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The Improvement of Chord Protocol about Structured P2P System

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Abstrak

Protokol Chord adalah salah satu protokol yang paling klasik dalam sistem P2P terstruktur, dengan karakteristik: efek yang baik, keandalan, efisiensi query tinggi, disamping keuntungan lainnya. Namun, Chord tetap memiliki dua kelemahan utama yaitu kecepatan pencarian sumber daya yang lebih lambat, dan penahanan routing lebih tinggi. Paper ini membahas struktur Chord yang baru melalui kombinasi setelah dilakukan modifikasi, yaitu dengan mempertimbangkan pada kekurangan-kekurangan tersebut. Struktur Chord baru memiliki super-node dan common-node yang berdampingan, super node-super node, dan node-node manajemen umum. Struktur baru menggunakan hukum Zipf menentukan proporsi super node dan common node. Pada bagian akhir, struktur baru disimulasikan oleh perangkat lunak simulasi, dan hasilnya adalah protokol Chord yang telah ditingkatkan mampu menekan kekurangan-kekurangan sebelumnya jika dibandingkan dengan protokol Chord.

***Kata kunci**: protokol chord, sistem P2P, struktur*

Abstract

Chord protocol is one of the most classical protocols in structured P2P system, with the good effect, reliability, high query efficiency, and many other advantages. However, Chord agreement remains two main shortcomings the one that the searching speed of resources is slower, and the other that the detention of routing is higher. This paper in view of these shortcomings, combination with modification, then put forward the new Chord structure that super nodes and common nodes coexist, super nodes management general nodes. The new structure using Zipf-law determines the proportion of super nodes and ordinary nodes. The last, the new structure is simulated by simulation software, and the improved Chord protocol make better the previous shortcoming through the new structure compares with the Chord protocol.

***Keywords:** chord protocol, P2P system, structure*

1. Introduction

With the rapid development of network resource sharing, instant messaging, video transmission and other services, P2P networks have been widely used. The P2P network of distributed technology [1] has become a focus of international academic direction [2]. P2P network in accordance with the structure of the network can be divided into structured P2P network and unstructured P2P network, compared to unstructured P2P networks, structured P2P network no flooding resource search algorithm, which has a strong system scalability research value is also higher, including the chord network model is a structured P2P network in the most classic network model. This paper analysis the traditional chord model and some modifications chord model, then put forward a new improved chord model, though the theory and simulation analysis, prove the new chord model having a good efficiency.

2. Chord

2.1. The traditional Chord protocol

Chord protocol designed and development by MIT (Massachusetts Institute of Technology) [3], which is one resource positioning and routing protocols based on the structure

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of DHT P2P networks, it will be the entire P2P network node, and the resource information keywords mapped to a virtual an cycled space. Node in the network and resources to identify with the identifier and the identifier unique node identifier by hashing the node's IP address transform resource identifier with the key value, through the content of the resource identified hash transform.

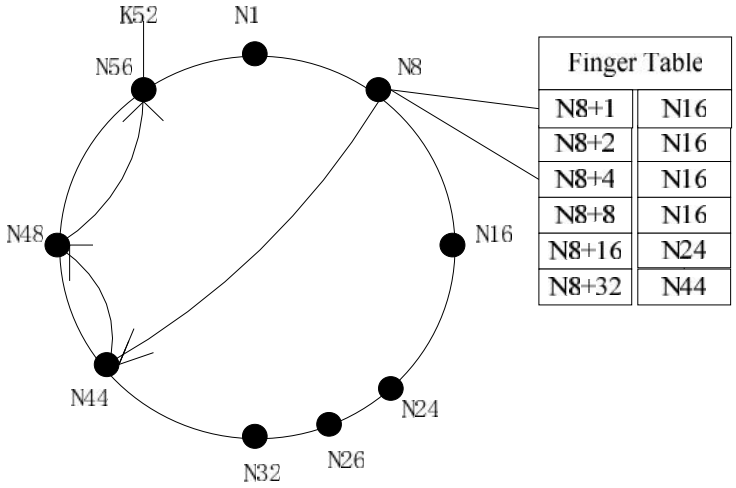

Figure1. The structure of Chord

Every node in the Chord maintain a finger table, the number of lines is $m = \log_2(n)$, column number is 2, As shown in figure 1 node N8 shows. Chord by searching nodes finger table, resource search, as shown in figure 1 shows N8 search resources K52 process. Because resources K52 stored in N56 node, the node N8 first to find N44 node, the node N44 find his finger table routing to N48 node, the final node to node N48 search N56, a total need 3 to jump.

2.2. The shortcomings of the traditional Chord protocol

The traditional Chord protocol has two main shortcomings [4] [5]:

(1) Chord search resources with 2^n jumps, when the destination node and the current node distance is so far, may be need many jumps to find the destination node, increased resources search routing hop counts.

(2) P2P system with thousands of users, the nodes and the performance of the nodes are great differences, there are a lot of ability is weak nodes in the Chord as independent node, they also want to be responsible for the system of a large number of search and download works. Due to the limitation of their own resources, they will cause the system response time increased, may become the bottleneck of that system.

2.3. All kinds of available improved Chord agreement

In view of the above questions, the researchers of Chord agreement various improvements; these improvements can be roughly divided into two kinds:

One kind is mainly to the Chord node's routing table to carry on the revision, balance the routing table size and search efficiency, such as literatures [6][7][8] proposed bidirectional search mechanism, nodes not only can clockwise search resources, but also counterclockwise search resources. Literature [9] to reverse routing table structure modification.

Another difference in node performance, these papers puts forward the super nodes management general nodes train of thought, the Chord structure was improved, such as literature [10] proposed ring structure, the super nodes constitute the main ring distribution in the middle, each super nodes management from a ring distribution in the Lord of the rings around. Literature [11] [12] was presented according to the small world model Chord, the Chord for points cluster management. Such modifications still has some shortcomings, such as not

sure a super node management how many common nodes, ring structure of the node identifier and not on the node's IP address to hash function get, so less of practical existence.

3. This paper improved Chord

3.1. Z-chord system structure

In view of the above questions, based on the existing improvement method, in this paper, the chord model made the following improvements:

1. Introducing the concept of node, the single loop structure, but to chord ring to partition management, each division has one super node; the super node is responsible for the management of the area of common node.
2. According to the Zipf law [13] determine super node and ordinary node proportion, Zipf law is one of the most widely used lows in literature metrology, it has been widely used in computer network.

According to the Zipf law determine and ratio of super node and common node is 1: 4. If the four common nodes distribution in the super node's left, we can get the new chord structure as shown in Figure 2.

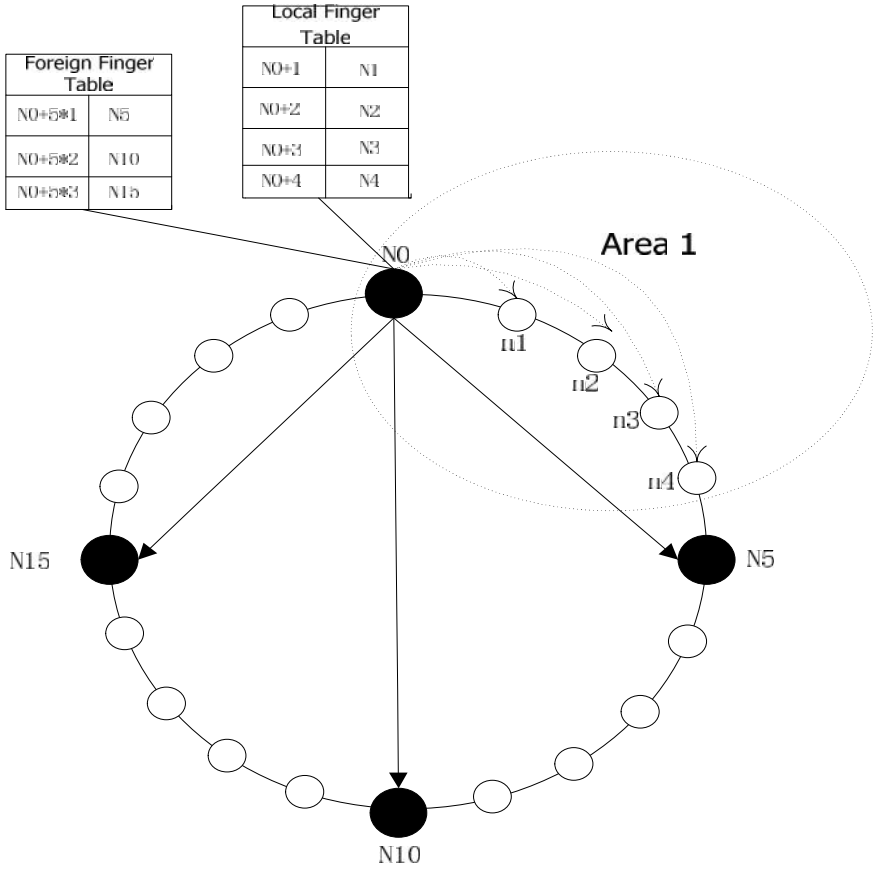

Figure2. The structure of Z-Chord

3.2. Z-chord structure analysis

In the each partition, super node assumes a lot of rights and obligations. The super node has two routing tables, one local area routing table and one foreign super nodes routing table. Common node only has one local area routing table.

The local area routing table contains all nodes' routing information which in the partition, super nodes responsible for the local area routing table's update. When a common node join

into the structure, firstly concludes that the new common node belong to which super nodes management area, after node join into the area, notify the super node update the local area routing table, after the super node update the local area routing table, super node shared it with the common nodes which in the partition.

Super node routing table contains all super nodes' routing information which in the new structure, it is known that the super nodes' hop counts between logic for 5n jumps, namely super node every 5n jumps for node routing information constitute a super node routing table. New chord structure, since each super node is responsible for the management of a region in the system, occupies an important position, must ensure that each super node always online, if a super node have to exit the network, must be selected another super node to replace the super node as soon as possible.

When resources search, firstly according to the key words to determine target node position, if the source node and destination node in the same area, because the local area routing table contains all areas node routing information, then only need one jump to complete the search. If the source node and destination node are in the different area, but all of them are super nodes, because foreign super node routing table contains all super node routing information, so only need one jump to find the target node; If one of the source node and destination node is super node, then super node to super node need one jump, common node to super node need one jump, a total need two jumps; If the source node and destination node both are common nodes, then the source node to the area super node one jump, between super nodes need one jump, destination node to the target area super node need one jump, a total need of three jumps.

4. Simulation analysis

Through the simulation results of the proposed the new Z-chord structure's performance evaluation. In this paper use Peersim simulation software, the resource search average routing hop count and the average delay of performance test. Peersim is one based on Java professional P2P network simulation software.

According to the average routing hop count, this paper use $N = 2^k$ ($k \in (10, 15)$) different orders of magnitude scale node, a total of 100 x 2^k storage quantity of key information to respectively into Line simulation experiments, the 1 024, 048, 4 096, 192, 000, and 258 this 6 groups of different number of 100 times route search operations, The simulation results as shown in figure 3 shows.

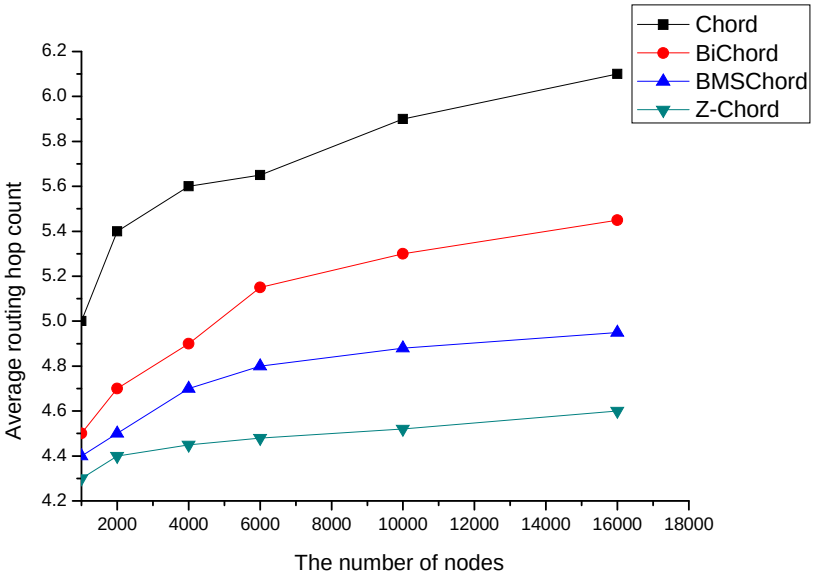

Figure3. The average routing hop count of Z-Chord and other researches

From figure 3 we can see, Z-chord system average routing hop count less than the traditional Chord system, Bi-chord [14] and BMSChord [15] .So the Z-chord improve the search efficiency of resources. In theoretical analysis, resource search average hop count in 3 jump, but in practice, due to the source node has a certain probability confusion destination node in the partition, probably in secondary routing, which increases the routing hop count, so the income routing hop count is higher than theoretical analysis routing hop count.

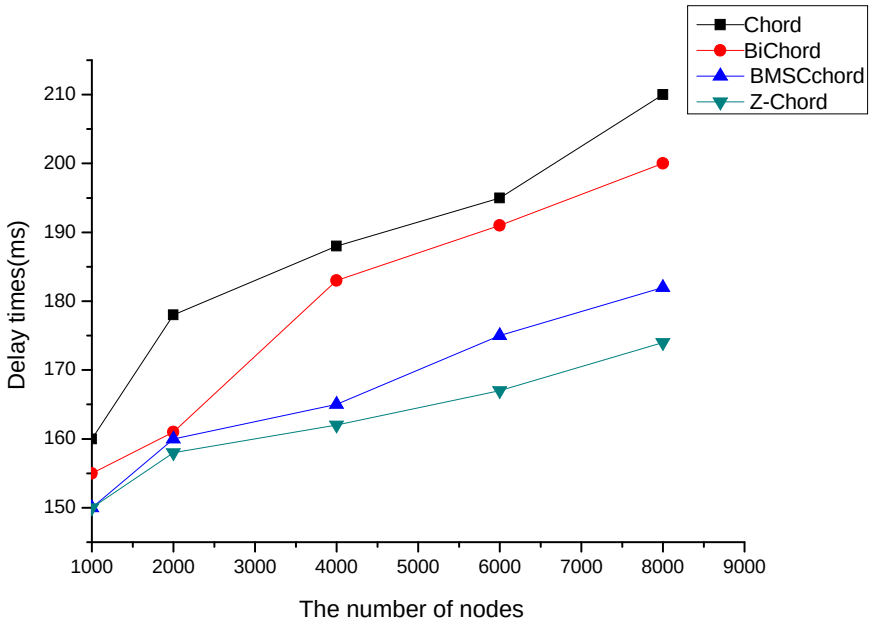

Figure 4. The routing time delay of Z-Chord and other researches

From figure 4 we can see that Z-chord routing delay less than traditional Chord, Bi-chord and BMSChord, this is because the Z-chord reducing some of the poor performance of the common node workload, but if the system has too many nodes, super node load will increase greatly, once beyond the super node to withstand range, Z-chord routing delay will be greatly improved.

5. Conclusion

In this paper, consider the shortcomings of chord agreement, based on the existing improvement, put forward the new method that nodes in the network according to the node performance divided into super nodes and common nodes. Super nodes management general nodes, chord to partition management, use the power law determines the one super node management general node's number, then constructed the new partition chord structure. Through the simulation results show that the new structure can reduce the resource search routing hop count, reduced the routing delay, with the good performance.

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