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A NEW QUEUING TECHNIQUE IN ADAPTIVE MULTIPATH ROUTING FOR CONGESTION CONTROL WITH PACKET PRIORITY IN WIRED DATA NETWORKS

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ABSTRACT: This paper proposes a new queuing technique in Adaptive Multi-Path routing based on packet priority. Simultaneous Multi-Path routing is used to improve the data performance over a congested network. The traditional method of transmitting the data is done by using Simultaneous Multi Path Communication (SMPC). Two types of SMPCs are proposed, in which SMPC-I, which uses multiple paths independently and SMPC-P, which uses path priority control algorithm in conjunction with SMPC. SMPC-I and SMPC-P maintains throughput regardless of path length and priority control. In addition to available SMPC methods, proposed method provides better solution to improve the performance of communication network. A theoretical approach of AMPC-PP proposed here based on packet priority for important data over normal data on a congestion network with route adaptability.
Keywords: Multi-path communication, Path priority, Independent paths, Packet priority.

1. INTRODUCTION

A Network comprises a number of nodes and links for processing of data from source to destination. The process of transmitting the data from source to destination is called routing and it is done by making use of the best path through the network. Data packet can be routed either by using single or multipath routing techniques [1]. Single path routing is the traditional method of transmitting the data through the network. But, the major problems here with this scenario are: less network bandwidth utilization, more delay; if any node or link fails entire data will be lost, less throughput and leads to scope for congestion. These problems can be minimized by using multipath routing. Here in this method, a number of hosts are connected by using a number of nodes and links. All node and link capacities differ in the network. Data packets are transmitted from source to destination through a number of paths. Best paths are selected based on shortest path and it is computed in the network based on traffic. Paths are selected by the type of service requested by the user in the network. For different applications, multiple paths may be used to meet their requirements [2].

Multipath transmission is realized in source and hop-by-hop routing, multi-topology routing, Software-Defined Networks, Multi-Protocol Label Switching, Flow-Aware Multi-Topology Adaptive Routing that interconnects a number of links in network virtualization, and Multipath TCP [2]. The major advantage of choosing multi-path routing is reduced delay.

2. LITERATURE REVIEW

Although, multi-path routing is used to reduce congestion by splitting the data over several potential paths without knowing the path capacity. This problem can be minimized by using load balancing technique. In load balancing, load over a path is decided by available resources and traffic in that particular path [1]. A number of multipath routing techniques have been proposed. The basic technique is Simultaneous Multi-Path Communication (SMPC) [3]. First method in SMPC is SMPC-I based on independent paths. This method is based on bandwidth control. Second method is SMPC-P, which is based on path priority. These techniques does not support for packet priority. The major drawbacks in these methods are greater delay and reduced network performance [4].

A method proposed by Peter Key et al. [5] for avoiding congestion in multi path routing using load balancing, but this method is unable to route the data packets if there are more link failures.

There after a number of multi path routing techniques proposed with load balancing [1], [6-9], but these methods requires more control messages, does not support for route recovery, as well as supports only for single link failures.

Paganini proposed Multi Protocol Label Switching (MPLS). This method provides better routing and capable of interfacing to existing routing protocols, but it requires additional layer between data link and network layer and also router requires knowledge about MPLS [10].

3. ADAPTIVE MULTIPATH ROUTING FOR CONGESTION WITH PACKET PRIORITY:

Major disadvantage in multipath routing is that, if any link or router fails, source chooses alternate path based on the available routing table information. This process takes more delay, there by increases the data transmission delay, reduces the network performance. This drawback can be eliminated by using adaptive multipath routing. If a link fail or router fails, then the nearest router sends a request to another neighbouring router. If any one of the router responds then the data packets will be forwarded to that router. By using this technique the source routing can be avoided, thereby reducing the delay and improves the network performance.

In addition with adaptive multi path routing, importance is also given for urgent data packets by indicating the packet priority. Here we have tested the performance by using only two packet priorities. The priority will be verified at the router based on the following technique.

- If there is any congestion at a router or any other important data is being transmitting through the router, a check point is created at the router to identify whether the data packet is having a priority or not.
- If the data packet is not having highest priority then it is passed to the queue.
- If the data is having highest priority, then it is directly transmitted to output side without passing through the queue.

The packet priority is verified at the router using additional block called packet priority verifier. It will verify the packet with highest priority, if the condition satisfies, then the packet will be directly forwarded to routing decision and switch allocator unit. This method will eliminate the unnecessary queuing delay. This will reduce the overall delay in the network, thereby increasing the system performance.

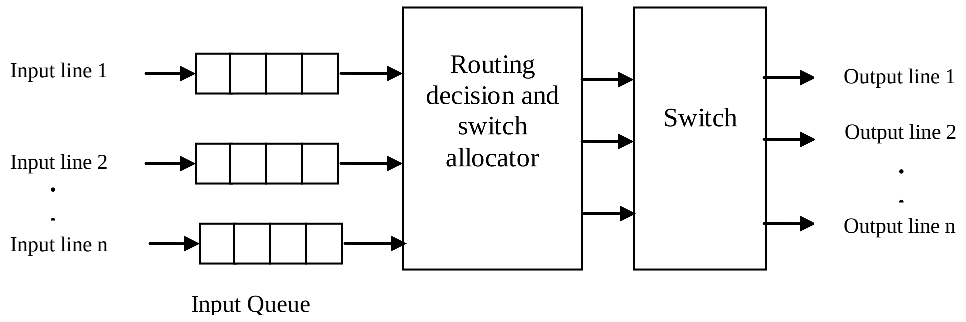

Fig.1: Traditional router functionality

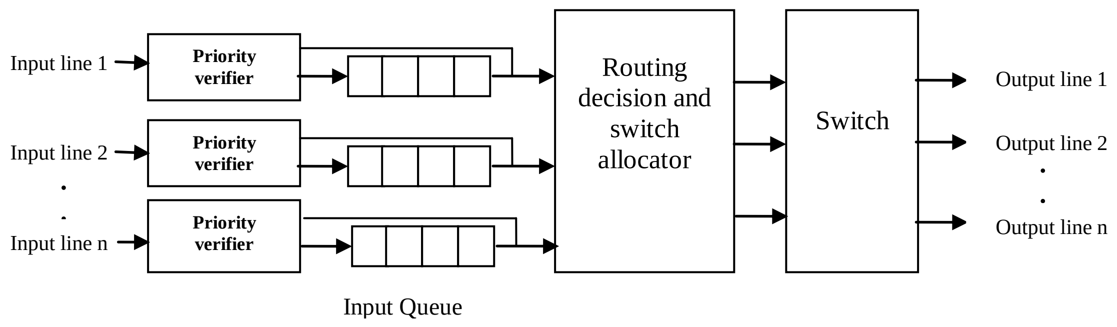

Fig.2: Proposed packet priority based router functionality

The simplest and most popularly used queuing technique in the internet is tail drop or drop tail. In this queuing technique, each packet is treated as same without concerning the packet priority. This queuing technique is based on FIFO (First In First Out), means whichever packet comes first into the queue will be transmitted first to output. If the queue length reached to its maximum capacity, then newly arrived packets are dropped until there is a space in the buffer.

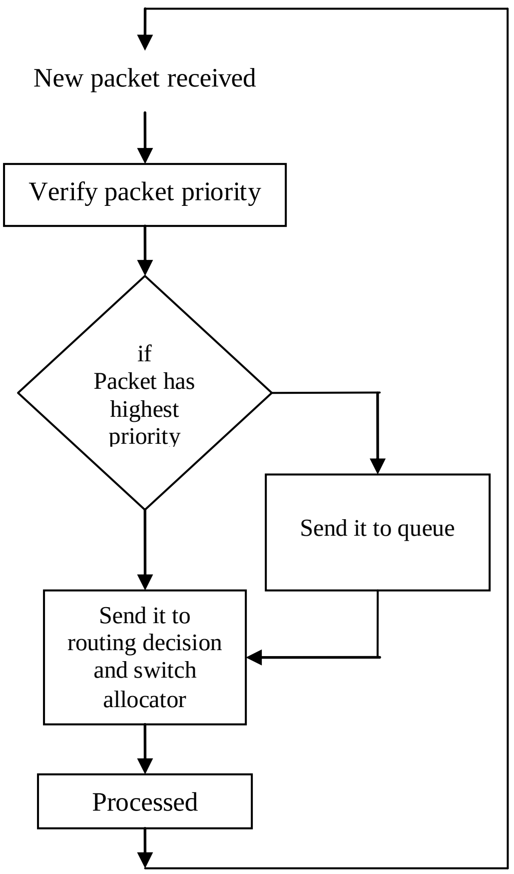

Fig.3: Flow diagram for proposed technique

Fig.1 shows the basic functionality of a router, where the packets are received at the input line of the router. Then the packets enter into queue, there after the packet is passed through routing decision unit. In routing decision unit, the packet output line is decided based on source address and destination address and then the packet is switched through a switch by switch allocator. It takes more amount of time for processing the packets by the router. The amount of time taken at the router depends upon the number of input lines and the maximum queue length. In conventional method all the packets are processed without considering any packet priority. This drawback is eliminated by using our proposed method at the router. The diagram for packet priority based router functionality is shown in Fig.2.

Fig.3 shows the flow diagram for the proposed method. It is very much clear that, prioritised packets transmitted first and the priority is based on their importance or type of service.

4. SIMULATION RESULTS AND DISCUSSIONS:

The results are tested by using Network Simulator-2 for data transmission through wired data networks. Simulation results are tested for various scenarios such as single path routing, multipath routing and adaptive multipath routing with and without packet priority.

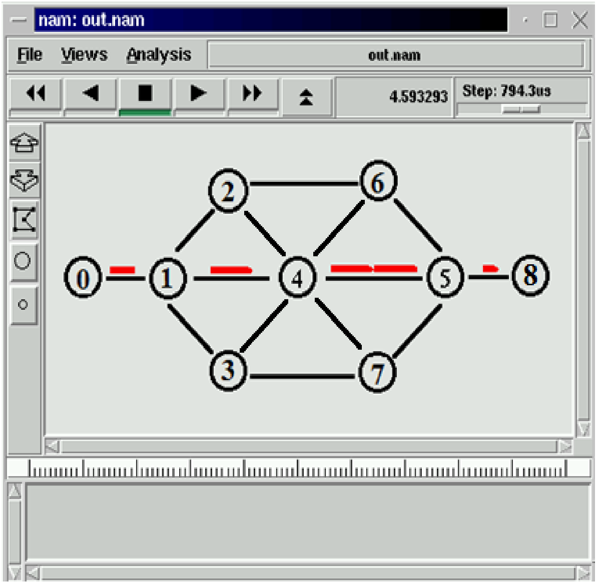

Fig.4: Single path routing

For the entire routing simulation a simple network environment is considered in which, it consists of 7 routers and two stations. “0” is designated as sender and “8” is designated as destination.

In Fig.4, single path routing is simulated and verified the end-to-end delay for with and without priority. The same procedure was repeated for multipath routing as well as adaptive multipath routing techniques. Multipath routing simulation result is shown in Fig.5. Fig.6 shows the adaptive multipath routing which provides an alternate path whenever a link failure occurs in the network.

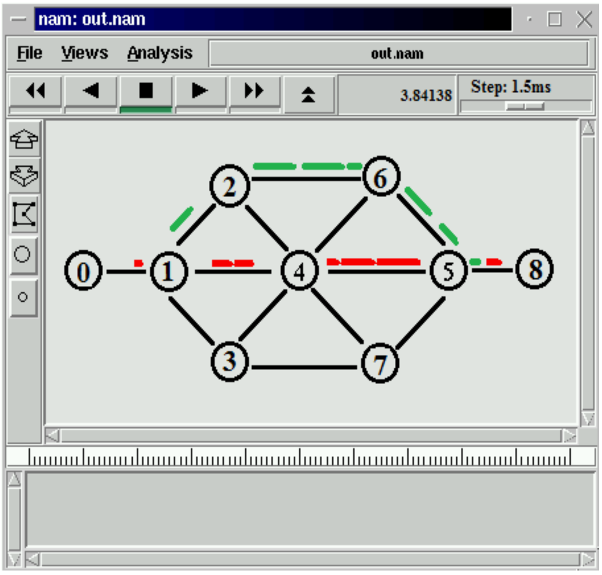

Fig.5: Multipath routing

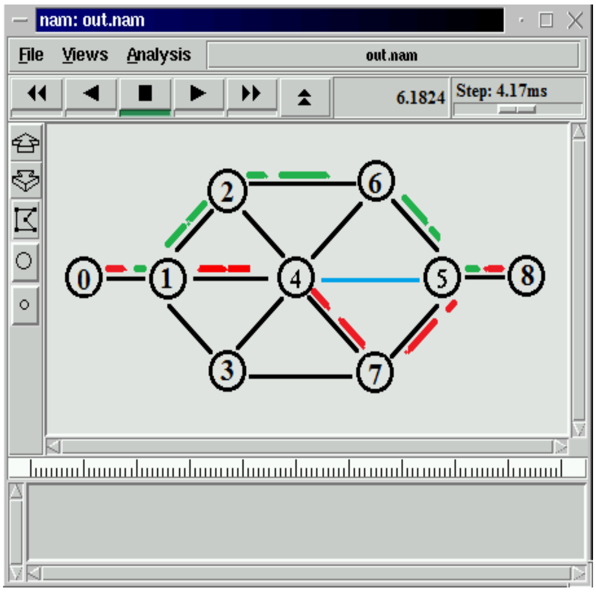

Fig.6: Adaptive Multipath routing

From Fig.6, it is evident that, link between 4 and 5 is failed; in traditional methods alternate path is chosen from source router. But here router4 sends a request to adjacent router and re-routes the data packets to destination. The end-to-end delay for single path, multipath and adaptive multipath routing with and without packet priority is shown in Fig.7, Fig.8 and Fig.9. Fig.10 shows packet delivery ratio by using packet priority for transmitting a video stream, which we have tested our method for various link capacities.

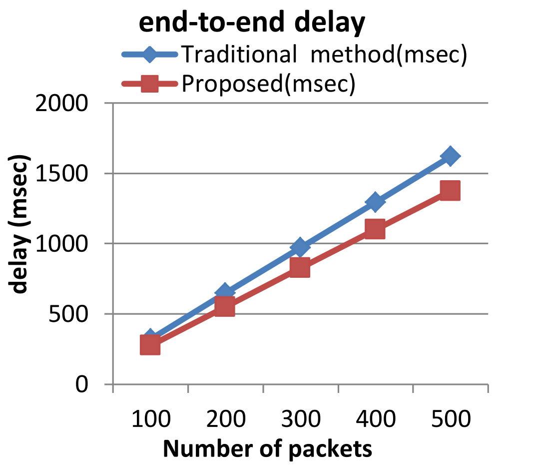

Fig.7: End-to end delay in single path routing with and without packet priority

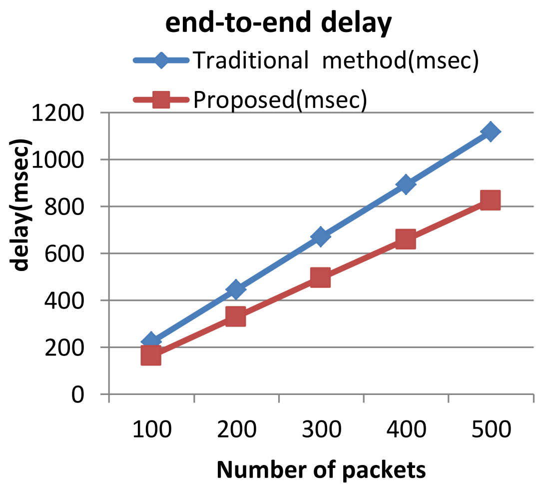

Fig.8: End-to end delay in multi path routing with and without packet priority

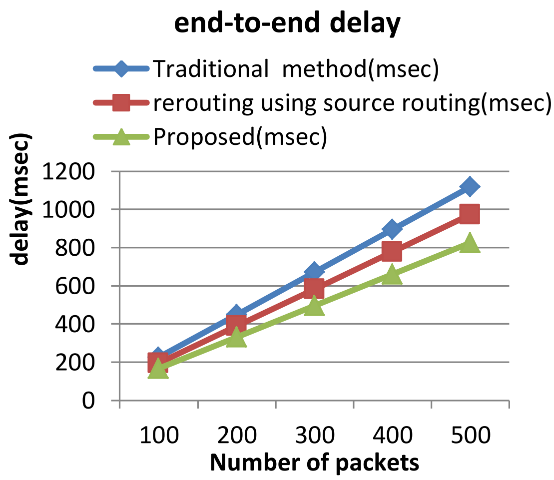

Fig.9: End-to end delay in adaptive multi path routing with and without packet priority

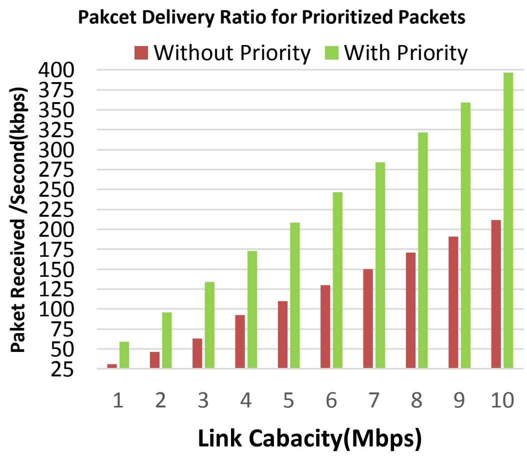

Fig.10: Packet delivery ratio with and without packet priority for various link capacities

5. CONCLUSION:

Here in this paper, we have shown adaptive multipath routing technique in addition with packet priority at router. Simulation results are carried out by using NS-2. It is evident that, proposed method has less end-to-end delay for packet transmission in the network. Simulation results will alter if we change link capacities, queue length and packet length. Here we considered link capacity of 1024Kbps, packet size of 1000 bits, queue length of 1000 packets. If any change in parameters, delay also changes. Now in the current internet research, routing plays a vital role especially in wired data networks. There are a number of multipath routing techniques available, but the proposed method gives a better performance compared to existing methods. Whenever there is a link failure or congestion, there is a necessity for traffic rerouting. This method not only provides adaptability in multipath routing it also provides the priority for important data to be sent without passing the data packets through queue.

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