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The Trust Model based on Punish Mechanism in Peer-to-Peer Network

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Abstract—Along with the rapid development of peer-to- peer network technology and the fast increasing number of persons, the problems of security in peer-to-peer network is becoming more and more.By researched the previous trust model of peer-to-peer network, bringing forword a trust model(PTM) for peer-to-peer networks based on punish mechanism. Firstly, using the method of social grouping nodes in the calculation model of trust. Then bring in punish mechanism in trust model. This model stimulate nodes which provide sincere service.

Keyword: incentive, trust model, peer-to-peer network, punish mechanism

1. Introduction

Every node in peer-to-peer network is equal.That is to say each node is the client and the server. Peer-to-peer network technology is widely used in many fields which are collaborative work, distributed information and resources sharing, large-scale parallel computation[1]. So the cooperation between nodes effectively slowed the pressure and bandwidth of server.Especially peer-to-peer network traffic has accounted for 60% of the backbone flow, that making web users fall in it. But there are a lot of Free-riding nodes in peer-to-peer network.Due to the independence and autonomy selfish nodes of nonco- operative behavior affects the usability and robustness of network. So in recent years scholars devote on incentive mechanism which can upset passive hitchhiking phe- nomenons on P2P networks[2]-[4].

Trust model[5]-[7] is a method of improving network cooperation.We can add trust mechanism in trust model to encourage nodes sharing resource and trading honest. In this paper propose a trust model based on the punishment mechanism.Whether the node transact with other nodes belong on the trust of the history deal.To punish the selfish node which make they providing free services or not getting services.That make every node to provide honest cooperation,and effectively prevent hitchhiking behavior.

2. Trust model

2.1. Trust computing

Through the study of existing trust model,combining with the relationship of social network can divide the nodes of peer-to-peer network in groups.Roughly divided into the direct trade group,the recommend credibility group,no relation node group.The characteristics of network similar with social communication

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network.In peer-to-peer network the trust of nodes in the direc trade group above the trust in recommend credibility group.To the recommended node trust is lower. For some trade after a period of time longer, the credibility of the node lower than before.

We assume that mutual trade nodes are A,D. Recommended node is B.So the related defined as follows:

(1) Direct trade group: They have direct trade with node A and trust more than 0.8.

(2) Recommend trust group:They have recommended trust to node A and trust between 0.6 and 0.8.

(3) No trade group: They have no direct trade with node A or trust below 0.6.

(4) Attenuation degrees θ: It is that the trust trade in time interval T which will lower than the trust current time interval (the I time interval).That is attenuation degrees. We use $\theta(k) = \rho^{I-T}, 0 < \rho < 1, 1 \le T \le I$.

(5)Trust: $TZ_{A\to D}$ is the trust degree from node A to node D.

(6)Recommendation trust: $TJ_{B\to D}$ is the trust degree of node B provide other nodes trust for node D.

This method have two parts which are direct trust and recommendation trust.The direct trust according to the trust of direct trade group.Recommendation trust will provide trust for node which request the trade according to the grouping nodes. The below figure is the computing trust workflow.

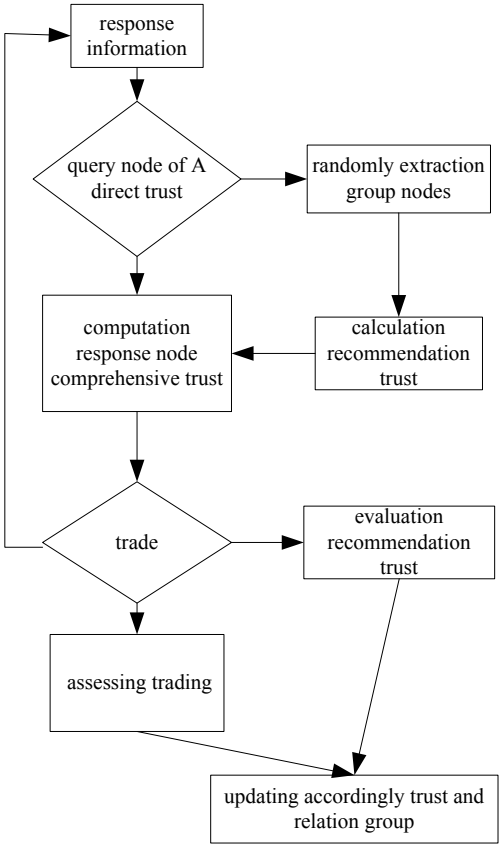

Fig.1. Workflow of computing trust

We use the formula $T = \alpha * TZ'_{A\to D} + \beta * T_{B\to D}$ to compute comprehensive trust.And $0 \le \alpha, \beta \le 1$ $\alpha + \beta = 1$ .And current directly trust is $TZ'_{A\to D} = (1-\theta)TZ_{A\to D}$. In this formula every nodes use attenuation function to get the other nodes latest trust. But the parameters α , β inside set up by the needs of the nodes self. If there is not exist direct trust α will be 0.

2.2. Punish mechanism

In this paper the using of punishment mechanism based on social groups.Assuming the nodes only trade once in each round. The nodes can be client(request other nodes resources)and server(provide resources for other nodes).Each round of the transaction,the nodes will choose other node trade according to other nodes trust.

The trust model based on the punishment have three rules:

(1)Each node has the calculating trust in front model. The trust response the quality of service and trade strategy.The range of values is.It can be a trade node when the value above 0.8.

(2) Trust change rules:

a.If the node just enter network it trust is 1.It says $T = 1.[0,1]$

b.If the node A the trust lasted round above 0.8(mean $T \geq 0.8$),it trust will be 0(mean $T = 0$),if it take noncooperation(N strategy)when other node trust equal or greater than 0.8.Otherwise,the trust updates according to the method of computing model.

c.If the node A the trust lasted round below 0.8(mean $T \leq 0.8$),it trust will be $T = T + 1/d$,if it take cooperation(Y strategy)when other node trust equal or greater than 0.8. Otherwise, trust have no change.

(3) Each node will adopte strategiy according the size other node trust size and follow the below strategie:

$$H = \begin{cases} Y & if \quad T \geq 0.8 \\ N & if \quad T < 0.8 \end{cases}$$

We give the rules of punishing mechanism above paper.Inside,we can see in the (2) rule,add d for punish- ment degree.And d is not for 0,otherwise the punishment is not exist. When d is larger,node will choose whether cooperative behavior depending on cooperative behavior. When d is infinite,means the once noncooperation will lead to the trust less than 0.8 forever. According to the rules (3),and the node will not gain any other node service.

3. Analysis Performances of Model

In order to evaluate the effectiveness of trust model based on punishment mechanism we have a simulation experiment.We design that model network exists three classes nodes.

(1)Selfish unreason noncooperation(SUN):These nodes take noncoopration whatever other nodes have what strategy and trust.

(2)Altruistic unreason cooperation(AUC):These nodes take coopration whatever other nodes have what strategy and trust.

(3)Selfish reason node(SRN):These nodes will conside other's strategy and trust to choose hoe to provide coopration.

Suppose there are 1000 nodes in peer-to-peer network simulation system.And the proportion of the SUN type nodes are 30%,the proportion of AUY type nodes and SRN type nodes are 70%.

Firstly,we contrast the trading success rating varing with time of systems which based on punishment mechanism(PTM)and without punishment mechanism peer-to-peer network(P2P).In the simulation experiments, 20% of SUN type nodes not provide cooperative strategy in any experiments,and 80% of SUN type nodes will provide cooperative strategy after punish- ment. From figure 2 we can see, the rate of trading success in P2P system increased not faster than PTM system.That mainly because there are no punishment mechanism in P2P system. There will be no effect about their cooperation. While in PTM system,if no cooperation will be punished and oneself provid free cooperation and without the cooperation of other nodes. So the node will try to cooperation and to improve efficiency of trade.

Secondly, we contrast the change of SUN type nodes varying with time of systems which based on punishment mechanism (PTM) and without punishment mechanism peer-to-peer network (P2P). In the simulation experiments, if SRN type nodes without coopera -tion,they will be change into SUN type nodes. 20% of SUN type nodes not provide cooperative strategy in any experiments,and 80% of SUN type nodes will be SUN type nodes if they be punish when they take noncooperation. From figure 3 we can see, In P2P system,SUN type nodes rise quick varying with time. But in contrast of PTM system,the percentage of SUN type nodes fell sharply in this system.We can see this incentive mechanism can effectively restrain the node selfish behavior.

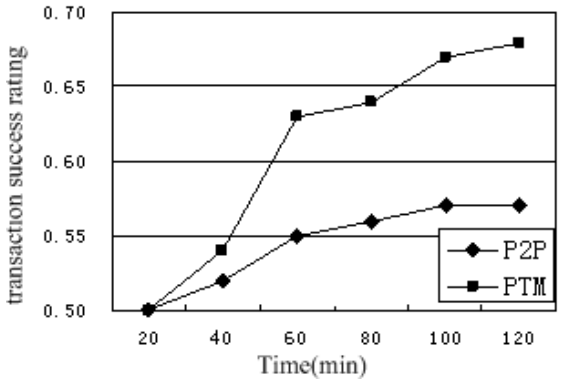

Fig.2. Trading success rating varing with time

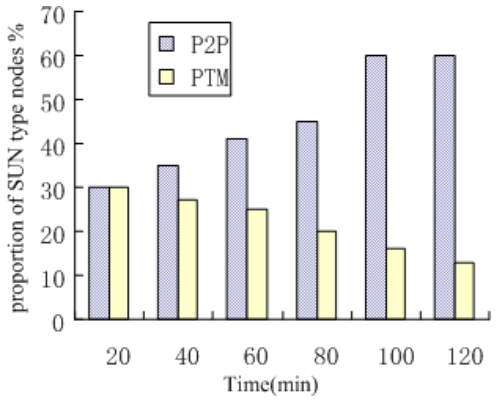

Fig.3. Proportion of SUN type nodes varying with time

4. Conclusion

With the wide application of peer-to-peer network tec- hnology,the hitchhiking problems in peer-to-peer net- work is getting attention.And all sorts of incentive mechanism produce and develop in this condition. This paper puts forward a trust model based on punishment mechanism.Through in back use of transaction trust and recommendation trust,and improve model punish- ment mechanism to incentive effect. Through the ana- lysising PTM more effectively than the previous model in hitchhiking problems. Good motivation for node cooperation,have very good effect of resources sharing.

5. Reference

[1] ORAM A. Peer-to-peer: harnessing the power of disruptive tech nology[M].[S.1.]:O. Rei lly Press,2001.
[2] FELDMAN M,PAPAD IMITR IOU C.Free-riding and white washingin peer-to-peer system[J]. IEEE Journal on Selected Areas in Communications,2006,24 (5):228-236.
[3] Wan Jian,Zheng Ruo-ting,Xu Xiang-hua. Research of incentive mechanisms in P2P network[J].Computer Applicatons, 2007,27(9): 2202-2205.
[4] Yu Yi-jiao,Jin Hai.A survey on overcoming free riding in peer-to-peer networks[J].Chinese Journal of computers,2008, 31(1):1- 15.
[5] Zhang Jing-mei,Zhang Jing-xiang. Researches on trust mod- els of P2P network security[J].Application research of comput- ers,2003,20(3): 76-78.
[6] Wang Yao,Vassileva Julita. Byaesian network trust model in peer-to-peer networks agents and peer-to-peer. Computing AP2PC 2003: 23- 34
[7] Dou Wen,Wang Huai-min,Jia Yan,Zou Peng.A recommen- dation based peer-to-peer trust model[J].Joural of software,2004, 15(4):571- 583.