DIVERSION ROUTING WITH LOAD BALANCING USING LBA-DR AND GA OPTIMIZATION

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ABSTRACT

Segment routing (SR) is a new network armature that has realized farther control of SDN (software defined network) in recent times. SR can achieve comity with the SDN, and it has come a perpetration result to some Traffic Engineering (TE) problems in the SDN. SR can realize directional data transmission from the source knot to the destination knot. Still, the control outflow in SR is also unlimited in numerous different scripts, which will beget hamstrung data transmission. Meanwhile, being results ignore the problem of an overlarge packet title in SR. thus, a routing scheme must be explored to achieve load balancing and consider the limited packet length in SR. Control outflow has an important problem in TE. To achieve the better of two targets, we propose the Intelligent Routing scheme for Traffic Engineering (IRTE), which can achieve load balancing with limited control charges. To achieve optimal performance, we develop an ant colony optimization algorithm as bettered ant colony optimization (IACO), and to achieve optimal performance, develop an inheritable Algorithm (GA) optimization for further enhancement, which is extensively used in network optimization problems. Eventually, we estimate the IRTE in different real- world.

topologies, and the results show that the IRTE with IACO and GA- Optimization analysis shows the out performs than the traditional algorithms.

1. INTRODUCTION

Traffic engineering (TE) has always attracted important exploration attention. Traditional TE concentrated on IP routing protocols, routing optimization problems, overlaying in an IP network, etc. utmost of these studies were conducted in traditional IP networks. With the arrival of the software defined network (SDN), experimenters began to concentrate on TE issues in the SDN, including business splitting and SDN protocol design. The SDN can help us achieve effective network operation, which can break massive TE issues that are delicate to realize in traditional networks. Still, the SDN faces great challenges, e.g., scalability issues that limit its operation compass. In addition, member routing (SR) has advantages in network structure that can help break these problems in the SDN. Thus, numerous scholars began to explore the possibility of combining the SDN with member routing. Member routing is a new network armature that has realized farther control of SDN in recent times.

SR can achieve compatibility with the SDN, and it has become an implementation solution to some TE problems in the SDN. SR can realize directional data transmission from the source node to the destination node. However, the control overhead in SR is also unlimited in numerous different scripts, which will causes hamstrung data transmission. Meanwhile, being results ignore the problem of an overlarge packet title in SR. thus, a routing scheme must be explored to achieve load balancing and consider the limited packet length in SR.

Control outflow has an important problem in TE. Applicable schemes for controlling outflow can optimize network transmission performance. In recent times, with the development of new network paradigms, i.e., the SDN, SR, and block chain, control overhead optimization has been used in different fabrics. Still, control overhead optimization is neglected in the SDN and SR. An unlimited control overhead causes an overlarge SR packet length, and decreases data transmission effectiveness. The length of an SR packet title increases as the routing length grows, which deteriorates the control overhead situation in SR. Experimenters didn't optimize network performance from the aspect of limited control outflow when working the issue of bandwidth load balancing in SR. thus the TE scheme in SR that combines bandwidth load balancing and limited control overhead graces deeper disquisition.

2. LITERATURE REVIEW

In this work, an intelligent routing scheme for TE (IRTE) in an SR terrain is proposed. The IRTE not only achieves bandwidth load balancing in an SR terrain, but also considers packets lengths for limited control outflow. The proposed diversion routing system is used to achieve our bandwidth load balancing target. The designs of the IRTE armature grounded on SR regulator and emplace diversion routing able bumps. The regulator collects the network status and generates the information matrix in each time interval. After entering the data transmission demand from source hosts, the regulator computes the diversion routing paths for them according to load balancing algorithms and the network situation. The two new load balancing and load optimization algorithms for the IRTE, including the load Balancing Algorithm with Diversion Routing (LBADR) and bettered Ant Colony Optimization (IACO) are designed. The LBA- DR generates the diversion routing path for each source knot through direct programming and the randomized rounding system. IACO analyses this matrix and provides a diversion routing path, which is generally different from the traditional shortest routing path. On the one hand, this diversion routing path from these two algorithms considers the bandwidth load balancing target, and decreases the maximum bandwidth use in the network. On the other hand, it controls the SR packet title length, and avoids the forwarding load situation. Latterly, the source establishes data inflow according to this diversion routing path and transmits data to the destination. Eventually, the bumps on this routing report the rearmost network status to the SR regulator to modernize the network information matrix. We apply our IRTE armature, and estimate it under real- world network topologies. We compare the designed algorithms with traditional algorithms. We compare their performances in six typical topologies with different figures of overflows. We record the control outflow of each algorithm and corroborate that our simulation is a test- bed trial. We dissect the changing trend of these two algorithms and compare their load balancing performances. We also explore the relationship between algorithm performance and the number of bumps, degrees, and parameters of IACO. The experimental results show that in different topologies, the IRTE realizes the bandwidth load balancing ideal. The maximum bandwidth use in utmost networks using the LBA-DR or IACO is reduced compared with former algorithms. With adding inflow figures, IACO achieves a performance advantages. Also, the load balancing gap between IACO and a traditional algorithm improves. The main benefactions are as follows. We design the diversion routing armature IRTE in the SR terrain for TE. We complete the function and operation of the3 SR regulator and diversion routing able bumps in the network. The network status is timely recorded in the regulator at each time interval. We formulate the bandwidth load balancing problem in the SR terrain, and design the LBA- DR algorithm and IACO algorithm to realize the load balancing ideal with the help of SR. We define the forwarding load situation in the SR terrain, and control the SR packet title length to avoid encouraging load. We apply and compare our IRTE armature in different topologies. The experimental results show that the LBA- DR and IACO of the IRTE significantly achieve bandwidth load balancing and avoid encouraging load in data transmission.

In this section, we introduce two new algorithms for bettered control charges. First, we introduce the idea and dissect the theoretical performance of the LBA-DR. also, we describe our IACO to achieve our target of bandwidth load balancing and load control. Then, first introduce our algorithm LBA- DR (load balancing algorithm with diversion routing), which is a new way to achieve the bandwidth load balancing objective and limited control outflow in SR. To achieve the load balancing and forwarding load optimization ideal in Formula (8), we first describe the medium and details of our LBA- DR, and also we dissect its approximate performance and cipher the approximate rate of the LBA-DR. To achieve the ideal of Formula, we design the LBA- DR for load balancing, and we show the LBA- DR in Algorithm 1.

3. METHODOLOGY

3.1 Input- Topologies

The performance of our bandwidth load balancing and packets length optimizing algorithm, including the LBA- DR and IACO are estimated by using these internet network topologies. The Internet Topology Zoo used to perform the simulation. The topologies include Abilene, Abvt, Aconet, Agis, Ai3, Airtel, Bell Canada, BellSouth, Bics, and Ion. All links are all undirected, and all bumps are diversion routing able in these topologies. The details of each topology are shown in this module. We elect seven topologies from the Internet Topology Zoo, including Abvt, Aconet, Ans, airtel, Bell Canada, BellSouth, and Ion. The number of bumps of these six topologies increases from 23 to 125 to test IRTE performance from a small network to a large network. We aimlessly induce 25 overflows with a size of 3 MB to 8 MB in these five network topologies. We record the maximum bandwidth use of these networks after all overflows are assigned to the suitable routing paths.

3.2 LBA- DR Analysis

In this module the algorithm LBA- DR (load balancing algorithm with diversion routing) is introduced. It's a new way to achieve the bandwidth load balancing objective and limited control outflow in SR. To achieve the load balancing and forwarding load optimization ideal in calculation. Seven topologies are named from the Internet Topology Zoo. The number of bumps of these seven topologies increases from 23 to 125 to test IRTE performance from a small network to a large network. The load balancing performance of maximum bandwidth use for five algorithms in these topologies are showed in this module.

3.3 Optimal- Analysis

In this module IACO and GA grounded optimization analysis are proposed, which isn't only prompts ants to search for a path of low bandwidth use. It also controls the forward markers to avoid a load of packet forwarding. Assuming that each link capacity of the topologies is 100 MB, and the bandwidth of each inflow is aimlessly from 3 MB to 8 MB. The targets of balancing bandwidth use, end to minimize the maximum bandwidth of the network. The maximum bandwidth of seven topologies were calculated, and also the adding the inflow control bandwidth are calculated for small, medium and large network topology.

3.4 Performance- Analysis

In this module the performance of our bandwidth load balancing and packets length optimizing algorithm, including the LBA- DR and IACO and GA are compared with being three algorithms. Maximum bandwidths of the five algorithms in five topologies are compared. The Comparison of the performance of load balancing through these algorithms as the number of inflow increases in small, medium and large network. The similarity graph shows that the maximum performance advantage of GA reaches advanced than the being IACO and other algorithms.

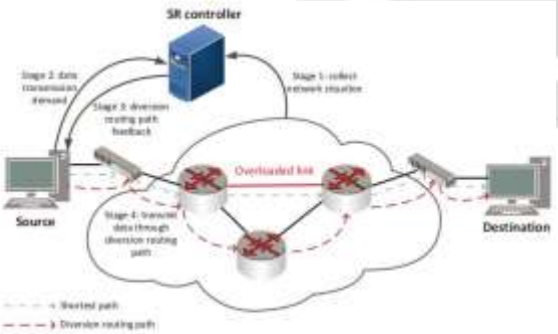

Fig 3.1 IRTE Mechanism

This result shows the load balancing advantages of GA and IACO and the LBA- DR in the situation of adding inflow number. The result shows that the maximum performance advantage of GA reaches in bell Canada topology compared with the other three algorithms. There are also performance earnings in other topologies compared with the traditional algorithm, OF Load and D- LBAH. To check the load balancing performance with adding inflow figures, we elect three topologies, Aconet, BellSouth, and Ion, which represent a small network, medium network, and big network, independently. We aimlessly proliferation the number of overflows from 10 to 30 in Aconet, Bellsouth, and Ion. As we can see, with adding inflow number, the link application growth of IACO, GA and LBA- DR is flatter than that of the traditional algorithm, OF Load and DLBAH. This is because with adding business demand, which causes network traffic, IACO and GA in the IRTE can help the hosts to transmit data more effectively.

The diversion routing system used to achieve our bandwidth load balancing target. IACO analysis this matrix and provides a diversion routing path, which is generally different from the traditional shortest routing path.

System Architecture We first compare the maximum bandwidth use of these three traditional algorithms with these two Algorithms in six topologies, and we also compare the performance of load balancing through these five algorithms as the number of inflows increases. For IACO and GA we compare the change in maximum bandwidth use in different algorithms, also we compare the maximum bandwidth use difference of each topology. Meanwhile, we estimate the maximum bandwidth use situation with the changing number of bumps and edges. Eventually, we modify the parameters for our bandwidth load balancing algorithm in each topology.

4. ALGORITHM

The LBA- DR includes three way to achieve bandwidth load balancing and overhead control Optimization.

Step- 1 Enter the data transmission demand from source knot s, the SR regulator computes a suitable routing path set P for s with the diversion routing number constraint x

Step- 2 From our evidence above, with constraint is NP-hard. This means that inflow f can elect further than one routing path to construct data transmission.

Step- 3 We aimlessly choose one path according to the path probability distribution. Also, the SR regulator will transmit this path for the source to construct data inflow.

Traditional TE concentrated on IP routing protocols, routing optimization problems, overlaying in an IP network. The arrival of the software defined network (SDN), began to concentrate on TE issues in the SDN, including business splitting and SDN protocol design. The SDN can help us achieve effective network operation, which can break massive TE issues. SR can achieve comity with the SDN, and it has come a perpetration result to some TE problems in the SDN. Thus, a routing scheme must be explored to achieve load balancing and consider the limited packet length in SR.

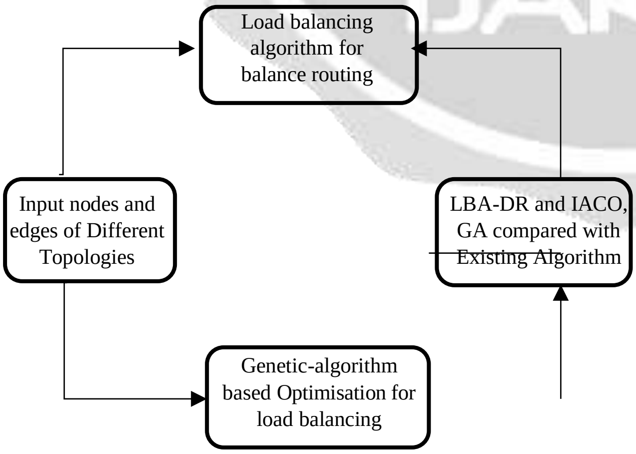

Fig 4.1 Flow Diagram of the proposed system

Member Routing brings control charges, i.e., fresh packets heads should be fitted. The charges can greatly reduce the forwarding effectiveness for a large network, when member heads come too long. An intelligent routing scheme for TE (IRTE) in an SR terrain is proposed. The IRTE not only achieves bandwidth load balancing in an SR terrain, but also considers packets lengths for limited control outflow. It also proposed the diversion routing system to achieve the bandwidth load balancing target. The IRTE armature grounded on SR regulator and emplace diversion routing able bumps. Two new load balancing and load optimization algorithms for the IRTE are designed. The load balancing algorithm with diversion routing (LBA- DR), and bettered ant colony optimization (IACO) and inheritable- Algorithm (GA) grounded optimization are the two algorithms used for load balancing optimization.

5. IMPLEMENTATION

5.1 Performance evaluation

Let G = (V,E) be a network, where V is the set of nodes and E is the set of links. Assuming that n traffic flows in our network, let F = {f1; f2; : : : ; fn} denote the set of traffic flows, and d(fi) denotes the traffic demand of fi . For each network flow fi, s (fi) and d(fi) represent the source and destination of traffic flow fi, respectively. For each fi, the source s (fi) will probably travel on the shortest path according to the traditional routing operation, and we call it Si . We use Si ={s(fi); x1 si ; x2si ; : : : ; xksi ; : : : ; d(fi)} to denote the shortest path Si for fi . In addition, we use Divi = {s(fi); x1di; x2di; : : : ; xkdi; : : : ; d(fi)} to denote the diversion routing path for flow fi . Let Ui denote the node number of Divi. Diversion routing path Divi is a pre-defined path for s(fi) and it normally differs from the shortest path Si to achieve our load balancing target. Let Ci denote the capacity of link ei , Ui denote the link utilization on of link ei , and Bi denote the occupied bandwidth of ei . Obviously Bi ≥ Ci . Thus, we can calculate Ui as

$$Ui = Bi/Ci$$

The load balancing objective can be formulated as follows. Given G = (V;E) and w find an operation Map (fi) for all fi = F ,

Min max U

$m \qquad i$

$\sum Z \sum z(d(f)) \leq Umax, Cmax$

$x=1 \qquad x$

5.2 Performance Analysis

5.2.1 Bandwidth comparison

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Fig 5.1 Maximum bandwidth comparison used in different topologies for six algorithms

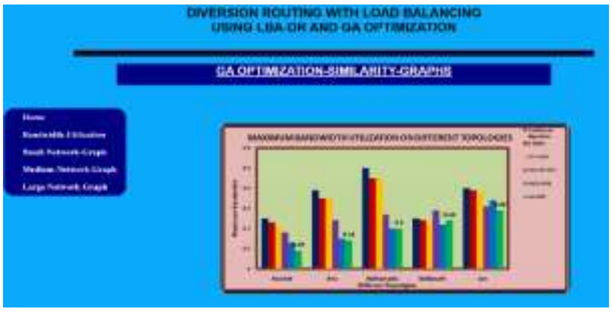


Fig 5.2 Similarity graph for bandwidth comparison of six algorithms

5.2.2 Data Flow Comparison

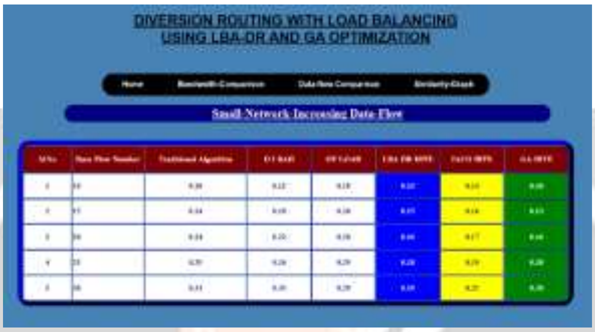


Fig 5.3 Increasing data-flow comparison on small network topology for six algorithms

Fig 5.4 Associated graph of increasing data-flow comparison on small network topology for six algorithms

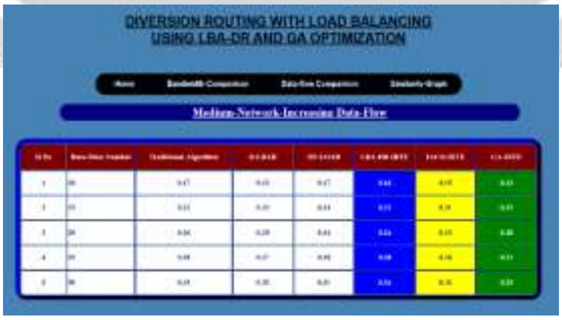
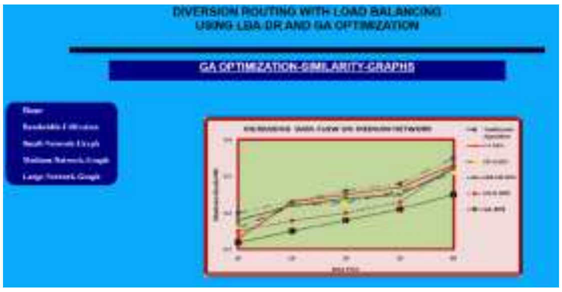


Fig 5.5 Increasing data-flow comparison on medium network topology for six algorithms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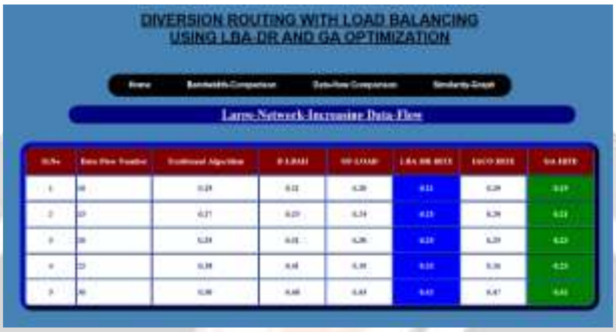
GA OPTIMIZATION-SIMILARITY-GRAPHS

Fig 5.6 Associated graph of increasing data-flow comparison on medium network topology for six algorithms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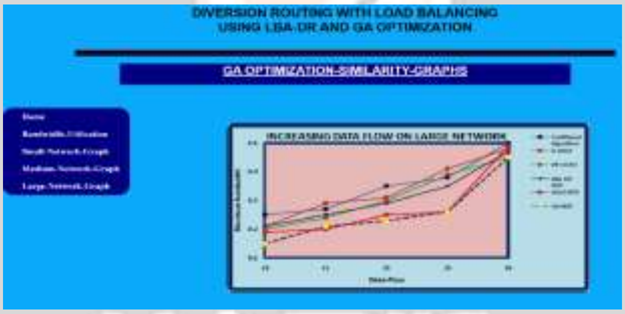
Large-Network-Increasing-Data-Flow

Fig 5.7 Increasing data-flow comparison on Large network topology for six algorithms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GA OPTIMIZATION-SIMILARITY-GRAPHS

Fig 5.8 Associated graph of increasing data-flow comparison on large network topology for six algorithms

6. CONCLUSION

In this work to achieve the load balancing with limited control overheads in the SR of the IRTE are proposed. The function of the SR controller and hosts in our IRTE system design is introduced. The LBA-DR and IACO and GA optimization algorithms to realize the objective of bandwidth load balancing and limited control overheads are designed. Different real-world topologies are evaluated and compare the difference in performance between the IRTE and the traditional routing algorithm. The results show that the load balancing performance of the IRTE is better than that of the traditional algorithm and effectively achieves limited control overheads in SR.

7. REFERENCES

[1] Shu Yang, Ruiyu Chen, Laizhong Cui, and Xiaolei Chang,” Intelligent Segment Routing: Toward Load Balancing with Limited Control Overheads, BIG DATA MINING AND ANALYTICS,ISSN 2095-0554 05/10 pp 55 – 71 Volume 5, March 2023.

[2] J. Zhang and C. Zhao, Q-SR: An extensible optimization framework for segment routing, Computer Network, vol. 200, p.108517, 2021.

[3] P. L. Ventre, S. Salsano, M. Polverini, A. Cianfrani, A. Abdelsalam, C. Filsfils, P. Camarillo, and F. Clad, Segment routing: A comprehensive survey of research activities, standardization efforts, and implementation results, IEEE Commun. Surv. Tut., vol. 23, no. 1, pp. 182–221, 2021.

[4] Z. N. Abdullah, I. Ahmad, and I. Hussain, Segment routing software defined networks: A survey, IEEE Commun. Surv. Tut., vol. 21, no. 1, pp. 454–485, 2019.

[5] M. Jadin, F. Aubry, P. Schaus, and O. Bonaventure, CG4SR: Near optimal traffic engineering for segment routing with column generation, presented at the IEEE INFOCOM 2019 - IEEE Conf. Computer Communications, Paris, France, 2019, pp. 1333–1341.

[6] X. Li and K. L. Yeung, Bandwidth-efficient network monitoring algorithms based on segment routing, Computer Network, vol. 147, pp. 235–245, 2018.

[7] Y. Desmouceaux, P. Pfister, J. Tollet, M. Townsley, and T. Clausen, 5LB: Scalable and application-aware load balancing with segment routing, IEEE/ACM Trans. Netw., vol. 25, no. 2, pp. 819–834, 2018.

[8] A. Cianfrani, M. Listanti, and M. Polverini, Incremental deployment of segment routing into an ISP network: A traffic engineering perspective, IEEE/ACM Trans. Netw., vol. 25, no. 5, pp. 3145–3150, 2017.

[9] M. Chiesa, G. Kindler, and M. Schapira, Traffic engineering with equal-cost-MultiPath: An algorithmic perspective, IEEE/ACM Trans. Netw., vol. 25, no. 2, pp. 779–792, 2017.

[10] B. Fortz, J. Rexford, and M. Thorup, Traffic engineering with traditional IP routing protocols, IEEE Commun. Mag vol. 40, no. 10, pp. 118–124, 2002

[11] D. O. Awduche and B. Jabbari, Internet traffic engineeringvusing multi-protocol label switching (MPLS), Computer Network, vol. 40, no. 1, pp. 111–129, 2002.

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