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Networking Research on Network Routing and Congestion Control

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ABSTRACT

Network routing plays an important role in improving the performance of networks in the Network layer. As a whole, the Hybrid Reference Model, structured by Physical layer, Data Link layer, Network layer, Transport layer and Application layer, is one of the prevalent reference models in the computer network. To understand the feasibility of improving the quality as well as the performance of networking, the innovation of network routing, especially in routing algorithm and congestion control, is essential to be considered.

Keywords: Network Routing, Congestion Control

1. INTRODUCTION

Being public, highly reliable, economic and communicative, computer network has been a prevalent medium all over the world. With the improvement of computer technologies, technologies of network has also been emphasized on and researched at any time. There exit several ways to improve the performance of network. As the aspect of Hybrid networks, IP routing and circuit switching can take advantage of improving the performance of networks. The effect would be obvious whilst the combination of IP routing and circuit switching is implemented. Network routing plays an important role in improving the performance of networks in the Network layer. As a whole, the Hybrid Reference Model, structured by Physical layer, Data Link layer, Network layer, Transport layer and Application layer, is one of the prevalent reference models in the computer network. To understand the feasibility of improving the quality as well as the performance of networking, the innovation of network routing, especially in routing algorithm and congestion control, is essential to be considered.

2. NETWORK ROUTING

The main function of the Network Layer is choosing a path for sending packets from source to destination by any ways. Moreover, the transmission packets may require making hops for finishing the journey smoothly. The problem of design thus is determining how packets are routed from source to destination. Basically, routes can be based on two kinds of ways. One is the route designed according to the fixed table and it's static as well as may not be changed, another one is the route designed at the beginning of each conversation and it's dynamical as well as can respond the load of the network properly. Moreover, the basic concepts of this research can be stated as follows:

- Connectionless (datagram) vs. Connection-oriented (virtual circuit): The concepts of connection-oriented service and connectionless service must be introduced. Connection-oriented service – the service user first establishes a

connection, using the connection and then releases it, modeled after the telephone system; Connectionless service – each message carries the full destination address, and each one is routed through the system independent of all the others, modeled after the postal system.

- Routing algorithm: choosing an optimal output line for incoming packet.

- Optimal principle: if a router J is on the optimal path from router I to K, then the optimal path from J to K also falls on the same route [1].

- Optimal criterion: to minimize any one or a combination of the following factors, including geographic distance, number of hops, mean queue length, bandwidth, communication cost and average traffic.

- Static vs. Dynamical routing [1]:
  Static routing – routing table is made in advance and off-line.

  Dynamical routing – updating routing table periodically according to the traffic and network topology changes.

- Centralized vs. Distributed routing [1]:
  Centralized routing – a Routing Control Center makes decision based on the global knowledge of the network, and shortcoming of computationally consuming and being vulnerable.
  Distributed routing – each router maintains its own routing table according to local information.

A. Distance Vector Routing [1]

- Distributed Bellman-Ford routing.

- Each router maintains a routing table, which contains the preferred route, together with the corresponding distance, to each of other routers in the subnet.

- Each router knows the "distance" to each of its neighbors.

- Each router periodically updates the routing table by using the information from neighbors.

B. The Count-to-Infinity Problem [1]

- Fast response to good news, but leisurely to bad news.

- How to set an upper bound to represent infinity?

1) Fast response to good news: It will add a length of hop per exchange. As a whole subnet, the longest path is the length of N hops, it means that all routers will receive the newest routes via N exchanges only.

2) Leisurely to bad news: In case there exits a router and whose value is higher than the minimum of its all neighbors, all routers would work their way up to infinity gradually in a kind of unknown situation. However, the numbers of exchanges are depended on the definition of the value used about infinity.

C. Possible solution to solve The Count-to-Infinity Problem: Defining the upper bound of time delay, and then determining whether or not the router is destroyed by a delay time. However, it's quite difficult to define the upper bound for determining whether the router is destroyed by a delay time. Although the split horizon algorithm can sort out the count-to-infinity problem, sometimes it fails at certain situation [2].

D. Link State Routing

- Discover its neighbors and learn their network addresses.

- Measure the delay or cost to each of its neighbors.
- Construct a packet telling all it has just learned.
- Send this packet to all other routers.
- Compute the shortest path to every other router.

3. PROPOSED RESEARCH FRAMEWORK OF NETWORK ROUTING

Routing Algorithm plays an important role in network routing, and meanwhile it also determines the performance of network. A sound routing algorithm can both reduce the complexity and reinforce the performance, which comprises correctness, robustness, stability, fairness, and optimality. Basically, dynamical and distributed routing are widely used and become a trend recently. Distance Vector Routing is one of the sound routing algorithms, but there exists the count-to-infinity problem. Although the split horizon algorithm can sort out the count-to-infinity problem, sometimes it fails at certain situation. Link State Routing is also one of the sound routing algorithms, which comprises complete structure and was improved by earlier routing algorithms. The count-to-infinity problem could be reduced to the minimal at the basement of Link State Routing's concepts. Except these two routing algorithms, there still exist a number of routing algorithms, and each routing algorithms has its own merits and drawbacks. A further area aiming to investigate is a sound routing algorithm that integrates merits of other routing algorithms and improves shortcomings of other routing algorithms at the basement of Link State Routing's concepts.

4. CONCLUSION

Further studies and analyses of the Network Routing will help understand the problems involved in the research and development of Rapid Network. It is promising to pursue relevant key questions, which could try to rationalize the development of Rapid Network.

5. REFERENCE

[1] Andrew S. Tanenbaum, "Computer Networks", third edition, Prentice Hall, 1996.

