Models of Cooperation in Peer-to-Peer Networks,

A Survey[1]

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Abstract. Peer to peer systems (P2P) have more and more success from individual users point of view as well as industrial uses. P2P bring original capacities by giving to the end-users a more important role than a simple "customer". Although many works addressed the various techniques of exchange in these networks, a few explored it under the angle of co-operation with end-users. This seems necessary since it is obvious that networks data flows take their roots in human exchanges and cooperation. Thus, the aim of this article is to analyze the modes of co-operation in P2P systems, under the light of more general model of co-operation in networks taking in account the influence of the human factor. We also try to clarify the purpose of each application by proposing several mode of classification.

1   Introduction

The evolution of powerful PC with great storage capacities and fast access to Internet and the increase of available multimedia contents (video, audio, etc.) allowed developing direct forms of information exchange between users without using central servers. The example of direct FTP and P2P exchanges are included in this category. Although reflecting a recent change of uses, these practices are not new with reference to the beginning of Internet. Contrary to traditional mechanisms of communication such as the "client/server" model, these systems give more interest to individuals who freely share their resources.

Apart from technical constraints, the human factor is a fundamental element in order to understand networks mode of operation. It is clear, for example, that the availability of an object will be higher if it is replicated on several network nodes. Actually, the rate of contents replication is directly linked to its level of availability and will be dependent on several forms of co-operation between individuals trough, for example, implicit or explicit form of cooperation. The explicit co-operation consists in formulating contents accessibility as a deliberate choice from the person who replicates contents and the one who decides to download it (both actors of a more or less direct interaction). The implicit co-operation implies that the factors of the accessibility are less controllable. Indeed the availability does not imply the accessibility that takes into account the facility of data access. Content will be faster to download if it is popular but this popularity is not directly controlled by the individual who takes the initiative to put a content on the network nor even by who decides to download it. The popularity of contents is the consequence of complex phenomena of collective actions not easy to evaluate.

The purpose of this article is to analyze modes of cooperation in P2P networks in the light of more general mode of co-operation in the networks especially in systems based on contents replication and on the human factor. That will enable us to describe various academic works and commercial products. First of all we give an overview of the mode of cooperation in general networks technology and more specifically in web oriented replication systems (e.g CDN, caches networks, etc). Then we survey the main known P2P technologies under several angles and classification. The first is a functional segmentation describing the use of the technology (distributed computing, data sharing, etc). The second view categorizes mainly technologies with regards to the size of the community (few users, middle range community, intranet, Internet). We also survey P2P application under   the angle of the centralization level, the structure of the information system and the replication strategies.