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Optimization of Network Fast Flow Based on Anti-ant Colony Optimization

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Abstract

There are fewer research results of optimizing the network fast flow by relative optimal path in the links. This paper presents a conception of link capacity based on the foundation of concept convergence expectation and convergence gradient. Based on the convergence gradient, the relatively optimal path is used to analyze problem in a reverse perspective of ant colony algorithm, which is also called anti-ant colony algorithm. According to the pheromone strength and rate of flow, the link makes a second judgment to decide the route. In this way, the load balance rate of the flow achieved and the congestion of the network can be avoided. Experimental results show that the method achieved link load balancing and the network resources utilization coefficient can be improved.

*Keyword***.** Ant Colony Optimization, Network Fast Flow, Optimal Path

1. Introduction

In the current development of practical engineering, users put forward their demand for a higher quality of service requirement. It becomes the primary target to reduce congestion between the points, efforts to improve the coefficient of resources utilization, and provide a higher QoS assurance for the terminal user

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[1]. These requirements requires not only broadband access networks but higher network bandwidth, have the ability to provide differential service to satisfy the demand of user and application [2]. From the current network technology development, the growth of network bandwidth is much higher than the growth in processor speed and memory access rate, server will become a bottleneck in the network transmission, via high-performance local area network or internet through the server cluster is a effective structure which can provide highly scalable and available network services [3]. The core network equipment already unable to afford the data flow and growing strength calculation of the current situation separately. So how to optimize the control of the flow reasonably is becoming a TE(Traffic Engineering) research hotspot [4-5].

Bio-inspired mechanisms have increasingly been applied to network study. The ant-colony algorithm is a biological heuristic optimization method to simulate intelligent path selection in search of food. Researchers have tried different methods of network traffic optimization. Lu Jun [6], for the network resource management for load balancing and optimization, combines ant colony algorithm and network traffic engineering together, proposed a dynamic network load balancing method based on multi-ant colony. This method realizes the optimization of network resources. Ding Jianli[7] proposed hybrid ant algorithm realizes network resource equilibrium method, get the optimal solution by combining genetic algorithm and ant colony algorithm. Chen Junjian [8] and his teammate give up the way to find path in probability but use the method to find the path of node which is less in ant pheromone when ant finding the path. And this method solves the QoSR problem.

But researches below have no necessary consideration and analysis of relatively optimal path utilization to the link. This paper analyzes the link by anti-ant colony, and designs an anti-ant colony algorithm to optimize the network fast flow.

2. Link select of anti-ant colony analyzes

Ant colony decide the path by the strength of pheromone with no consider of Link load-sharing mechanisms. As a result, the path congestion leads to overall performance degradation of the network.

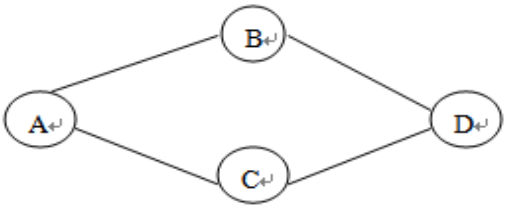

Figure 1. Simple topology of ant path-finding

Figure 1 shows a simple topology graph structure to describe the case that ant find the optimal path. The ant has 3 ways can choice from node A to node D, AD, ACD, ABD. Assuming ants from node A when beginning in accordance with the pheromone strength to select the route, then, the route with the highest pheromone strength have the biggest probability to be selected. Assuming at first, the pheromone strength on the 3 path is equal, ant will reach D from all three ways. Because of the length of 3 path is not equal, they will arrive D at different time, when ants start from A again, the pheromone strength on path AD is higher than the other two path, the probability ants select path AD will increase. With the increase in the number of ants select, the pheromone on path AD will increase at the same time. Then, about all of ants select path AD but not path ACD or ABD. The result is too many ants gathering on the path AD caused congestion, and resources are wasted.