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Cooperating Superpeers based Service-Parts Discovery for Ubiquitous Grid Networking (uGrid)

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Abstract—In a ubiquitous Grid networking (uGrid), discovery of service-parts and resources is essential. In this paper, cooperating superpeers based service-parts discovery which can increase the success rate of discovery is proposed.

I. INTRODUCTION

With the advance of ubiquitous society, it is possible to assume that everything will be connected to the network. Meanwhile, grid computing is a technique to create a high performance virtual machine by combining high performance computers (HPCs). A ubiquitous grid networking environment (uGrid) has been proposed [1], [2], [3]. In uGrid, everything is defined as "service-parts". Service-parts might need several Gbytes end-end network (ex. DVI over IP).

Discovery of service-parts is essential for user to get requested services. We try to use UDDI (Universal Description, Discovery and Integration) [4] for service-parts discovery. Since every device in the world could be defined as the service-parts, it is necessary to address scalable issues. A distributed UDDI should apply to search service-parts.

In this paper, cooperating superpeers based discovery method in uGrid is proposed. The proposed method controls the number of accesses for each superpeer to increase the success rate of discovery. Therefore, the proposed method can process clients 3 times more than the conventional method.

II. CONVENTIONAL SUPERPEERS BASED DISCOVERY

The conventional superpeers based discovery method [5] divides the network into some groups. There are few UDDI registries which manage service-parts in each group. In each group, one UDDI registry configured for a superpeer. A superpeer is the leader of the group and knows the information of all UDDI registries in the same group. Figure 1 shows a process of the conventional method. In Fig 1, when a client starts searching for service-parts, the client sends a search query to a nearest UDDI registry. The UDDI registry which received the query will search itself, and then forward the query to the superpeer of belonging search group when no requested service-parts were found. The superpeer then search within the group, if no requested service-parts were found, it forwards the query to neighbor superpeers.

A drawback of this method is that when a superpeer receives more query than it can handle, success rate becomes low.

III. PROPOSAL METHOD: COOPERATING SUPERPEERS BASED DISCOVERY

To increase the success rate of service-parts discovery, a new approach for service-parts discovery called cooperating superpeers based discovery is proposed. Cooperating superpeers based discovery, the proposal method, dynamically changes the group for search to control the number of accesses for superpeers. Therefore, our proposal method can balance the number of queries within superpeers to reduce the number of query losses and increase the success rate.

In the proposed method, it is able to set the appropriate value of thresholds, compare with the normalized access number of superpeer, and then change the group for search depending on the normalized access number. The
TABLE I
PARAMETERS FOR EVALUATION

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of UDDI registries</td>
<td>10</td>
</tr>
<tr>
<td>number of Superpeers</td>
<td>3</td>
</tr>
<tr>
<td>number of queries that can be handle</td>
<td>500</td>
</tr>
<tr>
<td>simulation time</td>
<td>10000 sec</td>
</tr>
<tr>
<td>query process time</td>
<td>0.68 sec</td>
</tr>
<tr>
<td>thresholds</td>
<td>0.9</td>
</tr>
</tbody>
</table>

normalized access number is defined as follow.

\[
\text{Normalized access number} = \frac{\text{number of query that superpeer can handle}}{\text{access number}} \tag{1}
\]

Figure 2 shows a process of proposal method. In the cooperating superpeers based discovery, when sending the query to the superpeer, superpeer checks the normalized access number of itself. If the normalized access number is larger than thresholds, the first accessed UDDI registry shifts the search group to neighbor group as shown in Fig 2. The query will send to a superpeer in new assigned group.

By changing the group, the normalized access number of superpeer will distribute. Therefore, the proposed method can control the access of superpeers and increase the success rate.

IV. PERFORMANCE EVALUATION

Computer simulations are used to show access distribution and success rate of discovery on both the conventional and the proposal methods. Simulation parameters are summarized in Table I.

First, Figure 3 shows the evaluation of access distribution for each superpeer. Query ratio in group 1 defines the ratio of query generation in group 1. In the conventional method, as the query ratio in group 1 increases, the normalized access number for group 1 increases, and group 2 and 3 decrease. However, in the proposed method, since the query will be forward to the other groups, the normalized access number becomes smaller than the conventional method. Also, all groups show almost the same values. From this evaluation, the proposed method can distribute the normalized access number.

Second, Figure 4 shows the probability of succeeded search of discovery. Success discovery is defined as discovery that was processed properly without query loss. In this figure, we the query ratio of group 1, 2, and 3, is set to 65%, 20%, and 15%. From Fig 4, as the number of clients increase, the probability of succeeded search decreases in the conventional method. Every UDDI registries in each group process received queries properly until the number of clients reaches 60. However, registries in group 1 are not able to handle search queries in the case of more than 60 clients. Moreover, registries in group 2 and 3 become unable to handle search queries as the number of clients increase. They start to reject queries, and finally the probability of succeeded search converges on 0. In the proposed method, the probability of succeeded search will also converges on 0. However, it gradually decreases because the access to each superpeers is distributed. From this evaluation, the proposed method reduces query loss and raise success rate.

V. CONCLUSION

In this paper, cooperating superpeers based discovery method in uGrid was proposed. The proposed method controls the number of accesses for superpeers. We showed that the proposed method can process clients 3 times more than the conventional method.

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REFERENCES