

# Trusted Resource Allocation in Grid Computing by Using Reputation

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## ABSTRACT

Grid system is a dynamic environment where every entity share the resources provided by the other entities. The system enables the coordinated and aggregated use of geographically distributed resources, often owned by autonomous organizations, for solving large-scale problems in science, engineering. However, application composition, resource management and scheduling in these environments is a complex process. The resource provider as well as the user should be convinced before beginning any transaction. Mutual trust must be established between the user and the provider. Trust is built on reputation. The concept of reputation is popular in peer to peer networks. But still it is not perfect in grid computing. This paper presents overview of existing reputation based models for resource selection and propose a new model for resource selection.

## 1. INTRODUCTION

With the increased network bandwidth, more powerful computers, and the acceptance of the Internet have motivated the constant requirement for latest and improved ways to compute. In 1990's, a novel computation environment, Grid computing, had come out. The idea to share processing resources between many organizations to resolve large scale problems has driven to

Computational grids. In the recent years, grid computing is rising as a viable paradigm to convince the continuous growth of computation power requirements.

Security requires the three fundamental services: authentication, authorization, and encryption. A grid resource must be authenticated before any checks can be done as to whether or not any requested access or operation is allowed within the grid. Once the grid resources have been authenticated within the grid, the grid user can be granted certain rights to access a grid resource. This, however, does not prevent data in transit between grid resources from being captured, spoofed, or altered. This problem is solved by encryption.

Two essential features of Grid Security are given by:

- *System Behavior Confirmation:* Grid resources such as applications, instrument or data have high importance and value; a grid security strategy must be formed based mainly on attack prevention. Entity authentication is an important means for controlling resources. But it does not provide means for attack prevention. That is better achieved with a behavior conformation mechanism.

- *Group Oriented Security:* Resource sharing is a group oriented activity. A grid security solution must support such capabilities.

Grid computing security environments are generally concentrating in properly authenticating users and hosts and in the communications between them. The effective utilization of the facilities of Grid computing requires advanced and secured resource management systems. The wide range of selection and high degree of distributed behavior leads to problem in selection. The degree, in which the resources are trusted, helps in allocation of resources. Reputation can be used as an important metric for trust calculation. The main issues characterizing the reputation systems are the trust metric -how to model and compute the trust and the management of reputation data - how to securely and efficiently retrieve the data required for the trust computation. There are some existing models for peer to peer net work systems, distributed systems and also for grid systems. All the models use reputation for determining the trust. These models are reviewed in this paper and the applicability of these models in enhancing the reliability for grid is analyzed. The rest of the paper is organized as follows: Section 2 surveys the previous work in the area of reputation. Section 3 defines trust and reputation and section 4 presents the proposed model with its parameters. Section 5 presents conclusions.

## 2. EXISTING WORK

Different approaches are developed in reputation management. Researchers propose different models for resource selection using reputation. A reputation-based framework is presented by Li xiong and liu [5]. They

claim that feed back values only are not enough for the calculation of trust and reputation. Y. Wang and J. Vassileva [6] propose a reputation model based on Bayesian network. According to their model the peers' needs are different in different situations. Selcuk et al. suggests in [7] a reputation based trust management system in which the reliability is calculated based on previous transactions. Ayman Tajeddine et al. in [8] propose a very impressive reputation based trust model. In this approach the initiator host calculates reputation value of target host based on its previous experiences and gathered feedbacks from other hosts. F.Azzedin, M.Maheswaran [9] discuss about managing trust in grid by proposing a behavior trust management model. Trust levels are graded from a to f. Both direct and indirect trusts are considered.

Gui Xiaolin, Xie Bing [10] proposes a trust model based on behavior tracks. Attenuation function is incorporated for decaying factor. Baolin Ma et al in [11] present a reputation based trusted model. Their model considers both direct feed back and feed back from other entities Direct trust is given with more weightage than the indirect score. Beulah kurian, Gregor von laszewki [12] provide a way for efficient resource selection by considering Eigen trust algorithm. Their approach is similar to Azzedin approach [9] except for a new parameter context.

### 3. TRUST AND REPUTATION

This section describes a short foreword regarding trust and reputation in the context of Grid Computing. When delegating a task, the initiator host must evaluate the trust on the other by considering different beliefs it can gather about the target host.

Marcim Adamski et al. [3] define trust as follows: "When we say we trust someone or that someone is trustworthy, we implicitly mean that the probability that he will perform an action that is beneficial or at least not detrimental to us is high enough for us to consider engaging in some form of cooperation with him. Correspondingly, when we say that someone is untrustworthy, we imply that that probability is low enough for us to refrain from doing so".

Reputation can be the source for building trust. According to Abdul Rahman et al. [4] reputation is an expectation about an entity's behavior, based upon its past behavior. Reputation is what is generally said or believed about a person's or thing's character [2]. Therefore, reputation is a measure of trustworthiness, in the sense of reliability.

### 4. PROPOSED MODEL

The proposed model uses direct trust as well as indirect trust. Higher weightage is given for direct trust. Direct

trust is calculated from transactions done directly. Indirect trust is measured by getting feed backs from entities in the same domain and also from other domains. The credibility of the recommenders feedback is estimated by considering different parameters such as similarity, activity and specificity. Similarity is calculated by kendall 's rank correlation. The feed backs are validated by using rank correlation. If the rank correlation is greater than zero the evaluation procedures of the two entities are the same. So the feed backs from those entities are accepted. Else those recommendations are not taken for trust calculation. Finally the direct trust and indirect trust are calculated. If the total trust is greater which is the sum of the two trusts is greater than the assumed threshold value then the resource is allocated else the resource is rejected.

When an entity in the grid system request the resource from the other entity, the resource is allocated to the entity only if it satisfies the above test criteria.

#### 4.1. Computation of Indirect Trust

Indirect trust is calculated by getting reputation (feed backs) from the other entities in the grid system. The unreliable feed backs are eliminated by using rank correlation. Each reputation is assigned with some weightage which is nothing but the credibility factor. The credibility is calculated by the following expression.

Credibility =  $a * \text{similarity} + b * \text{activity} + c * \text{specificity}$   
where  $a > b > c$  and  $a + b + c = 1$ .

$$\text{Similarity} = \frac{1 - n_c - n_d}{1/2 n(n-1)}$$

$$\text{activity} = \frac{\text{number interactions by recommenders}}{\text{Total number interactions by all recommenders}}$$

$$\text{Specificity} = \frac{\text{Number of interactions with initiator}}{\text{Total number if interactions with all other hosts}}$$

#### 4.1. Computation of Trust

Consider the scenario where entity x wants to interact with entity y to complete some task. X wants to measure the trustworthiness of y. The direct trust is calculated based upon the behavior of target entity on direct transactions. Then it inquires feedback about y from the entities in the same domain and from other domain. The reputation will be calculated from the formula given below.

$$\text{Rep } y/x_k = u * \text{direct trust} + v * \text{indirect1} + w * \text{indirect2}$$

Where  $u + v + w = 1$  and  $u > v > w$ .

$$\text{indirect 1} = \frac{\sum_{i \neq k} \alpha_i \text{ rep } y / x_i}{\sum_{i \neq k} \alpha_i}$$

$$\text{indirect } 2 = \frac{\sum_{j \neq k} \beta_i \text{ rep } y / x_i}{\sum_{j \neq k} \beta_i}$$

$\alpha, \beta$  are credibility factors.

If the trust value is greater than the threshold value the resource is allocated.

## 5. CONCLUSION AND FUTURE WORK

In this paper, Trust calculation model for resource allocation that is suitable in the Grid computing environment is proposed. This can be further enhanced for resource selection from the pool of resources in the Grid environment.

## REFERENCES

- [1] A. Arenas "State of Art Survey on Trust and Security in Grid Computing System " March 2006.
- [2] Gheorghe Cosmin Silaghi, Alvaro E. Arenas, Luis Moura Silva, " Reputation-based Trust Management Systems and their Applicability to Grids " *CoreGRID Technical Report Number TR-0064*, February 23, 2007.
- [3] Marcim Adamski, Alvaro Arenas, Angelos Bilas, "Trust and Security in Grids: A State of the Art", *CoreGRID White Paper Number WHP-0001* May 26, 2008.
- [4] A. Abdul-Rahman and S. Hailes. "Supporting Trust in Virtual Communities". In *HICSS '00: Proceedings of the 33rd Hawaii International Conference on System Sciences*, 6, Page 6007, Washington, DC, USA, 2000. IEEE Computer Society.
- [5] L. Xiong, and L. Liu, "PeerTrust: Supporting Reputation-Based Trust for Peer-to-Peer Electronic Communities," *IEEE Transactions on Knowledge and Data Engineering*, 16, No. 7, July 2004.
- [6] Y. Wang and J. Vassileva, "Trust and Reputation Model in Peer-to-Peer Networks," *Proceedings of the Third International Conference on Peer-to-Peer Computing (P2P'03)*, 2003.
- [7] A. Selcuk, E. Uzun, and M. Pariente, "A Reputation-Based Trust Management System for P2P Networks," *IEEE International Symposium on Cluster Computing and the Grid 2004*.
- [8] Ayman Tajeddine Ayman Kayssi Ali Chehab Hassan Artail "A Comprehensive Reputation-Based Trust Model for Distributed Systems " *IEEE 2005*.
- [9] F.Azzedin, M. Maheswaran "Evolving and Managing Trust in Grid Computing System" *IEEE CCECE*, 2002.
- [10] Gui Xiaolin, Xie Bing "Study on Behavior based Trust Model in Grid Security System", *Proceedings of the 2004 IEEE International Conference on Services Computing (SCC'04)*.
- [11] Baolin Ma, Jizhou Sun, Ce Yu, "Reputation-based Trust Model in Grid Security System ", Aug. 2006, 3, No.8 (Serial No.21) *Journal of Communication and Computer*, ISSN1548-7709, USA.
- [12] Beulah Kurian, Gregor von laszewki "Reputation based Grid Resource Selection " .