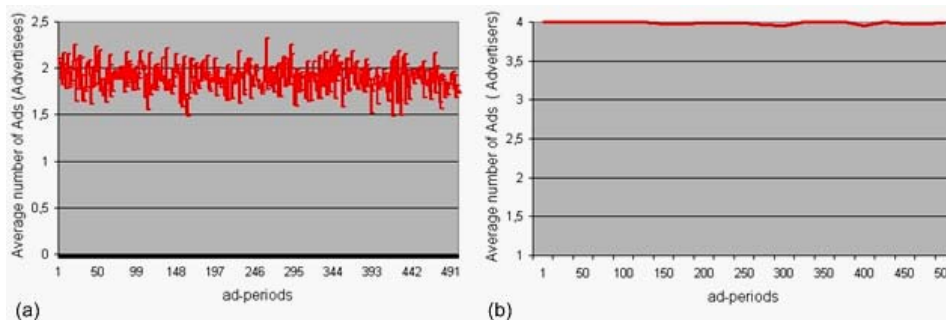


Fig. 1 (a) Average number of Ads for advertisees. (b) Average number of Ads for advertisers

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