Group P2P Network Organization in Mobile Ad-Hoc Network*

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Abstract. This paper proposes an effective file searching scheme named Group P2P to reduce the number of message transmission. In the Group P2P, peers distinguish Parent Peer from Child Peer. Also, we propose another scheme to manage Child Peers for reducing overhead in the group as joining and leaving.

Keywords: Group P2P, Group, Parent-child relationship.

1 Introduction

Peer-to-Peer (P2P) [1] is one of the most killer applications in the recent network techniques. Specially, P2P research is frequently progressed in the Mobile Ad-Hoc Network. But, recent P2P method has been studied under wired environment, which is not appropriate for the mobile environment. Typical mobile P2P techniques for Ad-hoc Network are ORION (Optimized Routing Independent Overlay Network) [2] and DHT (Distributed Hashing Table) [3]. However these techniques may occur a query message increasing problem and increasing overhead, when a user wants to find a file or contents in P2P.

In this paper, we focus on reducing overhead and the number of query messages in file searching sequence. So, we organize group P2P network using peers which distinguish Parent Peer (PPR) from Child Peer (CPR) in Mobile Ad-hoc Network. PPR manages CPRs' information, and each P2P group communicates with each other. For file searching, instead of using multi-broadcast transmission for P2P, we use PPR to get information of file. It is helpful for us to avoid occurring overhead. Our scheme also helps to manage peer join and leave in the mobile environment.

2 Proposed Scheme

Fig. 1. (a) shows our proposed a parent-child peer group. The group range is decided by PPR's RSSI. And the group boundary is decided to compare CPR's group ID in each group edge. A PPR manages a CPR and registers CPR's file information to the

* This work was supported by the IT R&D program of MKE/IITA. [2008-F-016-02, CASFI].
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C.S. Hong et al. (Eds.): APNOMS 2009, LNCS 5787, pp. 477–480, 2009.

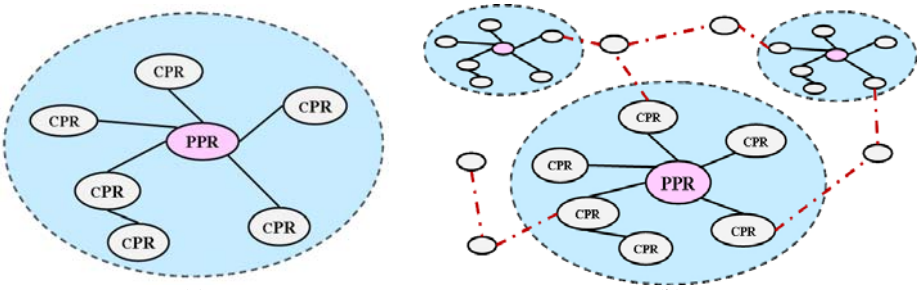


Fig. 1. (a) Proposed parent-child peer group (b) P2P network using proposed group

table in the peer group. Also each group communicates using the PPR and is organized the new P2P network.

Fig. 1 (b) shows P2P networks using group. We assume the PPR of each group itself knows local information and the neighbor PPR's local information for the peer group communication. If the new CPR joins in the P2P group, it makes a parent-child relationship with the recent PPR. At that time, the CPR checks a candidate of the PPR which has the smallest number of children and the strongest RSSI (Received Signal Strength Indication) [4] to choose PPR. Then the CPR joins a chosen PPR's group newly.

$$P_r = \left(\frac{K}{4\pi R} \right)^2 \bullet G_t \bullet G_r \bullet P_t \tag{1}$$

$$R = \frac{K}{4\pi} \sqrt{\frac{(G_t \bullet G_r \bullet P)}{P_r}} \tag{2}$$

Table 1. Parameters for RSSI Formula

Parameter	Description
P_r	Receiver side electric power [w]
P_t	sender side electric power [w]
K	Used wavelength (c/f) [m]
R	Distance between sender and receiver [m]
G_t	Sender side antenna electric power gain [dB]
G_r	Receiver side antenna electric power gain [dB]

To calculate distance between the PPR and the CPR, we can use RSSI. All peers can calculate RSSI by formula as shown in formula (1), (2) and Table. 1 [5]. If RSSI is strong, distance between PPR and CPR is close to each other. And if the number of

children are small, group's depth is low. If the CPR leaves a group, the CPR sends a secede message to the PPR and the CPR. If the PPR and the CPR receive the leaving message, they erase the CPR from their file management table. And the CPR, which wants to leave group, sends a leaving message to other CPR, if the CPR leaving group joins other PPR. The new CPR wants to join the recent CPR. The new CPR sends its resource information and its ID to the recent CPR and gets PPR's ID. The recent CPR receives new CPR's information and updates its file management table. Then the recent CPR sends update information to its PPR. In this procedure, the PPR can get resource information from all CPR which joins group. Therefore, if the CPR wants to get some files information, the CPR sends a query message to its PPR and can get information. However file information, which is wanted by CPR, may not be in its PPR's file management table. Then the PPR sends a query message to the neighbor PPRs.

2.1 Group P2P File Searching Scenario

Fig.2. shows P2P file searching scenario. The CPR "A" in the left group peer "A" sends a query message to its PPR to find a file "★". First, the PPR "A" checks whether a file "★" is in its file management table or not. Then if a file does not exist in PPR "A" file management table, the PPR "A" broadcasts a query message to neighbor PPRs. This procedure is repeated until finding file "★".

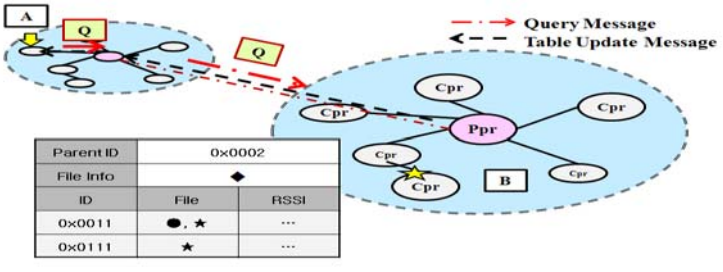
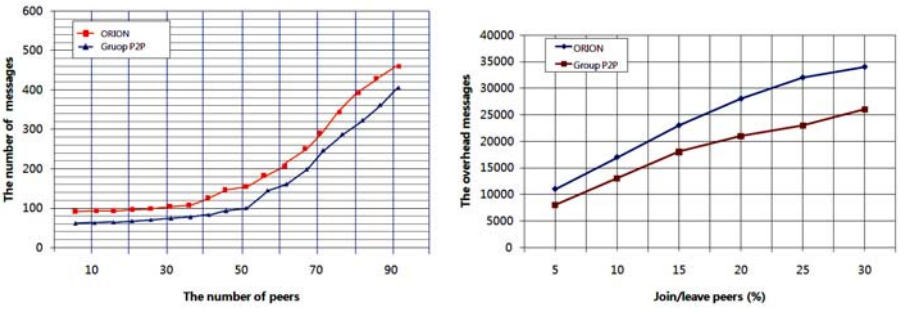


Fig. 2. Group P2P File Searching Scenario

3 Performance Evaluation

To evaluate the performance of our group P2P we perform the simulation using C++ codes. We increas the number of peers and compared with the number of message transmissions of both recent ORIOIN and group peer.

Fig. 3. (a) shows to compare the number of query message transmission and Fig. 3. (b) shows the overhead for updating the file management table as the number of joining and leaving peers changes between recent ORION and proposed group P2P. As shown in Fig. 3, we confirm decreased Query messages and reduced overhead in the group P2P.



(a) (b)

Fig. 3. (a) The number of query message transmission for the file searching (b) The overhead for updating the file management table

4 Conclusion and Future Works

In this paper, we introduce group P2P, which makes a relationship like parent-child, for reducing the overhead in mobile P2P environment. We can consider the number of query message transmissions are more decreased than recent ORION's transmission method in P2P network. However, our proposal increases cost of build and maintains the table according to method of build up the group and the number of CPR. If the number of groups is increased, it increases the query message transmission in the group P2P. Our future work is to optimize our Group P2P algorithm using PPR- CPR, and to improve the reliability and the stability. Also we adapt DHT algorithm to solve the message increase problem in our proposed Group P2P.

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