Resource Selection in Grid based on Trust and Reputation

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ABSTRACT
A Grid Computing System is a geographically distributed system with different domains sharing resources. The resources should be shared with out loosing individual's confidentiality and control over their resource. Recently, trust has been recognized as an important factor for selection of best resource in grid. A novel trust model is proposed in this paper where the best resource is selected based on the computational intensity of the resource, feedback from the consumers, context of transaction, time of transaction, number of transactions. The overall trust value is computed by the above factors.

Keywords
Grid computing, computational intensity, trust, feedback, reputation.

1. INTRODUCTION
Different resources are shared in the grid environment. The Grid was initiated as the way of supporting scientific collaboration, where many of the participants knew each other. In this case, there is an implicit trust relation, all partners have a common objective to complete a specific task, and then the resources should be provided within some defined and expected boundaries. The resources must be shared in such a way to ensure behavior conformity. Both the users who submit their jobs to resources and the providers who provide resources must get satisfaction out of the transaction. In grid environment both the user and provider are unknown to each other. There must be a system which can evaluate the user and provider before allocating the resource .Reputation based systems can be used for effective resource selection. A novel trust model is proposed in this paper to calculate the credibility of the service provider based on reputation.

The rest of the paper is organized as follows. Related work is briefly discussed in section 2. Section 3 defines the notations of trust, reputation and its characteristics. The proposed trust model for Grid Computing is proposed in section 4. The simulation and results are discussed in section 5. Finally, conclusion is defined in section 6.

2. RELATED WORK
Trust has been addressed at different levels by many researchers. In [1] behavior based trust model is proposed in which trust is computed by taking into account the direct trust, reputation and decay function. The various parameters like number of transactions for the different types of resources are not considered.

In paper [2] GridEigenTrust model is proposed under the grid environment. However, it hasn't resolved the shortcomings of the EigenTrust model. It hasn't provided solutions to resolve malicious ratings at a malicious node as well as cooperative fraud issues.

In paper [3] a Globus Monitoring and Directory Service (MDS) is developed that provides uniform, efficient and scalable access to dynamic, distributed and diverse information about the structure and state of the resources. However the information returned by this service is inaccurate or outdated and does not integrate a resource selection service.

The sporadic nature of Grid and its measured values and its possibility to integrate adhoc services in a grid environment [4] of which no historical data is available poses a severe limitation on prediction services.

Ayman Tajeddine et al. [10] propose a very fuzzy reputation based trust model by incorporating fuzzy logic. In this approach the initiator host calculates reputation value of target host based on its previous experiences and gathered feedbacks from other hosts. The recommenders can be from the same administrative control (neighbor) or from different trusted domain (friends) or from a completely strange domain (stranger).

Biswajit Upadhyay et al [13] describe a trust model that identifies the malicious resource provider by means of direct trust and indirect trust.

3. TRUST AND REPUTATION
3.1 Definition of Trust and Reputation
Trust plays an important role in all the aspects. In the grid environment, Trust plays a very important role in resource sharing. Farag Azeedin [1] defined trust as follows.

"Trust is the firm belief in the competence of an entity to act as expected such that this firm belief is not a fixed value associated with the entity but rather it is subject to the entity's behavior and applies only within a specific context at a given time".

A service provider publishes its service function description by which a service consumer can find the service. But a

service consumer faces a dilemma in having to making a choice from a bunch of services offering the same function. At this time, a service consumer needs to know not only what a service can do, but also how well a service can do. During this time the consumer gets the opinion of the provider from which it is about to get the service, from other consumers from their past transaction history is known as reputation. The definition of reputation as given by [1] is as follows:

"The reputation of an entity is an expectation of its behavior based on other entity's observation or information about the entity's past behavior within a specific context at a given time".

3.2 Characteristics of Trust and Reputation

Context specific:

Trust and reputation both depend on some context. For example, Mike trusts John as his doctor, but he does not trust John as a mechanic to fix his car. So in the context of seeing a doctor, John is trustworthy, but in the context of fixing a car, John is untrustworthy.

Dynamic:

Trust and reputation can increase or decrease with further experiences (interactions or observation). They also decay with time. New experiences are more important than old ones since old experiences may become obsolete or irrelevant with time passing.

3.3 Definitions:

Consumer:

A consumer is an entity which requests for a resource. The brokers are requester entities.

Provider:

A provider is an entity that provides the resource.

Entity:

An entity refers to a provider or consumer.

4. THE PROPOSED MODEL

In the proposed trust model the trustworthiness of a provider is based on the type of transaction, the number of transactions and the feedback provided by other entities in the past. A minimum threshold value is set for the number of transactions to be taken into account based on the type of resource. In the proposed model we take into account three types of resource namely printer, data and a computational resource. The threshold value plays an important role as the resources are shared in the Grid. For example if an entity requests for a resource printer it is highly impossible to give a feedback value for a resource by another entity if it has done limited number of transactions. At the same time, one entity cannot conclude that since the particular entity has provided some resource previously satisfying the minimum threshold value, it is suitable for sharing a different resource. Trust decays with time. A decay function is used to evaluate the entity's behavior based on the time.

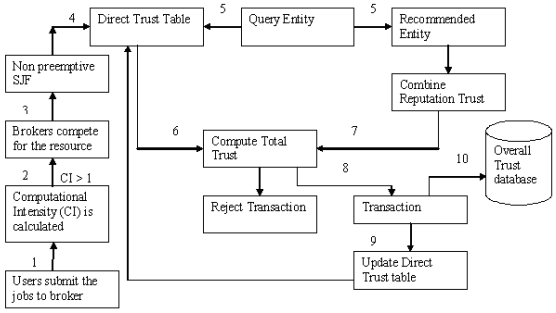

Fig 1- Components of trust model

The various components of trust model are shown in Fig1.The user submits the job to the brokers (requester entities) (1). The Computational Intensity of the resource is calculated (2).If the computational intensity of the resource is greater than one, the brokers (requester entity) compete for resource (3). The resource is allocated to one broker by a particular provider by means of non-preemptive shortest job First Scheduling (4). To check the credibility of the provider, the broker sends a query to all the neighboring entities (consumers) to provide trust value about a resource based on its previous transactions in a given context (5). All the entities will refer to their Direct Trust Table (DTT) and if there was a previous history of interaction, it responds to the query by giving the trust value along with the time of past interaction (5). The Direct Trust value and the Reputation Trust value are combined to give the overall trust value about a resource (6). If the total trust value computed is very poor then the transaction is rejected else if the overall trust value is greater than or equal to the required trust then the job is assigned to the resource for execution (8). After completion of the transaction the Direct Trust Table of the entities are updated accordingly (9). The trust update is done after completion of 'n' number of transactions by a resource. The overall database is updated (10).

Table 1 represents the trust value given for various providers by the consumers.

Table 1: Direct Trust Table

Providers	**Previous trust value**	**Current trust value**
Provider31	0.2	0.8
Provider32	0.5	0.4
Provider33	0.6	0.9
Provider34	0.1	0.3

The total trust value differs between 0 and 1.

Table 2 depicts the trust value and the meaning.

Table 2: The trust value and the meaning.

Trust Value	Meaning
0.9 -1.0	Excellent
0.6-0.8	Very good
0.3- 0.5	Good
< 0.5	Poor

4.1 Calculation of Computational Intensity

Computational Intensity (CI) is given by the formula:

CI = (4*WorkUnitDuration (seconds)) / (File Input Size (KB)/ File Output Size (KB))

4.2 Calculation of Direct Trust:

Direct trust is calculated using the formula

Direct Trust= α DT p-1 $_{A, C}$ + β $V_{A,C}$ p * T

where α is the weight age given to direct transaction and DT p-1 A,C is the direct trust value given by consumer A to provider C in the previous transaction and β is the weight age given by consumer A to provider C in the current transaction and VA,C p denotes the current trust value given by consumer A.

The time factor T is calculated using the formula:

$$T=e^{-\gamma (t2-t1)}$$

The difference of current time of transaction t_2 and past time last transaction t_1 is expressed as (t_2-t_1). γ is the weight age given to time factor.

Table 3: The time difference and factor.

x	r
0-120	0.5
121-240	1
241-360	2
361-480	3

4.3 Calculation of Reputation Trust:

Let us assume that a broker (B1) receives a recommendation from various entities about the same provider.

The reputation trust is calculated using the formula:

Reputation Trust = β * Credibility value.

B1 uses a credibility measure to evaluate the recommender's trust. The credibility

Credibility = $e^{-\text{round}(5-4*|D|)}$

where D=threshold value set by the requested entity for the recommender's trust-trust value given by the recommenders. Based on the credibility value, the broker B1 will calculate total trust.

Total Trust is given by the formula,

Total Trust = Direct Trust + Reputation Trust.

5. SIMULATION AND RESULTS

The simulation is done using Java as the front end and mysql as back end. The trust values are calculated and updated in the Direct Table and Credibility table. The request for a resource is generated randomly. If the resource requested is printer the threshold value is 100. Only if has performed 100 transactions then it is capable of providing the resource to other consumers. The minimum threshold value is set for a computational resource as 200. This is because the trust value is different for each resource in the Grid Environment.

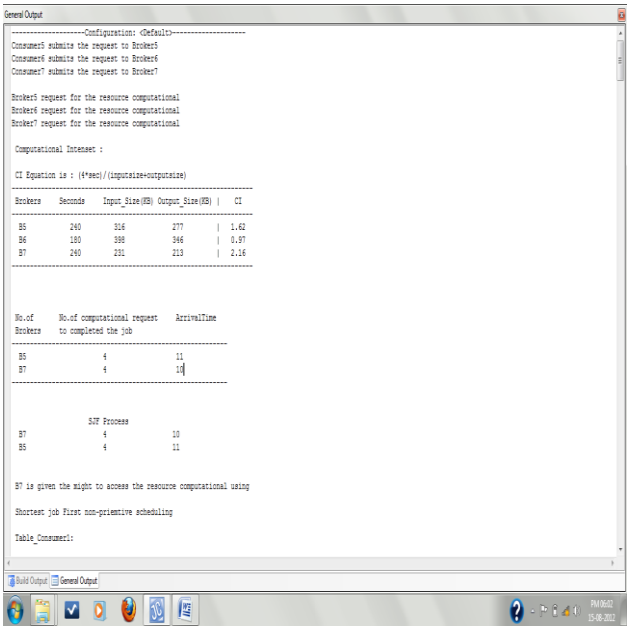

Fig2:Broker B7 is given the right to access the computational resources from various providers

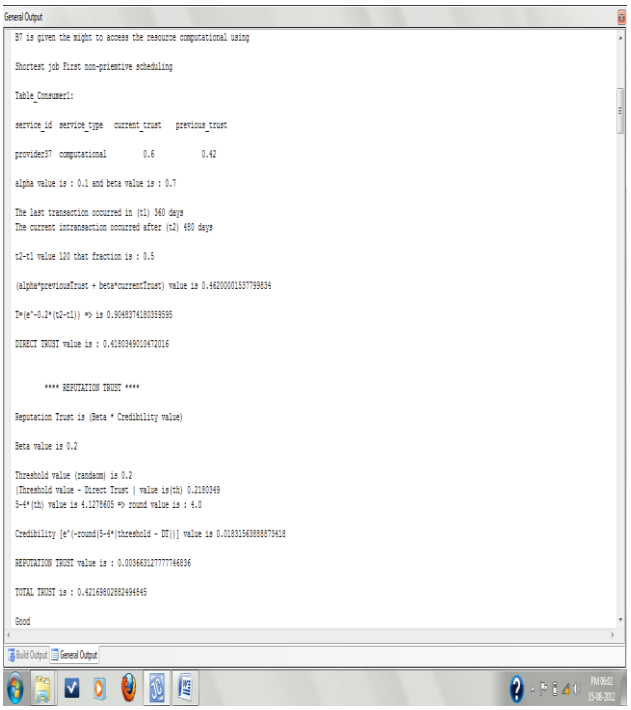

Fig 3: Calculation of direct trust for provider 37

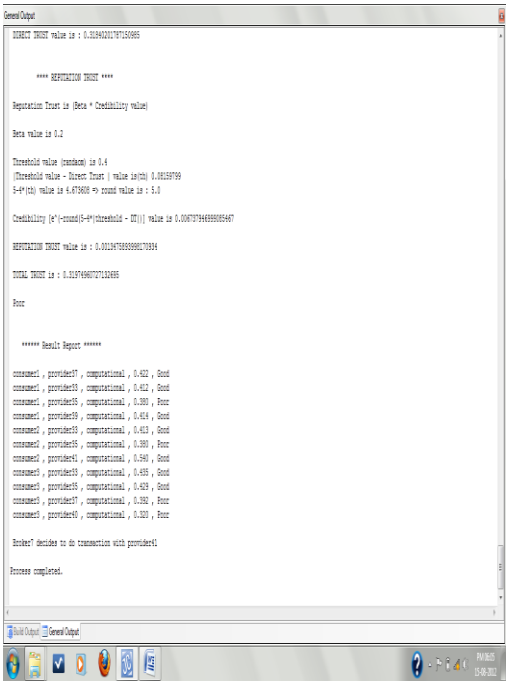

Fig 4: Broker B7 decides to do transaction with provider41

6. CONCLUSION

In this paper, a trust model is proposed to find the best resource. The future direction of the work is to build trust among multiple virtual organizations that spans over various domains by taking into consideration the various QOS parameters.

7. REFERENCES

[1] Farag.A.Azzedin and Maheswaran.M , 2002, "Evolving and managing trust in grid computing systems", in Proceedings of the 2002 IEEE Canadian Conference on Electrical Computer Engineering, pp 1424-1429.

[2] Beulah Kurian Alunkal,Ivana Veljkovic,Gregor Von Laszewki,and Kaizar Amin, ,2003, "Reputation based Grid Resource Selection", in Proceedings of the Workshop on Adaptive Grid Middleware,pp 28.

[3] G. von Laszewski, S. Fitzgerald, I. Foster, C. Kesselman, W. Smith, and S. Tuecke, 5-8 Aug. 1997, "A Directory Service for Configuring High-Performance Distributed Computations" , in Proceedings of the 6th IEEE Symposium on High-Performance Distributed Computing, pp. 365–375.

[4] G. Von Laszewski, G. Pieper, and P. Wagstrom, 2003, "Gestalt of the Grid in Performance Evaluation and Characterization of Parallel and Distributed Computing Tools",ser. Series on Parallel and Distributed Computing.
Wiley,[Online].Available:http://www.mcs.anl.gov/ "gregor/papers/vonLaszewski--gestalt.pdf

[5] L.Xiong and L. Liu, 2004, "PeerTrust: Supporting Reputation- Based Trust for Peer-to-Peer Electronic Communities," IEEE Trans. Knowledge and Data Eng., vol. 16, no. 7, pp. 843–857

[6] S.D.Kamvar, M.T. Schlosser, and H. Garcia-Molina, 2003. "The eigentrust algorithm for reputation management in p2p networks", in WWW '03: Proceedings of the 12th international conference on World Wide Web, pages 640–651, New York, NY, USA, ACM Press

[7] Chang E, Dillon T S, Hussain F K., 2005, "Trust and Reputation Relationships in Service-oriented environments", 3rd International Conference on Information Technology and Applications. Sydney: IEEE, .4-14.

[8] Baolin Ma, Jizhou Sun2, Ce Yu, August 2006, "Reputation-based Trust Model in Grid Security System", Journal of Communication and Computer, Volume 3, No.8 (Serial No.21), pp 41-46.

[9] Alfarez Abdul-Rahman and Stephen Hailes, 2000, "Supporting Trust in Virtual Communities", Proceeding of the 33rd Hawaii International Conference on System Sciences,pp 4-7

[10] Tajeddine, A, Kayssi, A, Cheab, A and Artail, H. (2009) "A comprehensive reputation-based trust model with Fuzzy subsystems for distributed systems", Applied Soft Computing 345–355

[11] G.Kavitha, V.Sankaranarayanan, 2010, "Secure Resource Selection in Computational Grid Based on Quantitative Execution Trust", International Journal of Computer and Information Engineering, pp 151-157

[12] Vivekananth.P, "A Trust Model For Grid Resource Selection", 2010 3rd International Conference on Advanced Computer Theory and Engineering(ICACTE),v6, 182-184

[13] Biswajit Upadhyay, Abhishek Bandyopadhyay , Avijit Bhowmick, 2012, "Proposed a Robust Trust Model for Reliable and Secure Transactions in Grid Computing", International Journal of Computer Science and Information Technologies, Vol. 3 (3), 4362 - 4365