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Proposal of Web Cache Sharing in Mobile P2P Network Environment

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1 Introduction

The opportunity to view web contents by a mobile phone has rapidly increased in recent years. However, when many users demand the delivery of various contents respectively, it will oppress the electric wave resource of the cellular network. Therefore, it is difficult to satisfy a variety of users. On the other hand, P2P file-sharing occupies a high percentage of the traffic volume in the fixed Internet at present and may also become highly attractive in mobile network environment. In this paper, we propose a method of cache technology for web information among mobile nodes in mobile P2P network environment which is constructed by an ad-hoc network as well as the cellular network. By doing this, nodes can transmit contents via ad-hoc network and hence lighten the burden of cellular network. In order to reduce useless search traffic and file sending and receiving operations, we introduce "keyword" search method in the ad-hoc network.

2 Related Work

To improve the speed of web access and reduce cost of cellular network, many researches have imported ad-hoc network. A method which splits a file into pieces and enables nodes to exchange the pieces with neighbor nodes was introduced in [1]. However, the main disadvantage of this method is that users can not see their required contents until they complete the process of mutual pieces exchange. What's more, since contents have to be divided into pieces and combined again, errors may occur in this process. A mobile peer-to-peer entertainment system was introduced in [2]. Unfortunately, in this system, an extra cache peer has to be used as cache server besides mobile peers and thereby an index server is needed to provide search service for mobile peers, the index server breaks down will lead to system crash.

3 Proposal System

In this chapter, we describe the architecture and actions of our proposal system in detail.

3.1 System Configuration

In this system, the following approaches are adopted.

1. Using cache to store popular contents in mobile peer to reduce the usage of cellular network. When a mobile peer sends its request to the server, other mobiles in ad-hoc network will be searched firstly (Fig.1-a). If the contents requested have been stored in a mobile cache, mobile peer unloads download contents directly from the cache of nearby mobile peers (Fig.1-b). If contents are not stored in any mobile's cache, mobile peer downloads them through cellular network and at the same time stores them as cache (Fig.1-c and Fig.1-d).

2. After storing web contents as cache in mobile, the mobile cache peer broadcasts its cache information in ad-hoc network to update the sharing information with neighbor mobile peers.

3. Keywords that are registered by mobile users to describe what they are interested in are also broadcasted in ad-hoc network (Fig.2). According to the degree of information similarity, it is easy for mobile peers with the same keyword to become neighbors (by using Winny network [3]). For example, we can assume that users who registered the keywords "tour" have a high probability to download contents about "tour" from other mobiles peers which also provide a lot of contents about "tours" themselves.

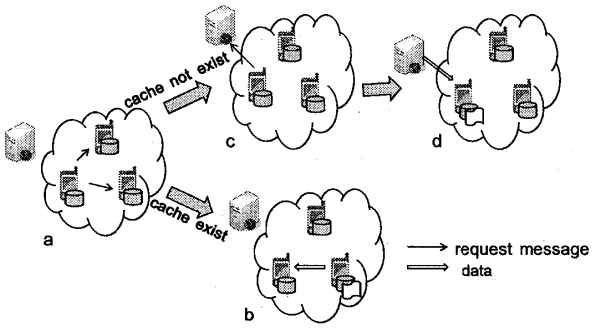

Fig.1 Contents transmission with cache.

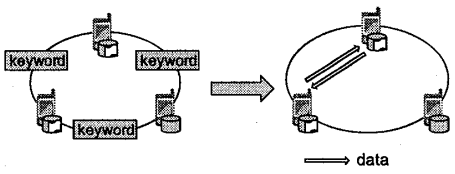

Fig.2 Contents transmission using keyword.

3.2 System Action

Figure 3 and Figure 4 show the action of mobile peers when accessing web contents.

Download General Contents (Fig.3)

1. Mobile peer A searches contents information through ad-hoc network. If contents information is found, peer A sends request message to contents holder (mobile peer B). Peer B replies this request and peer A gets contents from peer B directly through ad-hoc network.
2. If contents information is not found, peer A sends request message to web server. Web server replies request message and sends response message to peer A . Peer A gets contents from web server through cellular network.
3. Peer A stores web contents as cache and broadcasts contents information through ad-hoc network.

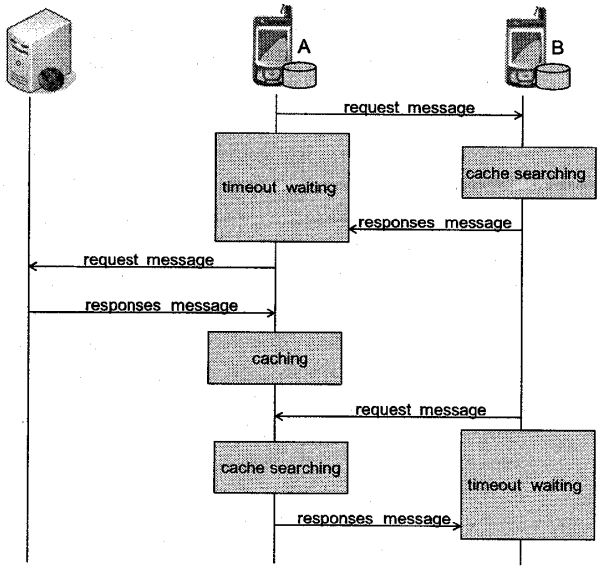

Fig.3 Sequence of contents fetching.

Broadcast and Download " Interesting " Contents (Fig.4)

1. Peer A and peer B login keyword information and broadcast through ad-hoc network respectively.
2. Peer A searches peers that hold the same keyword information.
3. If peer B holds the same keyword information, peer B is found and peer A gets contents from peer B.

4 Evaluation

In this proposal, we introduced cache and keyword search method into a mobile P2P environment. In related work [1], when m nodes request the same file, each node receives $1/m$ of the file and exchanges the pieces with other $m-1$ nodes. The count of access to server is expressed by C_1 and that among the nodes is expressed by F_1. The corresponding count in proposal system are expressed by

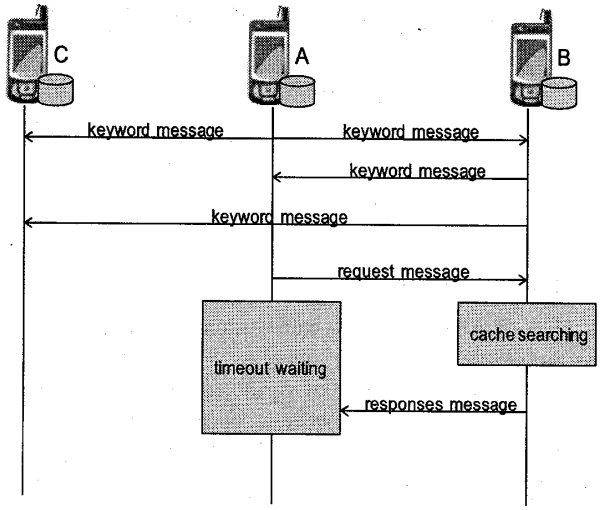

Fig.4 Sequence of contents fetching with keyword.

C_2 and F_2.

$$C_1 = m \quad F_1 = (m-1)m,$$
$$C_2 = 1 \quad F_2 = m-1.$$

When m increases substantially,

$$C_2 \ll C_1 \quad F_2 \ll F_1.$$

Our proposal system reduced the access and the corresponding possible errors. In comparison with the system introduced in [2], it has a better stability because the index server has been removed.

5 Conclusion and Future Work

In this paper, we have revealed a proposal for viewing web contents by introducing cache to store contents in mobile peers. As to mobile peers which have similar needs, we broadcast the keyword to make it easy to become nearby peers. However, the proposal has a limitation in an environment with few peers. In this case, it is difficult to search for peers with the same keywords and " keyword " search method may fail to work. Better search methods that can play a role in a variety of mobile environment will be investigated in further studies.

References

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