Chapter XXXIII
Subjective and Objective Trustworthiness of Acquaintance Peers

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In a peer-to-peer (P2P) overlay network, a peer process (peer) communicates with other peers and manipulates objects like databases in the peers. Service of each peer is characterized in terms of types of methods and quality of objects supported by the peer. It is critical to obtain service information on what peers support what service. In a fully distributed, unstructured P2P network, there is no centralized coordinator like index and super peer. Each peer has to communicate with its acquaintance peers and obtain service information of other peers. It is critical for a peer to identify which acquaintance is trustworthy since acquaintances may support obsolete service information and may be faulty. There are subjective and objective types of the trustworthiness, of each acquaintance peer. In the subjective approach, a peer obtains the trustworthiness of an acquaintance peer by itself through communicating with an acquaintance. On the other hand, a peer takes trustworthiness opinions on an acquaintance from other peers, that is, how other peers trust the acquaintance peer in the objective approach. In this chapter, a peer only takes opinions of trustworthy peers by excluding faulty peers differently from the traditional reputation concepts. The types of trustworthiness on an acquaintance peer are not always

similar. A peer has to decide on which trustworthiness type is taken. In this chapter, we postulate the more confident of its trustworthiness opinion the peer is, the more significantly the subjective trustworthiness is taken into account. If the peer is less confident, the subjective and objective types of trustworthiness are taken respectively. We also discuss how to define the confidence.

INTRODUCTION

In this chapter, we discuss a fully distributed, unstructured peer-to-peer (P2P) overlay network where there is no coordinator like centralized index Napster (1999) and super peer KazaA (2003) and each process is peer and autonomous. Peer processes (*peers*) on computers are cooperating by not only exchanging messages but also manipulating objects like databases in P2P overlay networks. There are many discussions on how to detect a target peer which holds an object like flooding algorithms as studied by Crespo and Garcia-Molina (2002), Egemen, Deepa & Hanan, (2002), Ripeanu (2001), Watanabe,

Hayashibara and Takizawa, (2005), and Ratnasamy, Francis, Handley, Karp and Schenker (2001), Rowstron and Druschel, (2001), Stoica, Morris, Karger, Kaashoek and Balakishnan, (2003) and Zhao, Kubiatowicz and Joseph, (2001). A peer has to manipulate a target object in addition to detecting which peer holds the target object. Only a peer that is granted an access right can manipulate a target object in an authorized way. For an object $\boldsymbol{o}$, services supported by peers are classified into holder peers where the object o is stored, manipulation peers, which are allowed to manipulate the object $\boldsymbol{o}$, and authorization peers, which can grant access rights of the object $\boldsymbol{o}$ to other peers Watanabe et al., (2005).

In a fully distributed P2P overlay network, each peer has to obtain service information of other peers through communicating with its acquaintance peers, that is, what peers support what types of service. A peer has to communicate with its acquaintance peers and obtains service information on objects. A peer leaves and joins the P2P network and changes its service by obtaining new service through downloading files and throwing away some service. Thus, a peer is in nature changing service information. Service changes of peers are propagated to peers through peer-to-acquaintance communications. A peer might hold obsolete service information since it takes time to propagate the change information to the peer. Another peer might be faulty. Here, it is critical for each peer to recognize which acquaintance peer is trustworthy on service information. There are *subjective* and *objective* types of the trustworthiness of each acquaintance peer. In the subjective approach, a peer obtains a trustworthiness opinion of an acquaintance peer by communicating with the acquaintance peer. A peer issues an access request to an acquaintance peer and then receives a reply from the acquaintance peer. If the reply satisfies the access request, the peer perceives the acquaintance peer to be more trustworthy with respect to the access request. On the other hand, a peer obtains opinions on the subjective trustworthiness of an acquaintance peer from other peers in the objective approach. The more trusted an acquaintance is, the more trustworthy the peer can perceive the acquaintance to be. There are multiple ways to obtain the objective trustworthiness depending on trustworthiness opinions of which peers are taken. The less confident of its own subjective trustworthiness of the acquaintance peer, the peer is, the more the peer takes the trustworthiness opinion of every peer. This is the traditional reputation concept Xiong and Liu, (2004). If the peer is more confident of its own opinion, the peer only takes trustworthiness opinions of acquaintance peers which the peer knows well and whose opinions are similar to its