International Journal of
INTELLIGENT SYSTEMS AND APPLICATIONS IN ENGINEERING
ISSN:2147-6799 www.ijisae.org Original Research Paper

Effective Working Principles of Back Office in the Rural Sector Using Multiprotocol Label Switching

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Submitted: 05/02/2024 **Revised**: 13/03/2024 **Accepted**: 19/03/2024

Abstract: India's Information Technology (IT) and IT-enabled services companies are looking for Greenfield locations to help them to overcome some of the country's financial difficulties. The back office atmosphere in the Multiprotocol label switching enhances IP network functionality in a variety of ways. Despite its expanded features, MPLS architecture shares a lot of similarities with traditional IP networks. As a result, the design phase for MPLS networks is quite similar to the design stage for any IP network. This article compares and contrasts MPLS and IP technologies that is implemented in the rural sector back office, focusing on what they have in common. The basic design stages of MPLS and other IP networks are explained briefly, while the difficulties unique to MPLS networks are discussed in greater depth. This article focuses on MPLS point of existence design, MPLS routing design challenges, and label space availability.The working and communication of back office in the rural area is enriched with the MLS mechanism. The proposed system is evaluated with the assistance of the existing state-of-art techniques.

***Keyword**: Back office, ITES, MLS,*

1. Introduction

IT enabled Services (ITeS), also known as web accessible services, mobile service, or teleworking, refers to the entire range of activities that uses information technology to improve an organization's productivity [1,2]. IT and ITES companies in India are looking for greenfield premises to avoid growing salaries, high worker replacement, and deteriorating infrastructure in existing industrial hubs. For subsidiary city areas or second-tier cities, this has created a possibility [3, 4].Business Process Services (BPS) are services, which are outsourced to companies that specialise in outsourcing. Defined business operations that aren't part of an organization's core strengths might be outsourced to organisations who specialise in completing such tasks. This provides such businesses with more flexibility in terms of maintaining their money and operations [5-7].

IT and IT Enabled Sectors (ITES) are blooming in urban areas. As globalization has emerged, there is no geographical boundary for Business Process Services (BPS) and IT sectors, anything can be done from anywhere from rural sectors. There are so many graduates facing unemployment problems in the rural sectors, though they are all highly qualified, they are not getting proper employment opportunities in their home towns. They are migrating to urban areas to get the employment opportunities where it is already overcrowded and most polluted. Naturally the graduates are leaving their communities and their hereditary business which include agriculture [7, 8].

The talented graduates who are not in a position to migrate to city side are going for under employment. By way of implementing this can create employment opportunities for the rural graduate, so that the beneficiaries need not leave their community and they can continue to do their family business as well. The talent pool will stay back in their home town and by way of retaining them the rural areas will also develop in near future [9, 10].

In IT and ITES, the data security is playing a vital role. Cyber security is very important in all businesses using Internet services [11, 12]. All Personal Identifiable Information (PII) should be secured from the intruders, for which data security is very important for implementing any kind of business using Internet services and data breech can be avoided[13]. To overcome this problem secured socket layer (SSL) switching technique is essential. Multiprotocol label switching is coming under SSL switching [14, 15].

Multiprotocol name exchanging (MPLS) is a skeptic directing strategy intended to accelerate and shape traffic

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streams across the venture wide region and specialist co-op networks. Keeping away from the complex in the steering table and accelerating the traffic, it guides information starting with one hub then onto the next hub dependent on the most brief way mark, which distinguishes virtual way between the far off hubs as opposed to finishing focuses [16, 17].

This exploration portrays how to deal with the information exchanges like solicitations, Bank compromise and diary section posting between the customers and the clients in a got way utilizing Multiprotocol mark exchanging. In country regions the horticultural area alone can't take care of the issue of joblessness or underemployment because of its occasional nature, so we need to set out extra work open doors other than Agriculture. IT and ITES will settle the joblessness issues in the country area [18].

ITES, both voice and non voice organizations will be a fruitful one. The individuals who are having sound space information with great correspondence ability can foster themselves in the two areas and the alumni who are having sound area information not very well in correspondence can foster themselves in non voice process, So that business openings can be made like metropolitan regions. Monetary Development of a nation relies upon the legitimate usage of HR. The Micro and socio economy of the country areas will likewise create via holding the populace in a similar old neighborhood. The development of the nation relies upon the development of the town areas.

The surviving from the article is coordinated as follows: outline and the meaning of MPLS is given in Section 2, a viable administrative center structure with MPLS is nitty gritty in Section 3, the procured results are examined in Section 4 and the article is finished up in Section 5.

2. Multi-Protocol Label Switching

MPLS capacities further develop the administrations conveyed by IP networks by conveying rigid traffic designing and nature of administration (QoS). Network administrators have a great deal of opportunity with regards to redirecting and directing traffic across clog and connection disappointments regions in their organizations because of traffic designing. A named switch in a MPLS network allots a "name" to mark edge switch (LER). Each name switch (LSR) decides sending of decisions simply dependent on the data of the mark when traffic is disregarded a name exchanged way (LSP). The LSR takes out the old name from a parcel at each jump and replaces it with another name that educates the accompanying bounce how to sent bundle.

Rather than finishing a modern course search contingent upon the objective IP address, MPLS mark changing methods empower switches to decide steering choice dependent on the subtleties of an overall name. Alternately, switches (or ASIC-based switches) can execute course look rapidly that is sufficient to deal with most association assortments, this is essential reasoning for developments like MPLS is not generally considered to be the significant reason. An extensible IP network control and a stage autonomous information plane are normally utilized in MPLS. In the information plane, it's used with ATM switches,IP bundle switches, and optical switches. This permits these information plane methods to profit from one another while building up an expansive, feasible organization. In spite of the past finding, MPLS gives a few different benefits to IP-based organizations, including:

- IP Virtual Private Networks (VPNs) – Service suppliers can build Layer 3 IP VPNs with private course and sending tables in their organizations utilizing MPLS.
- Layer 2 Transport – Layer 2 administrations, like Ethernet, Frame Relay, and ATM, may now be continued an IP/MPLS center because of ongoing particulars created by the IETF's PWE3 and PPVPN working gatherings.
- MPLS Traffic Engineering (TE) – This uses limitation based steering that implies the way for a progression of traffic is the speediest distance that satisfies the necessities of traffic stream's or limitations.
- MPLS TE Fast ReRoute (FRR) – This strategy utilizes not really settled channel to move traffic across network interruptions, giving interchanges frameworks with the simila 50-ms security as SONET. Subsequently, it is a strategy which shields MPLS TE LSPs from disappointment of hub and connection by nearby fix system with the LSPs at the disappointment point, empowering information to be traded on them in light of the fact that their headend switches intend to make new start to finish LSPs to substitute them. Interface security is managed by a copy way that rejects just a solid connection of the underlying way, while hub security is given by a reinforcement way that sidesteps a solitary hub of the underlying way.

Because of MPLS' adaptability, contemporary organizations might execute cutting edge Layer 2 and Layer 3 VPNs, further developed QoS, and versatile control planes for optical organizations.

3. Proposed Methodology: Improved Adaptive Variable Splitting Ratio with Load Balancing (IAVSR-LB-MPLS) for MPLS

Multi-Protocol Label Switching (MPLS) is a common solution for circumventing present IGP deficiencies and balancing network congestion to achieve traffic engineering requirements. In traffic engineering, IP networks and recommended MPLS are used to cope with traffic engineering. The MPLS expands the design space by allowing alternative virtual topologies to be supplied on top of the actual topology of the network. This may be accomplished in a rather simple method. When the magnitudes of traffic fluctuations are minimal, the Adaptive Splitting Ratio (ASR) method minimises the count of iterations that is necessary to balance the load (L_B) and the count of iterations necessary to acquire the shortest end to end delay (E_D). The L_B and E_D become huge when the magnitudes of traffic variances are substantial. As a result, the ASR algorithm will be altered to improve performance even when input traffic varies greatly.

In the IAVSR-LB-MPLS load balancing algorithm, the unbalanced states are divided into two regions, depending upon the difference between the maximum link cost and minimum link cost of the network as, far balanced and near balanced region.

When the difference between the maximum link cost (max_i) and the minimum link cost (min_i) of a path is large, the splitting size is kept large, in order to reach the near balance state with less number of iterations. This large difference (between maximum and minimum link cost) region is called far balanced region. In the far balanced region, the splitting step size δ_s(i) is kept larger and also varied adaptively as given below,

$$\delta_s(i) = (1/T)\emptyset_q(i-1) \text{-----(1)}$$

Where the parameter T is called net granularity value.

The large step size produces oscillation at the balanced state. When the cost difference (max_i- min_i) is low, the splitting step size used for the rebalancing action is reduced, which in turn reduces the magnitude of the oscillations at the balanced state. This small difference region is called near balanced region. A threshold (t) value is used to differentiate the two regions. In the near balanced region, the splitting step size pt (i) is kept small. It is expressed as follows,

$$\delta_{st}(i) = (1/T_g)\emptyset_q(i-1) \text{-----(2)}$$

where g is the granularity parameter as discussed in the ASR algorithm and its value is kept constant in the IAVSR-LB-MPLS algorithm.

The net granularity value T is expressed as,

$$T = \frac{[f_l-(max_i-min_i)]}{x} + S \text{-----(3)}$$

Wheref_l is the full load link cost and x is a preset parameter called tradeoff parameter. The value of x is set manually based upon the network topology and magnitude of oscillations. Diminishing the worth of x will expand the worth of T. Higher worth of T will diminish the parting step size and consequently it diminishes the extent of motions. The base worth of T is equivalent to S when the distinction among mi and man-made intelligence is equivalent to fl. The distinction among mi and man-made intelligence becomes greatest (equivalent to the fl) when every one of the approaching deals are steered through the most limited way, utilizing least jump directing calculation.

The boundary 't' is called limit worth and it is the limit esteem between the far adjusted area and the close to adjusted locale. The parting proportion is kept up with at a bigger worth to decrease the IB, until the expense contrast (mi-simulated intelligence) arrives at this limit level. This limit level is maintained least in control to diminish the number emphasess needed to arrive at the fair state. Simultaneously, the limit esteem is to be more prominent than the base parting step size to stay away from motions.

Algorithm 1. IAVSR-LB-MPLS

1. Calculate link cost of each link.
2. Calculate the path cost of all the paths p belongs to P_k.
3. Find a path q belongs to P_k having maximum cost and a path r belongs to P_k having minimum cost.
4. Calculate the net granularity value T
5. If (max_i-min_i) > t, then, calculate the splitting step size δ_s(i) using equation $\delta_s(i) = (1/T)\emptyset_q(i-1)$
Decrease the path load of the path q as, $\emptyset_q(i) = \emptyset_q(i-1) - \delta_s(i)$-----(4)
and increase the path-load of the path r as, $\emptyset_r(i) = \emptyset_r(i-1) - \delta_p(i)$ -----(5)
6. For the other entire paths, keep the old splitting ratio.
7. Else [(maxi – mini)], calculate the splitting step size δ_s(i) using the equation $\delta_{st}(i) = (1/T_g)\emptyset_q(i-1)$
Decrease the splitting ratio of the path q as, $\emptyset_q(i) = \emptyset_q(i-1) - \delta_s(i)$-----(6)

and increase the splitting ratio of the path r as,

$\emptyset_r(i) = \emptyset_r(i-1) - \delta_p(i)$ -----(7)

8. For the other entire paths, keep the old splitting ratio.

As in the ASR calculation, the connection cost of a most extreme stacked connection in the way p is taken as the expense of the way p. Subsequent to computing the expenses, all things considered, and ways, the net granularity esteem (T) is determined utilizing condition (3).

In sync 5, condition (4) diminishes a piece of the heap from the most extreme expense way and condition (5) expands the heap of the base expense way at the far adjusted district. Stage 7 actually looks at the limit between the all over adjusted area. At the point when the close to adjusted district is reached, the conditions (6) and (7) are utilized to part the heap from greatest stacked way into least stacked way.

4. Result and Discussion

The exhibition of the IAVSR-LB-MPLS calculation is assessed utilizing a similar test network utilized for the ASR calculation. Load is applied to the test network for reproduction so that the normal connection cost maxvis equivalent to 0.4. The greatest connection usage is seen subsequent to joining the IAVSR-LB-MPLS calculation on the MPLS hubs with different upsides of tradeoff boundary 'x'.

The greatest connection usage (interface cost) as an element of the quantity of emphasess with x = 6, t = 0.01 and g = 10 is given in Figure 4.1. It shows that the size of swaying is extremely least and practically irrelevant.

Table 1. Usage of Link vs. Iteration

max_util	0.6	0.8	0.9
5	0.55	0.83	0.73
10	0.41	0.6	0.77
15	0.4	0.4	0.4
20	0.39	0.39	0.39
25	0.38	0.38	0.38
30	0.37	0.37	0.37

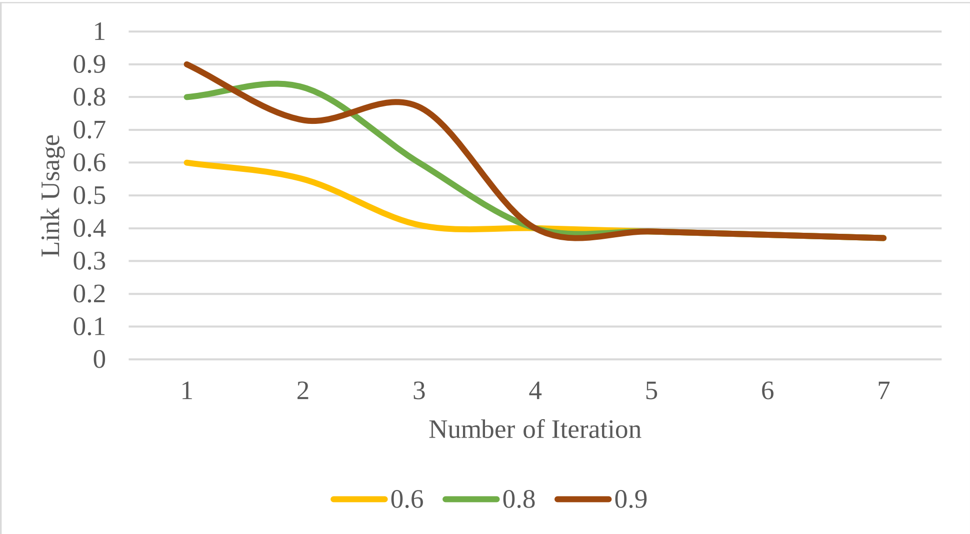

Figure 1. Usage of Link vs. Iteration

Table 2. Usage of Link for average link value 0.6

max_util	0.7	0.8	0.9
5	0.65	0.74	0.65
10	0.6	0.63	0.6
15	0.61	0.61	0.61
20	0.6	0.62	0.6

25	0.61	0.61	0.61
30	0.61	0.62	0.61

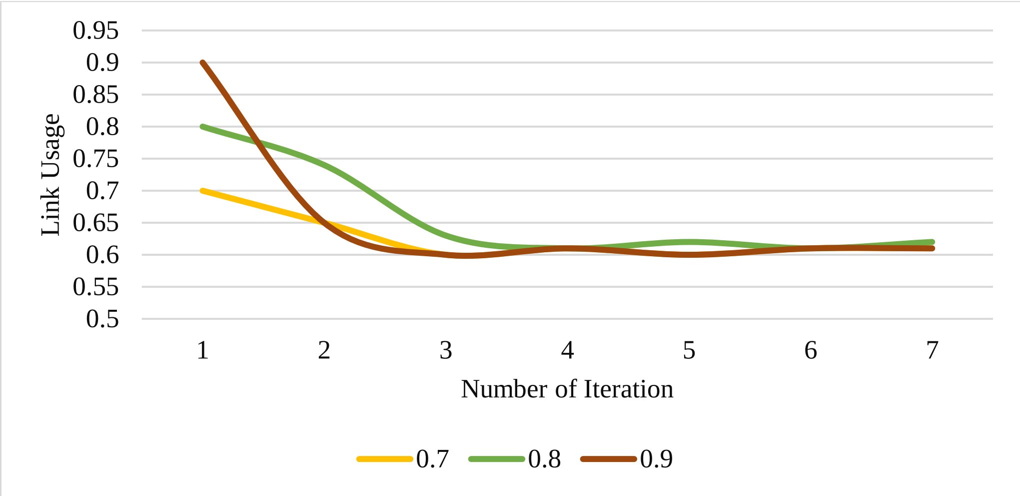

Figure 2. Usage of Link for average link value 0.6

The maximum link utilization (link cost) as a function of number of iterations with x = 6, t = 0.02, g = 10, a_v = 0.6 (60%) and max_i = 70%, 80% and 90% is given in Figure 4.2. When comparing Figures 1 and 2, there is no considerable difference in B_L. However, the magnitude of oscillation becomes high at a_v = 0.6 (60%).

Comparing Figures 2 and 3, it is observed that the inclusion of the parameter 'g' using equation (2) reduces the oscillations at the cost of a small increase in the B_L.

Table 3. Usage of Link for average link value 0.6 without g

max_util	0.8	0.9
5	0.72	0.82
10	0.58	0.59
15	0.65	0.66
20	0.58	0.59
25	0.65	0.66
30	0.58	0.59

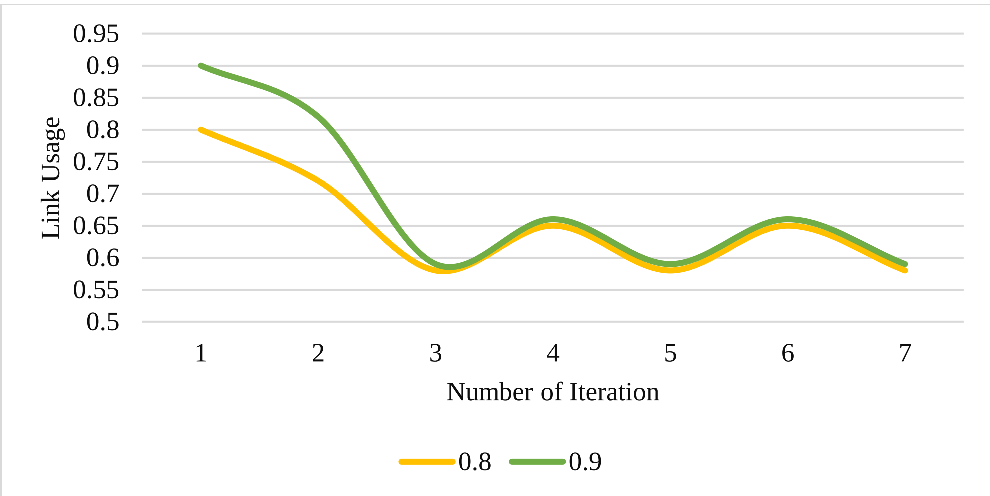

Figure 3. Usage of Link for average link value 0.6 without g

However, when the average link cost and minimum link cost are increased above 0.6, the oscillations emerge even with the addition of parameter g. The maximum link utilization (link cost) as a function of a number of iterations with x = 6, t = 0.02, g = 10, a_v = 0.8 (80 %) and max_i = 85 %, 90 % and 95 % is given in Figure 4.

Table 4. Usage of Link for average link value 0.6 and x=6

max_util	0.85	0.9	0.95
5	0.84	0.83	0.87
10	0.82	0.82	0.81
15	0.81	0.79	0.79
20	0.79	0.8	0.8
25	0.78	0.79	0.79
30	0.79	0.8	0.8

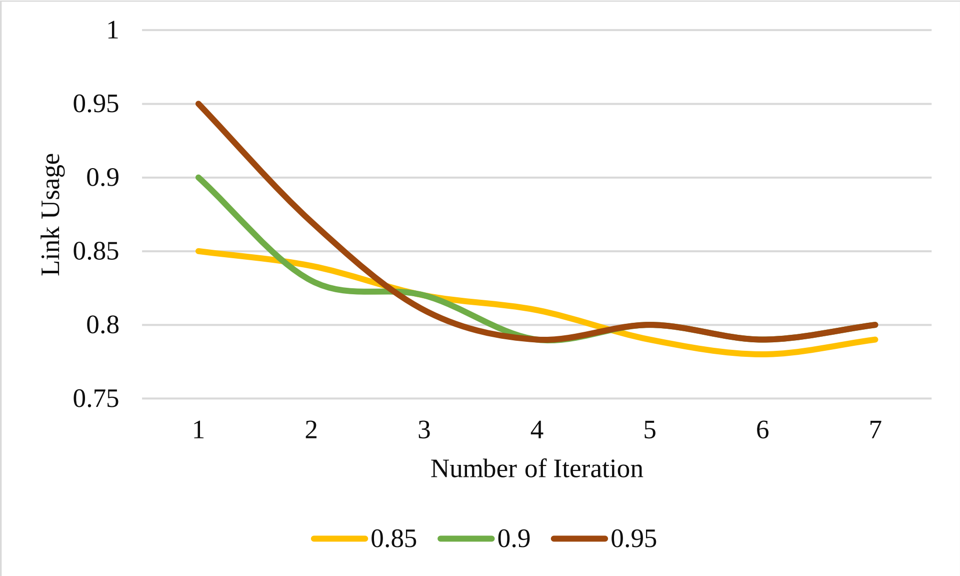

Figure 4. Usage of Link for average link value 0.6 and x=6

The Figure 4 illustrates that the magnitude of oscillations is very high and it is independent of the value of max_i. This is because of the high splitting step size at a_v = 0.8. In order to reduce the magnitude of oscillations, the net granularity value is increased to reduce the splitting size by reducing the trade-off parameter x.

End to End Mean Delay

The IAVSR-LB-MPLS algorithm is incorporated into the MPLS nodes, using network simulator to find out the end to end mean delay and the throughput.

Table 5. End to End Mean Delay in IAVSR-LB-MPLS

Iteration	Delay
5	0.75
10	0.61
15	0.6
20	0.6
25	0.6
30	0.6

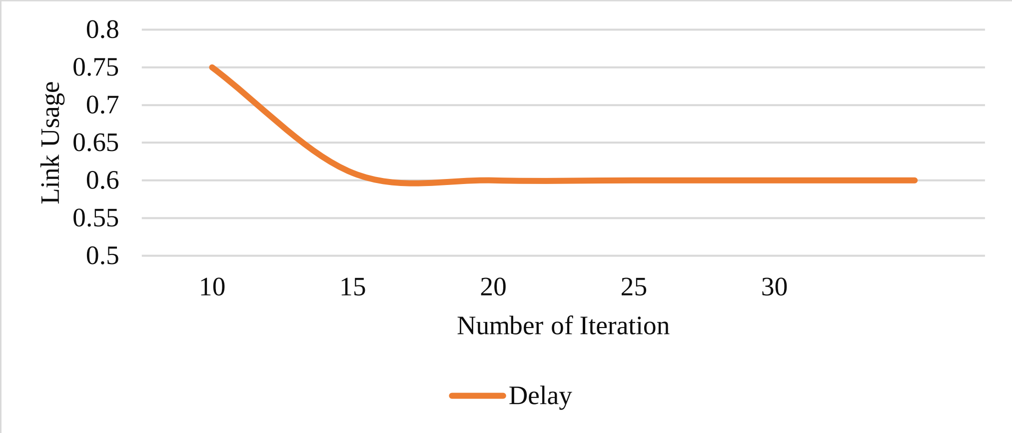

Figure 5. End to End Mean Delay in IAVSR-LB-MPLS

The topology and the input traffic are the same as considered in the case of ASR algorithm. The end to end delays are observed before load balancing and during load balancing using IAVSR-LB-MPLS algorithm and they are illustrated in Figure 5.

Without load balancing, the delay is at maximum (0.00018 second) and the delay is minimum at the balanced state (0.00013 second). During load balancing, the delay is reduced gradually as shown in the Figure 5. The number of iterations required to reach the minimum mean delay (ID) for different values of b is given in Table 5.

Throughput

To find out the throughput of the algorithm, 9 Mbps traffic is considered as total input. Figure 5 shows the throughput of IAVSR-LB-MPLS load balancing algorithm as a function of time. The IAVSR-LB-MPLS algorithm maintains the throughput to the maximum value of 9 Mbps with respect to time.

Table 6. Throughput in IAVSR-LB-MPLS vs Time

Time (s)	Throughput (Mbps)
0	0
1	0.9
2	0.91
3	0.92
4	0.9
5	0.9

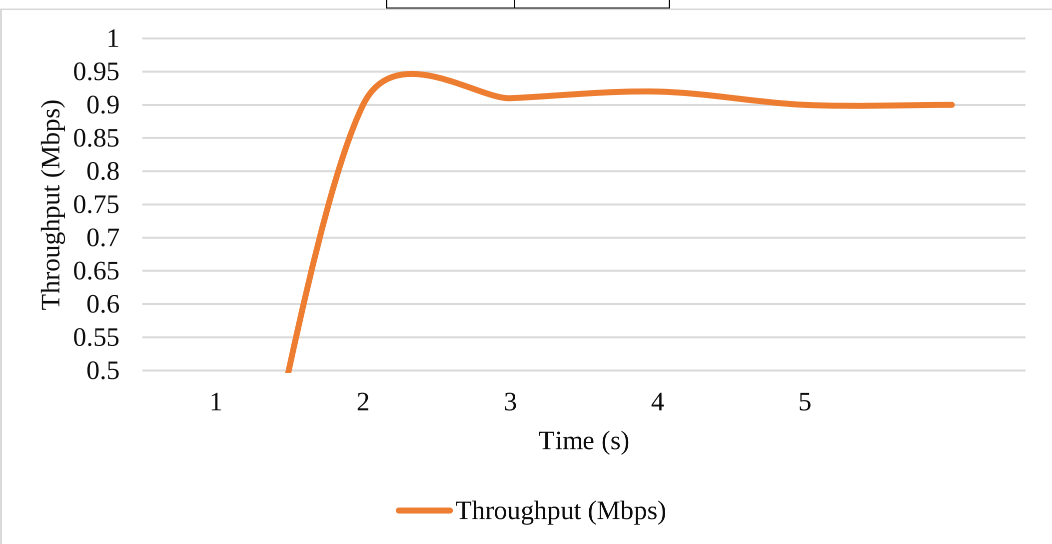

Figure 6. Throughput in IAVSR-LB-MPLS vs Time

Figure 6 illustrates the throughput of the IAVSR-LB-MPLS algorithm and the minimum hop routing as a function of traffic size. The throughput is maintained at the maximum level of 1 (100%) by the IAVSR-LB-MPLS algorithm.

5. Conclusion

IAVSR-LB-MPLS Algorithm is developed with a new splitting method to reduce the number iterations required to balance the load with reduced magnitude of oscillation. The focal point of IAVSR-LB-MPLS algorithm is its capability to distribute traffic among multiple parallel LSPs and to balance the load evenly and consequently. The simulation results show that, even for large variations in the link load, the IAVSR-LB-MPLS algorithm reduces the B_L from 100 to 20 and the number of iterations required to reach the minimum mean delay (ID) is reduced to 37. It is proved that fast load balancing and reduced magnitude of oscillation increase the throughput of the network to the maximum value of 1.0 by preventing the packet loss. The back office in the rural areas are enhanced by the proposed IAVSR-LB-MPLS mechanism which in turn promotes the IT and ITE's service. In future, the approach can be enhanced for the generation of oscillations completely at the balanced state.

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