



## Submission a new method for resource discovery in grid by the use of active node grouping

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### ABSTRACT

Today there is an acceptable situation for any increase in resources connected to grid and providing great low-cost calculation power. Regarding the active and heterogeneous situation of connected resources to grid and diffusion of these resources in wide geographical situation, one of the most important problems of grid is discover the required resources. There are two major groups of grid resource discovery methods meaning centralized & non-centralized methods with some special and personal problems. The current presented methods are resulted from combination of above-mentioned methods. The fundamental problem in these new methods is going towards various problems in centralized or non-centralized methods including hierarchy method, tree method, and virtual organization and so on. For instance in tree methods we have servers with a fixed and constructional role. Any damages of them may cause a lot of costs. There is also another worrying factor such as gradual greatness of group and various problems of non-centralized methods like non-defined distribution of messages and non-damping situation of the message.

This paper intends to propose a new method based upon active grouping of nodes. In this method we have independent groups of nodes with a separate server for management of domestic resources of group. Then group server may call other groups for further relations upon recognition of territorial nodes of groups and finding group servers. We should create server and territorial nodes in a way not to bear a fixed role and could replace with other nodes. The proposed method in this paper has been compared with other resource discovery methods on analytical basis and also through simulation of grid environment for small & great environments as well. According to the obtained results, this method has a more harmonized application in speed factors, reducing of network traffic and also better application in damping of quick wasted messages.

**KEY WORDS:** grid resource discovery, nodes grouping, territorial nodes, Message damping

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### INTRODUCTION

Regarding the increase of needs and expectations of human being of computer, it was necessary to have high level of calculation power to resolve any problems. Due to some financial & technological limitations in calculation power hardware, any increase in software power may provide this idea that the most important step is to have common calculation power of systems. We have a replacement of serial calculations (in which the jobs will be ordered one by one for further performance on a processor) with dividing of jobs on current computer processors and concluding the obtained results in these calculation methods known as distributed calculations. In spite of suitable efficiency of distributed systems, it may face with some special limitations the most important of which was further needs to harmonized participating systems. Therefore, the users faced with financial limitations for supplying or renting of these harmonized systems. The idea of benefiting from these unemployed calculation powers was resulted from the mentioned problem and also presence of thousands computers in internet environment and/or other great networks most of which could not use of these resources. This is the idea of grid creation.

Grid means a virtual environment for distribution process in which we have heterogeneous distributed resources at different geographical points and with a powerful virtual environment. One of the most important problems in grid environment is quick & low –cost finding of connected resources to the active grid with adding or reducing resources. Since the mentioned resources are heterogeneous and supplied in a wide geographical field by different organizations with different situation, we will face with a lot of complexities. Therefore there are a lot of methods from the beginning of grid introducing which may be divided into two groups of centralized & non-centralized ones.

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Centralized methods mean a central management with the statistics of all current resources and a suitable reply at any time by continuous updating of its own data base. The mentioned methods bear a high level of efficiency but we will face with a lot of problems by the growth of connected computers to the grid and lack of measuring of these methods. On the other hand, such a central management system will be changed into a bottle neck point any damage of which will be resulted in total network damage. Therefore it is necessary to have non-centralized and measurable methods in this field. Non-centralized methods are generally based upon flooding message sending among network nodes without any centralized management.

A node which may receive the search in flooding sending of message is obliged to send the same on all exit ways. In such a case it is possible to have firstly a search to all possible ways and total network coverage and secondly finding the considered resource in least possible time. But naturally we will face with different problems like overhead of network and further traffic for which there are a lot of efforts for reducing the mentioned overhead. There are some constructed non-centralized methods based upon fixedness of network structure and benefiting from hash tables in which we have a guarantee for finding a resource but the great error of them is their lack of responding any resources active behaviors and/or continuous need to updating of network structural table which may cause a lot of overheads.

Upon submission of non-centralized non-constructed methods, there will be a solution for the problem of active sources support. But this problem has been changed into further endeavors for removing any mistakes in flooding sending system governing on these algorithms. For this purpose we have tried to control such a traffic load by applying different TTL policies (Time-To-live). We have flooding sending process in some of the methods based upon random movement among network nodes which may cause a reduction in traffic methods but generally have a high level of reply and low level of coverage.

There is a movement towards different methods in recent methods with relevant advantages of both centralized and non-centralized methods. Therefore we have some algorithms related to creating of different groups and classes of nodes and/or any relation between some nodes. For instance it is possible to point out to the tree structure method of nodes in which the head branch may keep relevant information of its own children and also creation methods of groups from nodes. These methods make better any search as well. But the basic problem in these methods is going towards one of both centralized and/or non-centralized methods. For example in tree methods we have servers with a fixed and constructional role. Any damages to them may cause a lot of costs. Also there are some problems in non-centralized methods due to gradual greatness of the group (this means indefinite distribution of a lot of messages and lack of suitable message damping). There is a new method proposed in this paper based upon active grouping of nodes. We have tried to remove any problems of the mentioned methods. Therefore by establishment an active and independent structure, there will be a little costs of change in this method and so much suitable for great and active environments. On the other hand, any benefit from centralized model in each group may cause a speed movement of researches and more control on waste message. As a result these two methods have a nice suitability.

## PROPOSED SEARCHING METHOD

The current nodes of the grid in proposed method would be divided into a collection of nodes in a maximum distance  $d$  from central node or server. Then a group means a collection as well. Such a maximum distance is named as group depth or group diameter and displayed by letter  $d$ . Territorial nodes means those nodes on group territory with highest distance from server. For example if we consider the depth of group equal to 100, the mentioned node is located in a distance of 100 steps from the server. The next nodes of this type of nodes belong to other groups.

The base of discovery method of proposed resource in this paper is to establish different groups on an independent and active form in grid environment in which one node is a symbol of centralized form of data reserve of current resources in group and further relations with other groups as well. The nodes of each group may confirm to the server any current and supplied resources through specific time intervals. If a node needs any resource, it may send a requesting message to the group server. Then the server may introduce a requesting message to group server by checking the list of current resources, if there is the required resource in mentioned group. Otherwise, it may send a searching message for recognized servers of surrounding groups. After studying the message and ensuring about non-repeated of which, all surrounding servers may send the message to their neighboring servers. Otherwise it may send a list of recognized and surrounding servers for applicant server in order to enable it for further ordering. Upon receipt of these lists of server, the applicant server may find a better recognition of the environment and perform relevant functions on this list in the name of betterment process.

One of the major problems in all peer-to-peer methods by creation small & great rings in searching way. In other words, it means finding wasting goals. For example regarding the following figure if server A is applicant server, it is possible to consider any searching movement up to node C as effective and suitable as possible. This is because of acceleration of covering functions by development of searching square. But any movement from C to D and later to E will increase repeating servers. Applicant server in this method is able to recognize promoting way. This means that it is easily possible to recognize any limitation of servers from geographical position by comparing the sent lists and send it on a promoting way for more efficiency in measuring of the environment and quicker finding out the resource.

It is possible to say that followings are relevant procedures for creation the best list of servers:

Omission of repeating servers

Considering any similarity factor of servers

Archiving of similar servers (with regard to similarity factor with possible description in different environments) and providing a promoting way

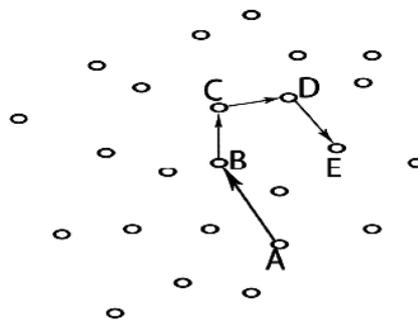


Figure (1): Creation of promoting way

The other aspect of this method is recognition of other groups' server. Territorial nodes are responsible for this duty.

Territorial nodes send a message to their surrounding nodes for recognition of surrounding servers. Then surrounding nodes of territorial node will introduce themselves to the mentioned node. Since territorial node is located at the territory of this group with other part groups in another group, it is possible to recognize only one message of at least two groups with one step.

Territorial nodes confirm the list of non-repeated recognized servers to the server of their own group. Then it may register them in case there is no more address in the relevant servers. Then it is possible to use these addresses for out of group searching. Surrounding servers may do the same similarly. As a result a searching message will exit from the node and provide a quick wide aerial coverage. Since the message is single-part with a specific destination, it may transfer from one server to another without no more traffic.

Now we will explain the method in details as follows:

### 1- Starting the activity of one node and group making

The node will send a message of step-I for surrounding systems at the time of primary loading. Then the node will search for a server and a distance lower than  $d$ . The surrounding nodes which may receive this message may confirm their server to its new node. The mentioned new node will introduce itself as the first recognized sever as the new member as well. Otherwise the node will send a step-II for second time. In case that no node responds this message for two times of sending, the mentioned node may load the server and apply as a server.

### 2- Recognition method of territorial nodes

Upon specifying a general message with d-step by a server, this message has a counter and a reduction one digit in each step. In case the nodes receive any messages with zero step, they are territorial node. Then they may load searching service for recognition of surrounding groups servers.

### 3- Specifying of replacement server

Group server will appoint one of the nodes in its step as the substitute server for transfer all information in special time intervals regularly. The presence of a substitute serve in step 1 means the maintenance of group near to the server in previous form in case of exit of major server. Furthermore it is possible to have different changes through replacement none of them has any costs for the group. The mentioned changes may add new nodes to the group and/or any changes in territorial nodes because of non-fixed role and no more effect on group job continuation.

Substitute serve is responsible for considering the presence of the server. This is applicable by sending a message at special time intervals to the server. In case the server does not responsible to the messages and exits from the group, substitute server will be responsible for major serve and introduce itself to all group nodes by sending a message.

On the other hand, serve is obliged for the presence of substitute server. In case of any exit of substitute server from the group, main server will appoint another node as its substitute. For more confidence of this method, it is possible to increase number of substitute serves and introduce different nodes as the substitute serve and furnish them with required information.

### 4- Semi-active & non-active territorial nodes

If there is not a new server in the introduced servers list by a territorial node which all of them have been introduced previously by territorial nodes, such a territorial node is marked as a semi-active territorial node by the server. The mentioned nodes will be non-active at 1-hour time intervals without any role in server search. Upon the end of this time, they may start their functions if there is not a new server in obtained servers of this node, the mentioned node will remove its label and otherwise wait for next time interval as a semi-active node.

If the list of introduced servers by a territorial node is exactly similar to the other territorial node, the server may inactivate one of both nodes in general.

## RESULTS

### 1- Simulation environment conditions

Simulation environment includes 100 nodes. The band width is fixed in all environments. There are 300 resources with random distribution of nodes. For similarity of the case, all groups and territorial nodes have been regulated by hands in our proposed method. The considered functions have been written in Gridsim version V with loading by Alea software – version 2.1.

The proposed method of this paper has been compared with one of the specified TTL methods and through random movement and the best neighbor where TTL=200 and as one of the recent connective methods.

### 2- Evaluated factors

#### 2-1- Efficiency of method in finding a resource

For considering this factor, we have studied any special waiting tasks. Therefore little waiting show quicker required resource. Figure (II) shows the result of studying this factor for three algorithms.

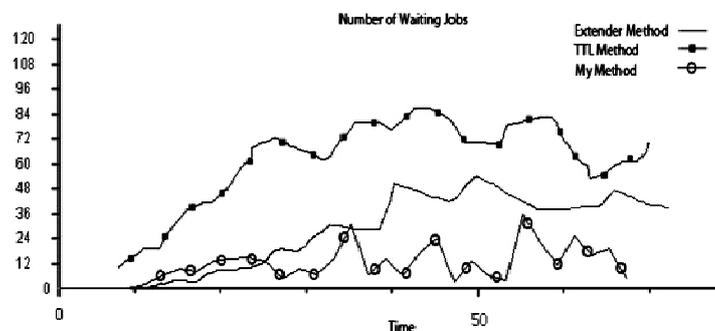


Figure II- Scrutiny of waiting tasks

## 2-2-Performance costs on relevant network

The major analysis factor in different methods with non-centralized and measurable methods is manner of message distribution. This is because this factor may apply great costs on the network. Following items have been studied for this purpose:

### Number of sent messages

Figure III illustrates total number of sent messages from the beginning and later for all three methods. In order to have a justice comparison we considered all sent messages in three considered methods. The important point in these diagrams is growth speed of sent messages more than the number of messages and with lower gradient in proposed method.

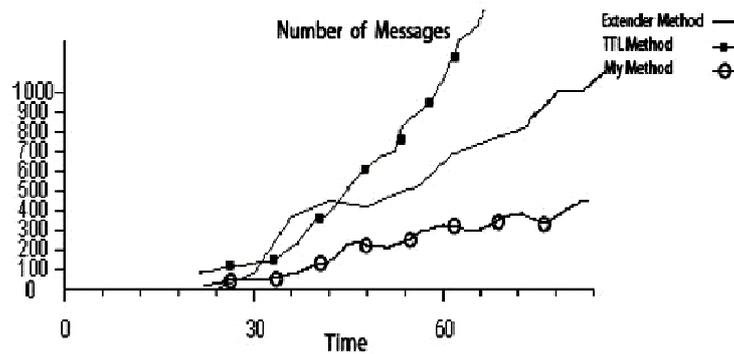


Figure III: Total number of sent messages

It has been tried in proposed method of this paper to have a control on all sent messages and prevention from sending any arithmetic progression of it. Followings are sent messages in this method:

- 1- At primary loading of a node: Limited message with step 1
- 2- For confirming the resources to the group server: Unicast message
- 3- For finding out neighboring servers by territorial nodes: Limited message with step 1
- 4- Sending the research to the outside of group: Unicast message

As it was said in messages 1 & 3 and with regard to the nature of the method and type of mission, there are some messages with relevant reply from the first neighbor, therefore they are so much limited and would be sent by step 1.

Messages 2 & 4 have a specific destination and are single-display type. Therefore with regard to their suitable damping mechanism, they would not require huge costs for the network.

### Message damping

Suitable damping of sent message to the network is one of the very much important factors related to network traffic. Since this message is repeating in most methods and diffused from one node to another, completion of messages movement after creation of the resource has a great effect on preventing from applying wasting load on the network. Since any sending of searches will be limited only to the servers in proposed method and the server may ask for continuation of the research before sending, therefore message damping in this method has a suitable level provided that upon finding out the considered resources it should be stopped as soon as possible. Figure IV shows the number of current messages in the network upon completion of all functions as the network duties.

### 3-2-3- Method responding at great environments

Structure is limited only to the inside of the groups in proposed method. Therefore centralized management could be defined only for the same group. Any relation among groups is based upon non-centralized form by sending a message from one server to the neighboring one. Territorial nodes with a non-fixed role would recognize the neighbor as well. Any changes in environment situation in comparison with other methods based upon a structure for the environment has minimum costs, while it is so much high in tree or hierarchy methods due to the

marketing of the structure. Therefore the mentioned changes of nodes and also greatness of environment are free from any threats in this method. On the other hand in case of abundance of orders on a group, there will be different responds to them with regard to the diffusion of resources and load dividing on groups. For considering this subject, we considered a greater grid with the same conditions but accompanied with 500 nodes in 14 groups for better simulation in order to examine load quality of each group and load dividing in greater environment. Here we have fixed creation of groups for simplifying of simulation. Figure V illustrates the result of simulation. With regard to the percentage of group work, it is possible to say that in a great environment we may have easy dividing of load among the groups.

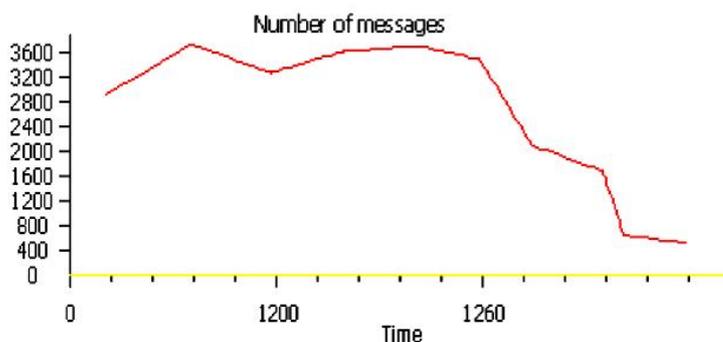


Figure V: The behavior of proposed method in great environment

## Conclusion

In comparison with centralized methods and based upon the structure, the proposed method in this paper has a better function in great & active environments from view point of environmental changes and also from efficient finding of resources and quick searching moves among group serves and quick coverage of the environment viewpoints. There is a good control on created overhead in this method with suitable damping and sending them to thoughtful servers for further prevention from sending any repeated searches and reduction of useless search. Therefore our proposed method could be considered as a suitable and harmonized method for applying in real and great grid environments. Any more researches about registration and applying of successful & unsuccessful responds of territorial nodes on different sending searches may cause an increase in future productivity of this method.

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