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Improving the Performance of Routing Protocols for Video Conferencing on MPLS Networks

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Abstract**—** Today, video conferencing is a new technology and one of the most sought after features for expressing online features. Providing a realistic and fast connection is a basic requirement of this technology, which enables Multiprotocol Label Switching (MPLS). The development of the MPLS network platform is the basis of next generation networks for the expansion of multimedia applications. It can be shown that the most important concept in the field of network traffic engineering in MPLS platform is Label-Switched Path (LSP). The purpose of routing algorithms is for increase the number of requests accepted based on satisfaction with the quality of service. Most research in this area focuses solely on bandwidth, and relatively few studies consider both delay and bandwidth limits. In this research, a novel routing algorithm according to the identification of acute links is proposed. This algorithm assigns a path to a new request that has the least critical links. This technique ensures that future routing requests are met with less interference. The simulation of the proposed routing algorithm is performed on the ANSNET network topology based on various evaluation criteria. The simulation and analysis of comparisons show that the proposed algorithm provides the best performance for video conferencing.

Keywords**—** MLPS Networks; Video Conferencing; Routing Algorithm; Critical Links

I. INTRODUCTION

With the growth of the Internet, various applications such as Internet telephony and video conferencing have become very popular, which to achieve these applications need to provide the right quality of service [1]. To save time in attending conferences, you can use services called video conferencing. Although this technique has been used for some time; But what needs to be paid more attention today with the advancement of technology is the way information, audio and video are transmitted. Communicating via video conferencing requires the provision of an IP network platform. This platform can be provided through the Internet, MPLS, etc., depending on the amount of bandwidth consumed [2]. Multiprotocol Label Switching (MPLS) provides a real-time, fast IP-based connection for video conferencing.

One of the basic fields in traffic engineering from MPLS platform is Label-Switched Path (LSP) routing [3]. The objective of routing algorithms is to maximize the requests-count accepted with respect to QoS satisfaction [4-6]. Most research in this area focuses solely on bandwidth, and very few studies consider delay and bandwidth. In this research, we propose a novel routing algorithm with an optimization approach that takes into account both bandwidth limits and end to end delay for route search. This technique can provide more requests in video conferencing and thus increase the quality of service. In MPLS, which uses a driven control model to assign and distribute tags, LSPs are one-way in themselves, and two different LSPs must be created between source and destination to send two-way traffic. Because packet paths are fixed on MPLS networks, these paths can be introduced as network traffic engineering. Accordingly, various QoS restrictions, such as number of hop, jitter, delay, and bandwidth used in new applications may be guaranteed [6]. MPLS has historically been based on the concept of label switching. A unique, unique tag is added to each data packet, and this tag is used to switch and route packets across the network. Initiatives and initiatives to switch multiple tags emerged in the mid-1990s to improve the basic display of IP routing software and increase QoS. Therefore, routing schemes that can use network resources more efficiently and meet QoS requirements are needed [7].

The purpose of this method is to reduce interference and increase the number of routing, based on the identification of critical links at each input/output in the network [8]. Identifying critical links helps manage routing and allocate optimal routes. The major idea of the suggested method in selecting the path to an input-output pair is to prevent the selection of routes with max-interference in contrast to other input-output nodes [9-11].

The rest of the article is configured as follows: Section II is dedicated to related works. The details of the proposed method for routing on the MPLS network are given in Section III and the discussion and experiments are given in Section IV. Finally, the conclusions and future work are described in Section V.

II. RELATED WORK

In IP networks, packets are routed by matching the destination of the IP packets with the routing table (using finding the longest prefix). The time consuming nature of this process (routing) was one of the main reasons for the emergence of MPLS. In MPLS, packets are assigned a fixed-length tag, and instead of routing using IP, the packets will be transmitted using their own tag. MPLS routers are mainly divided into two categories [12]: edge routers and central routers. When a packet enters the MPLS network, the edge router first tries to generate the appropriate tag for the packet. Since there is no field in the IP packets to enter the virtual circuit number, the MPLS header is placed between the second and third layer headers. [7]. MPLS was created to carry network packets using tags, such as IP routing. MPLS was created to solve the problem of slowing down routers in large and pressurized networks with a simpler mechanism such as tagging each customer’s traffic, while with the development of routers, MPLS is much needed to solve this problem. Not seen, it is used because of its great capabilities in traffic engineering and service quality as well as virtual private network [7].

In [13], the design, implementation and monitoring of MPLS networks based on the fuzzy approach is proposed. The purpose of this paper is to improve a fuzzy algorithm to divide network traffic and avoid congestion on MPLS network paths. To achieve this goal, a network traffic monitoring approach based on fuzzy logic in an intruder node has been proposed. The simulation results of this method show an improvement of 5.4% in the average latency and 3.4% in the average transmission loss rate for data traffic.

In [14], a Bandwidth Guarantee with Low Complexity (BGLC) method was proposed. This method is designed to improve traffic engineering in the MLPS network. The BGLC provides LSP setup requests for the input and output pairs of routers, as well as their bandwidth requirements. This means that paths that belong to more than one link are more important. Because BGLC only uses the network topology to detect critical links, this process is done offline before routing requests. In the online phase of BGLC, critical links remain by bandwidth before the request of the Dijkstra algorithm and are divided by the weight of the links. This algorithm has little time complexity; because the criticality of the links is calculated in the offline phase, it is only needed again when the network topology changes.

In [15], a demonstration of MPLS fuzzy traffic was proposed and implemented. They developed an optimized fuzzy algorithm to prevent traffic and congestion, which is implemented by introducing a fuzzy traffic monitor at the input node. In [16], the Label encoding algorithm for MPLS Segment Routing (SR-LEA) was proposed. SR-LEA uses the shortest paths in the network and its output is at least a stack of labels to express the SR-MPLS path due to the MSD limitation. Thus, SR-LEA significantly reduces the effect of MSD and restores pathway variability. Mustafa et al. developed a network bandwidth guarantee based on the MPLS platform on wireless networks.

In [17], the efficiency of multimedia applications in MPLS wireless networks using bandwidth management was proposed. With the development of new technologies and the need for online access to audio and video information, service providers need to better integrate network protocols with QoS. MPLS ensures communication reliability, minimizes delay, and speeds up packet transmission over the network. Meanwhile, LSP routing is one of the most basic techniques in traffic engineering of MPLS networks. The purpose of routing algorithms maximize rooted requests with respect to service quality satisfaction.

III. METHODOLOGY

The signals used for routing in this research are as follows: The directionless graph $G(N, LS, C, PD, P)$ is modeled as a network. Where, N is a list of routers or nodes, LS is a list of connections among nodes in N and C is a list of link bandwidth [18]. In other words, it is $c_{ij} \in C$, where $(i, j) \in LS$. PD is a list of $(i, j) \in LS$ link propagation delay and P is a list of input-output nodes. In addition let (s, d) be an overall value of P. The request to create route i is defined as follows (s_i, d_i, B_i, D_i), where s_i specifies the input router, d_i the output router, B_i the minimum bandwidth required, and D_i the maximum required delay [19]. Here, it’s assumed that the route request is entered at any time and the purpose of the routing algorithm is to determine the appropriate route for each request. In addition, increasing maximum current, network load balancing, reducing minimum end to end delay and maintaining bandwidth for next requests are goals of the proposed algorithm.

Video conferencing is a very exciting feature of real-time communication today, but fast communication is a basic need for this technology. Virtual Private Network Multi-Protocol Label Switching (MPLS) solves this problem and can communicate faster than other techniques. However, in MPLS, meeting the demand for future low-interference routing is one of the most important challenges ahead.

In this study, in order to manage delay and bandwidth, we identify critical links. We use an innovative weight to identify critical links. The proposed method, in addition to guaranteeing bandwidth, also guarantees maximum end to end delay. Here, goal is to assign a path to a new connection that does not have critical links. This ensures that future interference demand is met with less interference.

Before any route allocation and in order to identify critical links, one weight must be assigned to each link. In this study, weights are calculated innovatively by prioritizing the flow over delay (μ_{flow} and v_{delay}). Weighing links allows you to select the shortest weighted path with the sum of the minimum weight in the graph to identify critical links. Therefore, it can be said that identifying critical links helps in managing routing and allocating optimal routes.

In this paper, a standard network topology with the number of nodes and link bandwidth is considered as input. Based on the structure defined for request requests, one request at a time between input-output pairs (s, d) randomly with a bandwidth $(R.B)$ and a maximum end to end delay $(R.D)$ is created. The purpose is to assign a route to the request (s, d) so that more requests will be accepted in the future.
After receiving a request, the proposed routing algorithm first removes links from the graph with a bandwidth less than $R.B$ and then uses an initiative weight to identify critical links. The weights for each pair of links from the network graph are then calculated based on the critical links. In the next step, in the remaining subgraph of the network, the X path between (s, d) is searched based on the shortest weighted path with the Dijkstra algorithm. If route is not found; the path is crossed and algorithm is launched with the new request. If X is not empty, the presence of path $D(X)$ is calculated. Here, $D(X)$ is the end to end delay for path X.

Here, if $D(X) \leq R.D$; route X is assigned on request and the remaining network bandwidth is updated. Otherwise $(i, j) \in X$ is found with the maximum bandwidth and $R.B$ is applied to it. Apply the requested bandwidth if the remaining bandwidth $(i, j) \in X$ becomes zero; Add a unit to the requested bandwidth of $(i, j) \in X$ and recalculate $D(X)$. Otherwise, $(i, j) \in X$ with the least remaining bandwidth is removed from the network graph and a new path is searched in the remaining network graph.

A. *Limitations and assumptions*

There are different conditions and limitations for simulating the MPLS network platform and performing routing work. In this section, some assumptions about the research method are stated, which describes the position of the proposed method for routing.

- Awareness of LSPs: For each topology used, there is a set of input-output LSPs that are all available before simulation.
- Unaware of future requests: Each request is entered online and the routing algorithm has the task of assigning the route to it. There is no knowledge of the abyssal paths when examining the current path.
- Do not change the LSP in a request: A request has an input-output LSP pair that specifies the origin and destination in the network topology. It is not possible to redirect an LSP to a request due to routing failure or bandwidth depletion.
- Online routing algorithm: Due to the purpose of researching the routing of requests in video conferencing, the need to use an online algorithm is essential. This is while the requests are submitted to the network online and in order.
- Request Acceptance: A request will only be accepted if it is routed by the routing algorithm.
- Route delay: End to end delay in a route includes propagation delay and queue delay. The amount of propagation delay is fixed for each link in the route. Here, the server delay rate model is used to calculate the maximum delay (sum of propagation delay and queue) for each link.

B. *Interference*

The basic concept of the suggested method in path allocation for an input pair (s, d) is to avoid assigning routes that the most interference in the other input-output nodes. The concept of interference in the suggested method includes both delay and bandwidth constraints. The minimum path interference for a LSP is temporal, potentially maximizing between other source and destination nodes. The determination of a route and a link is related to the maximum current $\theta(s, d)$ and the minimum delay (s, d) between a pair of output input nodes (s, d).

C. *Server delay rate*

Based on the server delay, the max-end-to-end delay to a P route is alike to D_m and is defined from Eq. (1).

$$D_m = \frac{t-R}{t-r} . \frac{b}{r} + \sum_{(i,j)\in P} \left(\frac{M}{R} + \frac{M_{ij}^m}{C_{ij}} + prop_{ij}\right) \qquad (1)$$

Where, r, t and b are the rates of request, maximum and influx, respectively. M is the packet size, M_{ij} is the packet size of the path labeled with links i and j , C_{ij} is the bandwidth of the links, $prop_{ij}$ is the release delay for Links (i, j) and R the minimum bandwidth assigned to a link is the route.

D. *Maximum flow*

Max-Flow concepts the most bandwidth required among input-output nodes, which can be accepted by dividing the current by the bandwidth demand of that graph [5]. To reduce maximum current-output pair interference with other LSP nodes, requests should be routed in such a way that the maximum max-flow among other input-output nodes is maximized.

E. *Minimum end to end delay*

The minimum end to end delay of an input-output pair is the lower limit of the total delay of the links in the paths between nodes. To reduce interference, in terms of minimum end to end delay, with other input-output pairs, new requests should be routed in such a way that the new routes have the least impact on other routes.

F. Maximum flow and minimum end to end delay

In order to optimize route assignment in fields of minimum end to end delay and maximum current, a multi-objective weighted maximum optimization problem must be considered in order to assign weight to each link in the network. Then, to assign the path, the shortest path is searched according to the weight between the given input-output pairs using the Dijkstra algorithm. w_{ij} shows the weight of the link between nodes i and j based on the following Eq. (2).

$$w_{ij} = \frac{1 + \mu_{flow} \sum_{l_{ij} \in CM_{sd}:(s,d) \in P} \gamma_{sd} + \nu_{delay} \sum_{l_{ij} \in CD_{sd}:(s,d) \in}}{r_{ij}} \quad (2)$$

Where, r_{ij} is the remaining bandwidth of the l_{ij} link. γ_{sd} and λ_{sd} the weight of the input-output pair (s,d) per critical link is due to the bandwidth and delay, respectively, determined by the network administrator. μ_{flow} and ν_{delay} adjusted by the administrator to consider the effect of the delay on the flow so that $\mu_{flow} + \nu_{delay} = 1$. Also, CM_{sd} and CD_{sd} are expressed to specify the number of critical links due to the presence of the P set in the network. The number of critical links for the pair (s,d) is indicated by two parameters CM_{sd} and CD_{sd}.

The CM_{sd} parameter is for checking critical links due to bandwidth. If the pair (s,d) belongs to the set of Minimum Cut Links, it is critical and is a subset of CM_{sd}. Term $\sum_{l_{ij} \in CM_{sd}:(s,d) \in P} \gamma_{sd}$ represents the number of critical links belonging to CM_{sd} multiplied by γ_{sd}.

The CD_{sd}parameter is used to check for critical links due to delay. To find the critical link delay in each I/O pair, the link weight between the two nodes (i,j) is first calculated based on Eq. (2). Afterwards, the shortest weighty route with Dijkstra among any input-output pair is computed. In each route, the connection according to the minimum bandwidth is decretory. After the critical connections are removed, the Dijkstra algorithm is repeated to find the route, where the path with the least delay among the same input-output is considered. This is repeated until there is no route among these input-output. Term $\sum_{l_{ij} \in CD_{sd}:(s,d) \in P} \lambda_{sd}$ represents the number of critical links belonging to CD_{sd} multiplied by λ_{sd}.

IV. RESULTS AND DISCUSSION

The simulation is done with MATLAB software version 2019a and for comparison work, a PC with Intel corei7 configuration and frequency of 3.2GHz, 16GB memory and Windows 10 operating system is used. We use different evaluation criteria to evaluate the efficiency of the suggested method and compare it with other algorithms. These criteria are the number of requests accepted and the max flow. Number of requests accepted Indicates the number of requests routed. The max-flow between a input-output nodes (s,d) indicates the maximum amount of network bandwidth that can be assigned to subsequent requests between nodes s to d.

To evaluate the effect of different conditions on the performance of the proposed algorithm, in this paper, four different scenarios of maximum end to end delay and bandwidth are considered. These scenarios are as shown in Table 1.

Table 1. Defined scenarios for evaluating the proposed algorithm

Scenarios	Bandwidth	Maximum end to end delay
Scenario 1	{1, 2, 3, 4}	{95, 96, 97, 98, 99, 100}
Scenario 2	{1, 2, 3, 4}	{60, 61, 62, 63, 64, 65}
Scenario 3	{1, 2, 7.5, 9.5}	{95, 96, 97, 98, 99, 100}
Scenario 4	{1, 2, 7.5, 9.5}	{60, 61, 62, 63, 64, 65}

In this paper, the standard and well-known ANSNET network topology is used for simulation and comparison. This topology consists of two-way links and is shown in Figure 1. ANSNET consists of 18 nodes and 30 links, where the capacity of all links is 20 units. Here, the set of input-output pairs (LSP) is defined as $\langle (4 \to 15), (2 \to 16), (1 \to 17) \rangle$. Here s_i refers to the i-th origin and d_j refers to the j-th destination. For example, the origin of node 4 and the destination of node 15.

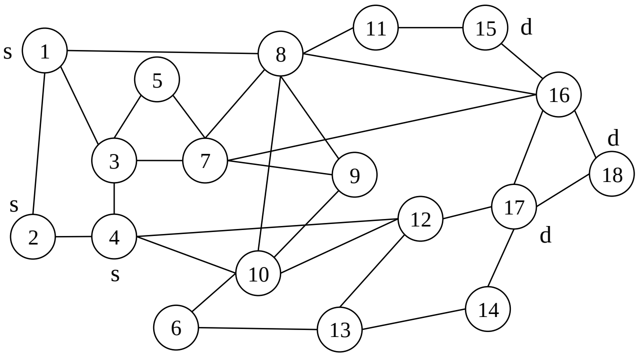

Figure 1. ANSNET network topology

In this paper, according to the reference [21], all the bandwidth capacity of the links in the ANSNET network topology is multiplied by 100 units. The reason for this is to check the number of more LSPs. In addition, according to the assumptions set out in [21], not all paths assigned to requests are eliminated until the end of the simulation, in other words, all LSPs will have a long lived.

The evaluation results of the proposed method are compared with algorithms including SAMCRA [20], EIGRP [13], MDMF [21], OPNET [22] and MPLS-TE [17]. Here, first, the efficiency of the suggested routing algorithm in different scenarios is evaluated based on the criterion of the number of accepted requests. Figure 2 shows the number of requests accepted by each algorithm out of 3,500 requests in the ANSNET topology.

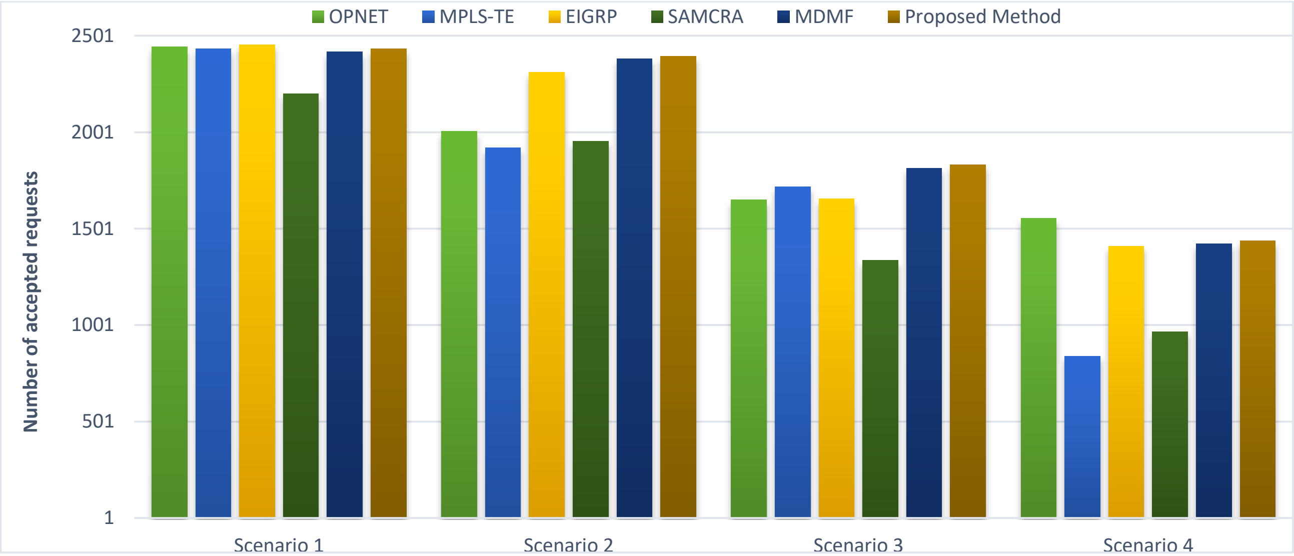

Figure 2. The comparison is based on the number of requests accepted

In general, the average maximum flow indicates the average network capacity to accept future requests. Figure 3 shows the simulation results considering the maximum flow criterion. A decreasing trend of this criterion was expected for all algorithms, because as the number of routed paths increases, the remaining network capacity decreases. Algorithms such as OPNET and SAMCRA are designed based on max flow retention and provide relatively better results than the proposed algorithm. However, the proposed algorithm for large requests (more than 2800) performs relatively better.

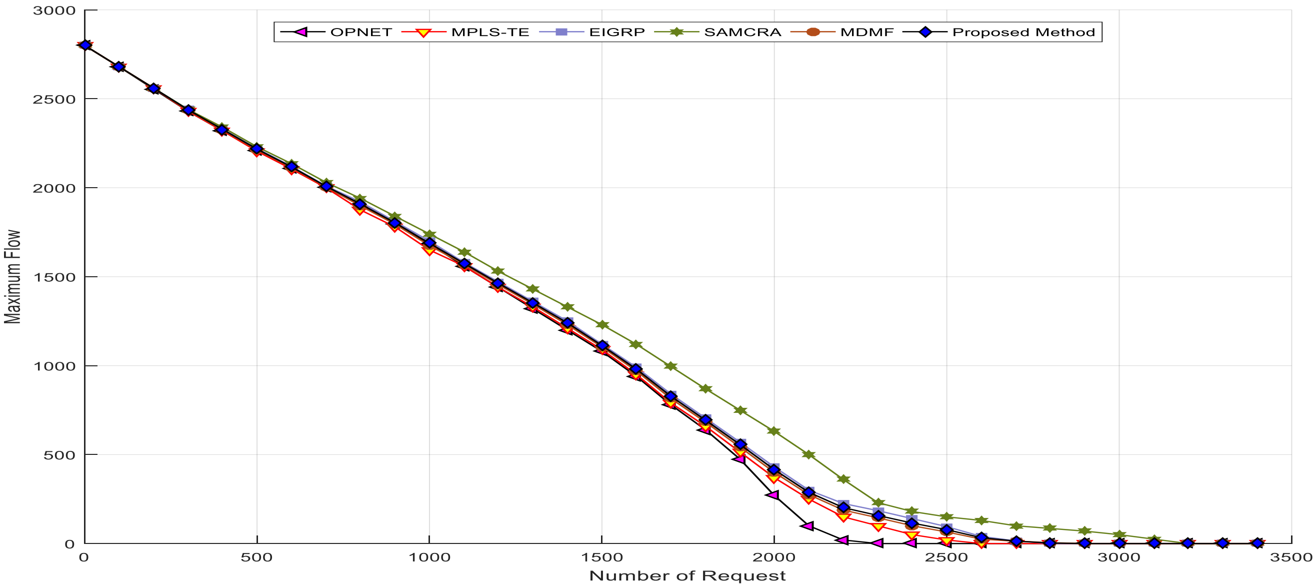

Figure 3. Comparison results based on maximum flow criteria

V. CONCLUSION AND FUTURE WORK

Today, the world-famous video conferencing has led us to the idea of using MPLS for optimize video traffic as opposed to IP networks. Overall, the MPLS network can be an appropriate technology in the face of real-time applications that are network delay and provide optimal use of network resources. Overall, MPLS performs well in real-time video conferencing with advanced power and end to end delay. Therefore, this paper proposes to improve the performance of routing protocols for video conferencing on MPLS networks using delay and bandwidth management. The performance of the proposed algorithm and MDMF is almost the same. The proposed algorithm performs well in the high number of requests (second place), because the weight of the links in the proposed algorithm is directly related to the minimum end to end delay. The suggested works well in distributed networks with suitable input/output pairs, but in dense networks it is better to use network faster for reduce response time in the router. For future work, it is recommended to check this limitation on the proposed algorithm.

REFERENCES

[1] Y. Zhang, Z. Fang, Z. Xu, “An optimal design of multi-protocol label switching networks achieving reliability requirements,” *Reliability Engineering & System Safety*, Vol.**182**, pp.**133-141**, **2019**.

[2] H. Attar, “Multipath routing mathematical model to solve the traffic engineering in multi-protocol label switching network,” *Journal of Computer and Communications*, Vol.**5**, Issue.**14**, pp.**113-121**, **2017**.

[3] M. Alhihi, M. R. Khosravi, H. Attar, M. Samour, “Determining the optimum number of paths for realization of multi-path routing in MPLS-TE networks,” *Telkomnika*, Vol.**15**, Issue.**4**, pp.**1701-1709**, **2017**.

[4] X. Yu, W. M. Lei, L. Song, W. Zhang, “A Routing Algorithm Based on SDN for On-Board Switching Networks,” *Journal of Information Science & Engineering*, Vol.**33,** Issue.**5**, **2017**.

[5] N. S. Rajput, ”Investigation of Multi-Protocol Label Switching for Intelligent Transportation Systems,” In *2019 6th International Conference on Signal Processing and Integrated Networks (SPIN)*, Noida, **India**, pp. **230-233**, **2019**.

[6] M. Swarnalatha, J. Komala, “Enhancement of Autonomous System for Inter Provider Service Using Multi-Protocol Label Switching,” *i-Manager's Journal on Wireless Communication Networks*, Vol.**6**, Issue.**2**, pp. **21-31**, **2017**.

[7] A. Rezaeipanah, H. Nazari, G. Ahmadi, ”A Hybrid Approach for Prolonging Lifetime of Wireless Sensor Networks Using Genetic Algorithm and Online Clustering,” *Journal of Computing Science and Engineering*, Vol.**13**, Issue.**4**, pp.**163-174**, **2019**.

[8] A. Rezaeipanah, H. Nazari, M. Abdollahi, “Reducing Energy Consumption in Wireless Sensor Networks Using a Routing Protocol Based on Multi-level Clustering and Genetic Algorithm,” *International Journal of Wireless and Microwave Technologies (IJWMT)*, Vol.**3**, Issue.**1**, pp.**1-16**, **2020**.

[9] A. Giorgetti, A. Sgambelluri, F. Paolucci, F. Cugini, P. Castoldi, “Segment routing for effective recovery and multi-domain traffic engineering,” *Journal of Optical Communications and Networking*, Vol.**9**, Issue.**2**, pp.**223-232**, **2017**.

[10] A. Arnita, M. Farid, “Implementasi jaringan virtual private network dengan teknologi Multi Protocol Label Switching (MPLS),” *JRTI (Jurnal Riset Tindakan Indonesia)*, Vol.**5**, Issue.**2**, pp.**28-40**, **2020**.

[11] K. S. Chen, “Label stacking scenarios in hybrid wavelength and code-switched GMPLS networks,” *Electronics*, Vol.**7**, Issue.**10**, pp.**251-262**, **2018**.

[12] B. J. Ambika, M. K. Banga, “A novel energy efficient routing algorithm for MPLS-MANET using fuzzy logic controller,” *International Journal of Information and Computer Security*, Vol.**14**, Issue.**1**, pp.**20-39**, **2021**.

[13] A. Bhandari, V. P. Singh, “Proposal and Implementation of MPLS Fuzzy Traffic Monitor,” *International Journal of Advanced Computer Science and Applications*, Vol.**7,** Issue.**1**, pp.**562-570**, **2016**.

[14] A. Alidadi, M. Mahdavi, M. R. Hashmi, “A new low-complexity QoS routing algorithm for MPLS traffic engineering,” In *Communications (MICC), 2009 IEEE 9th Malaysia International Conference,* **Kuala Lumpur**, pp. **205-210**, **2009**.

[15] A. Bhandari, V. P. Singh, “Proposal and Implementation of MPLS Fuzzy Traffic Monitor,” *International Journal of Advanced Computer Science and Applications*, Vol. **7**, Issue.**1**, pp.**562-570**, **2016**.

[16] R. Guedrez, O. Dugeon, S. Lahoud, G. Texier, “Label encoding algorithm for MPLS Segment Routing,” In *2016 IEEE 15th International Symposium on Network Computing and Applications (NCA)*, Cambridge, MA, **USA**, pp. **113-117**. **2016**.

[17] O. Z. Mustapha, R. E. Sheriff, F. L. Ong, “Bandwidth Management Using MPLS Model for Future Mobile Wireless Networks,” In *International Conference on Wireless and Satellite Systems*, Oxford, **UK**, pp. **62-71**, **2016**.

[18] R. Hanifia, “Penerapan Quality of Service (QoS) Differentiated Service Pada Jaringan Multi-Protocol Label Switching (MPLS),” *Jurnal Manajemen Informatika*, Vol.**9**, Issue.**2**, pp.**1-7**, **2019**.

[19] D. Nisha, R. Hussain, “An exploration of multi-protocol label switching (mpls) network: a review,” *Journal of Critical Reviews*, Vol.**7**, Issue.**13**, pp. **2664-2671**, **2020**.

[20] P. Van Mieghem, F. A. Kuipers, “Concepts of exact QoS routing algorithms,” IEEE/ACM Transactions on Networking (TON), Vol.**12**, Issue.**5**, pp.**851-864**, **2004**.

[21] M. N. Soorki, H. Rostami, “Label switched protocol routing with guaranteed bandwidth and end to end path delay in MPLS networks,” *Journal of Network and Computer Applications*, Vol.**42**, pp.**21-38**, **2014**.

[22] A. S. Qazi, W. Ahmad, “Performance Estimation of Realtime Video conferencing in MPLS and Non MPLS Environment,” *International Journal of Networks and communications*, Vol.**8**, Issue.**2**, pp.**34-36**, **2018**.

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