# Research on a Scheme for Improving the Chord Routing Algorithm

Wang Xiaobin
Economics and Management Institute
Shenyang Aerospace University
Shenyang City, China
32582669@qq.com

Wang Qingjun
Economics and Management Institute
Shenyang Aerospace University
Shenyang City, China
Sunday693682671@qq.com

***Abstract*—The research and application on Peer-to-Peer (P2P) is a topical issue in the present computer network field. The current P2P systems can be separated into two types. One is structured and the other non-structured. The Structured P2P system is based on the principle of DHT which aims to solve some of the problems which exist in the Chord Routing Algorithm. It is a representative structured P2P system. This thesis puts forward a scheme for improving the system. Based on the structural improvement mentioned, this thesis presents a PHFChord system which can improve the file availability and routing efficiency as well as increase the speed of the requiring resource file. In this thesis, the design of PHF Chord system is explained in detail, including the routing strategy, the joining of new nodes and exiting of old nodes.**

***Keywords- Chord; neighbors' routing tables; finger table; sub file***

## I. INTRODUCTION

The PHFChord system is shown in Fig 1. Each node is analyzed in three tables: the neighbors loctable table on logically; the neighbors Proxtable table on physically . And each node has sub files of the other nodes sent or index table of information header files established. Through the index table node can judge whether oneself have be inquires information resource file.

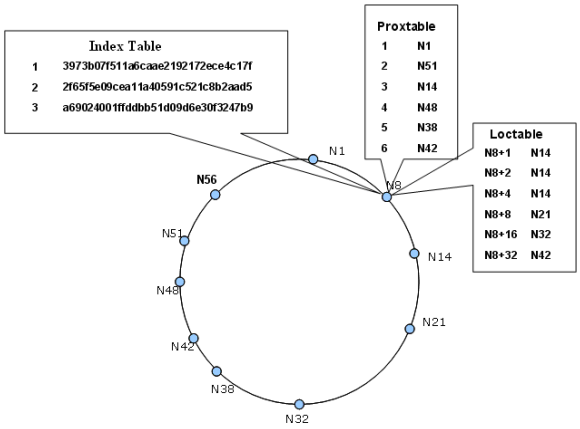


Figure 1. The structure of PHFChord

The index table has been established according to the information of sub file and information header file use B-tree structure.

The B-tree node has two sub trees when calculated, even for the current network node gains 10 million sub-files and information header files, the elapsed time complexity is merely O (20 ) in the current network nodes when research. Moreover, in the B-tree structure, each node has at least 2 sub-tree, so it will has less time complexity, the whole network research process is perfectly acceptable.

Index table information will be updated only when a node receives a sub-files or information header files. When the nodes in the network are joined and exit the index table, there will not any treatment, thus exempting the maintenance costs when the systems maintain the index table. Because the index table is only used for the search of local records information, it is not related to the overall system maintenance. Here we do not describe B-tree in detail. The following part is an introduction to the way of establishing an adjacency information table and the way of increasing resource files in the network to access to information.

### *A. Adjacency information table*

The Chord system is constructed by DHT mechanism overlay network (overlay), but it does not consider too much about the underlying physical network topology structure. The PHFChord system proposed in this thesis, when obtain the physical topology of the adjacency table, the corresponding three fields have to be added: the currently available bandwidth of the sub nodes, handling capacity evaluation parameters and the current storage space. In this article, the adjacency table after this expansion is called adjacency information table. These three information can be in the dynamic maintenance and request maintenance at the same time, in order to use the latest data.

### *B. Resource File for obtaining information*

The resource files published in PHFChord structure exist in two types. One is a fragment file which is formed after the segmentation of the resource file with a header, later known as the sub-file; the other is the file only with the header (header information conclude the list of resource acquisition information), later referred to as header files. So in the PHFChord system the resource files only exists in the forms of sub files and information header files, the system does not exist in the complete resource file, and then when the node access to resources it will be restructured .

The main function of sub files is to increase the resource file number in the network, used to provide multiple copies of the file. Header file is proposed based on the sub-file to further improve the coverage area for obtaining information

Published by Atlantis Press, Paris, France.

in the network and its function is to provide file access to information.

The internal format of header information is shown in Table 1.

TABLE I. STRUCTURE OF INFORMATION FILE

| Files name（255 bytes） |
|---|
| Segmentation total number(4 bytes ） |
| Backup information list（each 20 bytes total number） |

In order to avoid duplication of the sub-file name after segment, we use a hash function to name a sub-file, the name of each sub file name after the segment:

Sub-file name = hash (source file name) + sub-file number, (label = 0 ... num-1).

According to PHFChord system the table features in each node maintain Loctable and Proxtable. We regard the record nodes as the storage nodes in the sub files, and we regard the record nodes in the Loctable which is different from the record nodes in the Loctable as the storage node of the information header file.

Resource file segmentation algorithm is described as follows:

Reference the ideological of the files segmentation download in the current file-sharing system, the thesis proposes a copy establish algorithm based on files segmentation. The main idea is: To copy a file to the n candidate nodes, the original file will be divided into n sub-blocks of the same size as sub-files, each sub-file will be sent to one of the candidate node, and then each candidate node will spread its own sub files to other candidate nodes. When each candidate node gets all its sub files, after restructuring, it can get a copy of the resource file. All the original node and the candidate node can be jointly established the n × n network connection in the copying process. Each network connection used to transmit 1 / n copy of the data. Therefore, a copy of the file-based segmentation algorithm can let several nodes in the P2P network has the copy of the resources files.

Algorithm is divided into the following four stages:

*1) segmentation stage*

Segment the file, each sub-file data structure as shown in Table 4.2. When merging the files, the files name as the name of integration files, and is used to confirm the same files when merge the recovery files; the total segmentation numbers are used when access to information of files merge and to determine the number of entries within the list; backup information lists list the candidate node address information that select by source host when the resources published (the first is the published machine information of the source file), when search we can get a sub file of a file and this can obtain storage location information of other sub files to facilitate resource Location and access; file data, part of the data stored in the source file.

N8 represent the node which own the original file, the file size is Byte; R = {N1, ..., Nn} and it represent the set of n candidate nodes. A copy of the file-based segmentation algorithms are created throughout the distribution phase as shown in Figure 4.2. This stage segment file F into n sub-blocks of the same size: F1, F2, ..., Fn. Size (Fi) = size (F) / n ($1 \le i \le n$).

TABLE II. STRUCTURE OF SUBFILE

| File name（255 bytes） |
|---|
| Segmentation total number（4 bytes） |
| Backup information list（each 20 bytes，total number） |
| File data |

*2) The distribution phase*

The original node N0 establish n network connection with the node N1, ..., Nn, and sends the following contents to each node Ni ($1 \le i \le n$): sub-block Fi and the candidate node set R set = {N1, ..., Nn} which participate in the copy establish. In the next phase, the sub-block Fi will be sent to the candidate node.

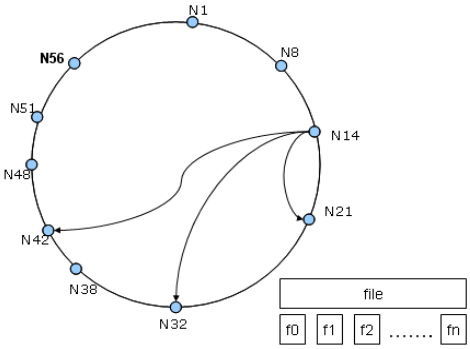


Figure 2. Subfile distribution

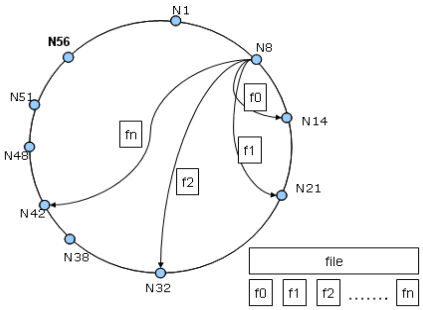


Figure 3. Subfile replication

*3) collection stage*

When node Ni receives the sub-block Fi of file F, according to the received set of candidate node R, establish n-1 network connection with the rest n-1 nodes of the set, and sent sub block Fi to them.

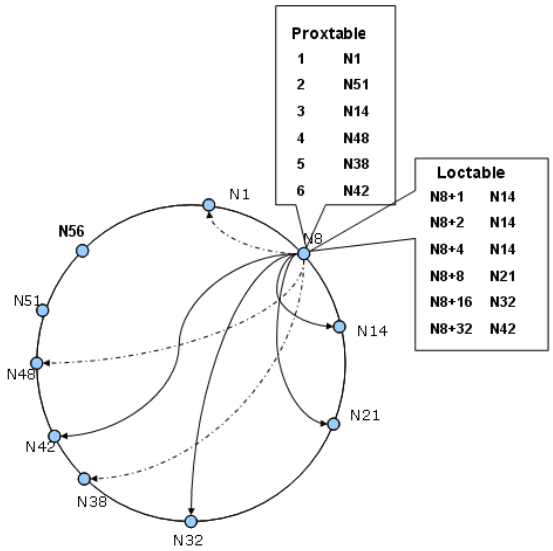


Figure 4. The structure of Chord with finger table

*4) restructuring phase*

When the collection phase is complete, each phase has complete the reception of each sub file block, based on the data partition phase of sub-block structure, according to the number of files sub block to re-group into the original files, from now on a copy was successfully created. File reorganization only in the node which initiated query, it conducts after obtain all the sub files.

## II. PHFCHORD ROUTING POLICY SYSTEM

Improved routing algorithm is based on the new create adjacent information table. And the difference from Chord is it consider the underlying physical topology information and the coverage information of the resources in the network when select the next hop, when access to resources it taking the node's processing power, bandwidth, storage space and other factors into consideration.

This algorithm takes full consideration of the logical relationship of the destination node, Chord routing relay nodes, neighbor nodes set, in the process of routing using the adjacent information table, each time looking for the closest possible target nodes to route, and it will greatly reduce the routing delay, and this can also guarantee the routing hops of the whole P2P coverage network less than the routing hops of Chord through limit area.

PHFChord system reduce the research delay in topology by taking physical topology into consideration and add the files segmentation strategy to increase access to information resources, this increase the coverage area of resources and when access to resources it will has more parallel downloads To further improve the routing efficiency.

## III. PHFCHORD SYSTEM NODES JOIN AND EXIT

PHFChord system also has good scalability, strong autonomy; it can keep the validity of the structure and the node routing tables in a dynamic network to maintain to support the dynamic node join / exit.

### *A. Node joins*

In PHFChord protocol, the node joining requires 3 steps:

Step 1: Initialize the information of new node's pointer table Loctable and the collection of adjacent information table Proxtable of the new node. Suppose node n had already known some node n ' in the network by some way before joining PHFChord network, to initialize the pointer table, n will be required to node n ' as it looks for other table in the pointers table. Adjacency table Proxtable initialized to empty, the information in the table will be collected by using landmark clustering algorithm and the round trip delay (RTT) measurement techniques.

Step 2: Update the pointer table which exist other nodes. After the nodes join the network it will call the update function of the other nodes through remote procedure, to update pointer table of other nodes. This step is the same as the step of original Chord.

Step 3: Pass the key identifier to node n from the successor node. In order to guarantee the smooth progress of the query when the node change, PHFChord agreement must ensure that the fellow-up point updates constantly of each node, PHFChord agreement call "stable" functions by the periodic of the background, so the pointer table and the successor node change in consistency . This step is also similar to the original Chord.

### *B. Node exit*

PHFChord autonomous system is a strong network, it support the dynamic exit of the node, the node's exit is also divided into normal and abnormal conditions, in response to the situation of non-normal exit, each node maintains a follow-up list (in logical) which includes log2N (N for the total number of nodes in the system) closest successor nodes.

- The normal exit of a node: When a node exit normally, it will notify its successor, predecessor, so these nodes will update its pointer table according to the information of the node which gets ready to exit.
- Send out retiring information to the system, each of the affected nodes updates their table information.
- Finally, the exit node transfers its own resources index information to its successor nodes.

## IV. SUMMARY

This thesis first describes the PHFChord improvement structure based on two points. It describes how to establish adjacency list describes and how to increase the capacity of the resource file to access information in the network by changing the forms of the resource files stored in the system. Through the description of these two points, so that the topology mismatch problem gets a certain degree of ease in the PHFChord system proposed in this thesis, while by

Published by Atlantis Press, Paris, France.

increasing the coverage area of information of the resources in the network and improve the efficiency of the routing.

Finally, the thesis explains the PHFChord routing strategy. From this thesis we can ascertain that the PHFChord is an improvement of the Chord algorithm. Besides the original pointer table which is based on the logical topology, the thesis has adds the adjacency information table which is based on physical topology and the physical factors of the information.

After considering the same characteristics of the two tables, segmenting the resource files for the use of changing the storage format of the resource file in the system, by increasing sub files and the information header files. When routing we reference to the contents of the three tables to improve efficiency.

## REFERENCES


[1] YuShao-Shan, YuJiong, Kamil, SunQi-Gang, DR-Chord:An Efficient Double- Ring Chord Protocol[C], The Sixth International Conference on Grid and Cooperative Computing, 2007:197-202.

[2] Wang Jing, Yang Shoubao, Guo Leitao. A bidirectional query chord system based on latency-sensitivity[C].Proceeding of the Fifth International Conference on Grid and Cooperative Computing. Washington:IEEE Computer Society, 2006: 164-167.

[3] Hongwei Chen,Zhiwei Ye.BChord:Bi-directional Routing DHT based on Chord[J], IEEE Press,2008:410-414.

[4] Shihui Duan,JinLin Wang.MChord:Chord Algorithm based on limited multicasting[C],2008 International Conference on Computer and Electrical Engineering,2008:233-237.

[5] Biqing Wang, Peng He. L-Chord:Routing Model for Chord Based on Layer-Dividing[C],2007 International Conference on Computational Intellig- ence and Security, 2007.

[6] Yi Jiang,Jinyuan You.A Low Latency Chord Routing Algorithm for DHT[C],2006 1st International Symposium on Pervasive Computing and Applications,2006.

[7] Kwon G,Ryu K.D.BYPASS:Topplogy-Aware Lookup Overlay for DHT-Based P2P File Locating Services[A].Proc of INFOCOM'02.2002:1190-1199.

[8] Jiang Junjie, Tang Feilong, Pan Feng, et al. Using bidirectional links to improve peer-to-peer lookup performance[J]. Journal of Zhejiang University: Science A, 2006, 7(6): 945-951.

[9] Gerald Kunzmann, Andreas Binzenbofer, Robert Henjes. Analyzing and modifying Chord's Stabilization Algorithm to Handle High Churn Rates[C]. 2005:885-890

[10] Dong Xuan, Sriram Chellappan, Muralidhar Krishnamoorthy. RChord: An Enhanced Chord System Resilient to Routing Attacks[C], Proceedings of the 2003 International Conference on Computer Networks and Mobile Computing, 2003.

[11] S Ratnasamy, P Francis, M Handley, et al. A Scalable Content-Addressable Network[C]. In SIGCOMM, ACM Press. 2001:161-172.

[12] Marti S, Ganesan P, Garcia-Molina H. DHT routing using social links[C]. The 3rd International Workshop on Peer-to-Peer Systems. La Jolla:Springer, 2004: 100-111.

[13] Ye-In Chang,Hue-Ling Chen,Sih-Ning Li and Hung-Ze Liu,A Dynamic Hashing Approach to Supporting Load Balance in P2P Systems[J],The 28th International Conference on Distributed Computing Systems Workshops, 2008: 429-434.

[14] Gennaro Cordasco,Alessandra Sala.2-Chord Halved[C],Proceedings of the 2005 Second International Workshop on Hot Topics in Peer-to-Peer Systems, 2005

[15] Liu Ye,Yang Peng,Chu Zi,Wu Jiagao.TCS-Chord:An Improved Routing Algorithm to Chord Based on the Topology-aware Clustering in Self- organiziong Mode[C],Proceedings of the first International Conference on Semantics,Knowledge and Grid,2006.


Published by Atlantis Press, Paris, France.