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Optical Grid Networking Supports for GT4

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[1] **Abstract:** This paper gives the evaluation of optical switching, packet loss, died lock and signaling conflict. Based on the evaluation, the capacity is managed to support for Globus Toolkit Version 4, which provide the virtual infrastructure for gird computing.

Keywords: Grid networking, GT4, died lock, conflict.

1. Introduction

As data and computational Grids produces and shares huge amounts of data in different locations [1]. University of Illinois at Chicago, CERN [2] and GILIF (the Global Lambda Integrated Facility) [3] begin to establish Grid networks. TransLight [4], StarLight [5] and CA*net 4 [6] have provided services of grid networking for computing grids. We evaluate the performance of optical networks and give a middleware-based solution for grid networking which supports GT4.

2. Evaluation of switching and packet transmission

Does the dynamic bandwidth (e.g. bandwidth on demand) work well? We simulated the BoD service in the computer. The simulation includes an ingress module, a buffering module and an egress module. The ingress module is designed to generate the burst traffic. The buffering module receives the burst traffic, saves such traffic as packets to a large buffer, and then sends these packets to the egress module. The egress module requests and modifies bandwidth for transmitting the burst traffic in the buffer.

Fig.1(a) illustrates the burst traffic generated by the ingress module. Based on such burst traffic the egress module requests and modifies the bandwidth in order to avoid congestion. One important consideration is the choice of control policies for modifying the bandwidth. In our experiment the control policy is based on the buffer size. Fig.1(b) shows the modification of bandwidth and the variety of egress traffic. As the change of bandwidth can't fully keep up with the variety of burst traffic, the egress module discards packets if the buffer is full. Fig.1(c) shows the packet loss and Fig. 1(d) shows the variety of buffer size. We can see that the dynamic bandwidth can't decrease the rate of packet loss.

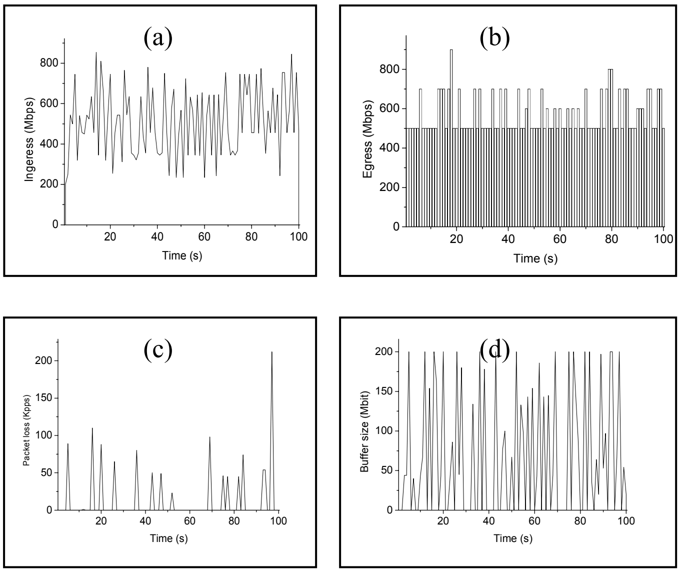

Fig. 1 Performance of transmission

Does bad control policy cause more packet loss? We also applied two different control policies to control the bandwidth. The first simulates fixed bandwidth over Ethernet lightpaths. The second simulates the request and modification of bandwidth. Figure 2 shows the results, where no matter what models, the packet loss still exists. The Ethernet circuit with 600Mbps of fixed bandwidth causes less total packet loss, while a bad control policy for the modification of bandwidth causes more packet loss and extra expense.

In our opinion, the dynamic bandwidth can't enhance the total transmission performance, so do optical burst switching

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(OBS). Therefore, we connect computers with grid network using the functionality of self-controlled traffic scheduling or fixed bandwidth rather than dynamic bandwidth.

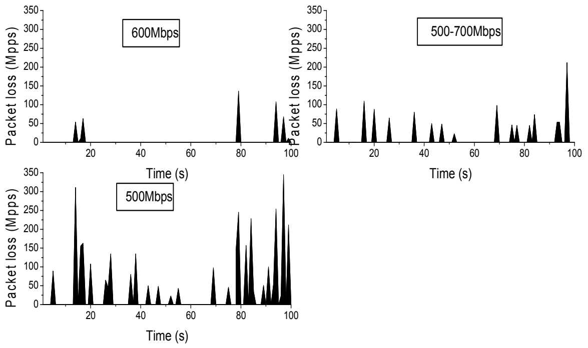

Fig. 2 Packet loss

3. Evaluation of signaling delay and conflict

Does signaling call cause the additional delay? Do two signalings request different capacity and cause the capacity allocation died lock? Do two signalings request the same capacity in different node and cause the conflict?

We measured the signaling delay in a node with various number of requests. The measurement in Fig. 3 shows that the delay per signaling increases when the ingress has more signaling packets to handle. Connection-oriented communication may cause died lock and conflict in the distributed resource allocation using signaling. The test in Fig.4 shows that when the number of signaling request increases the blocked number (failed number) increase as well.

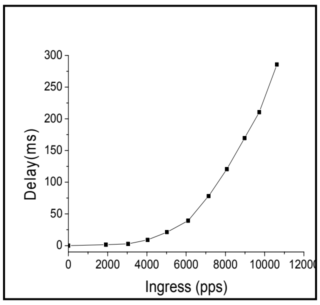

Fig. 3 Signaling delay

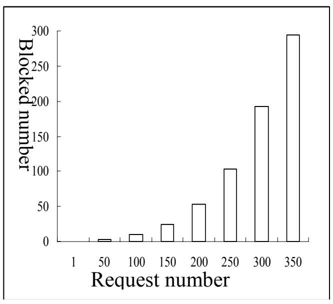

Fig. 4 Signaling conflict

4. Grid networking support for GT4

No middleware supports the optical transmission directly using optical networks. Moreover, the distributed computing or grid computing can't easily change their structure and software. In our solution (in Fig. 5), we give and define various service based on the management of optical capacity, TCP (transmission control protocol) and interfaces in order to support several requirements including the bulk data transmission. The service is bound to GT4 infrastructure in order to support the ordinary structure of grid computing.

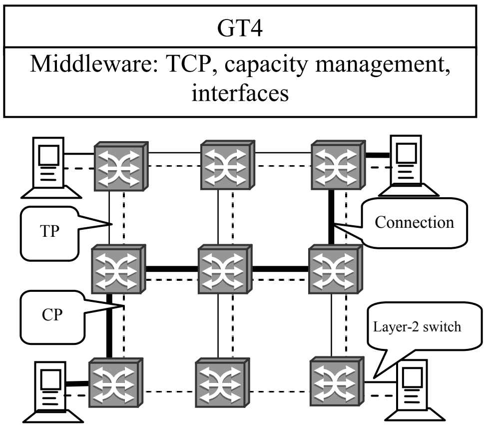

Fig. 5 Grid networking support for GT4

5. Conclusion

Grid networking is a new communication infrastructure for computational grids. However, Challenges including died lock and conflict will still existed and slow the step to use optical network as ease-use capacity. Evaluation of transmission performance is crucial. The grid networking support for GT4 will enhance the performance of grid computing and the usage of optical capacity.

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