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Hop and Route

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Abstract- In this paper, The PEFT (Penalize Exponential Flow Splitting) achieves optimal traffic engineering with compare to other protocols like OSPF, DEFT. While DEFT is also new link state routing protocol provably achieves optimal traffic engineering but PEFT leads to significant reduction in the time needed to compute the best link weight. We propose a new link-state routing protocol is PEFT (Penalizing Exponential Flow splitting), that splits traffic over multiple paths with an exponential penalty on longer paths.
Keyword: Open Shortest Path First (OSPF), routing, traffic engineering, Penalize Exponential Flow Splitting.

I. INTRODUCTION

Designing a link-state routing protocol has three components. First is weight computation: The network-management system computes a set of link weights through a periodic and centralized optimization. The second is traffic splitting: Each router uses the link weights to decide traffic-splitting ratios among its outgoing links for every destination. The third is packet forwarding: Each router independently decides which outgoing link to forward a packet based only on its destination. In PEFT,Forwarding of packet is same as OSPF.The differences is only that OSPF splits traffic evenly among the shortest paths, and PEFT splits traffic along all paths, but penalizes longer paths(the paths having larger sum of link weight)exponentially. Penalizing Exponential Flow-splitting (PEFT), proving that it achieves optimal TE and demonstrating that link-weight computation for PEFT is highly efficient in theory and in practice.

II. LITREATURE REVIEW

A. Existing system

1) OSPF (Open Shortest Path First): OSPF split the traffic evenly over shortest path only. It takes more time for data transmission. OSPF needed the large amount of memory, because it maintains multiple copies of routing information. This protocol has no ability to adjust the splitting percentages. So the optimization problem is difficult.

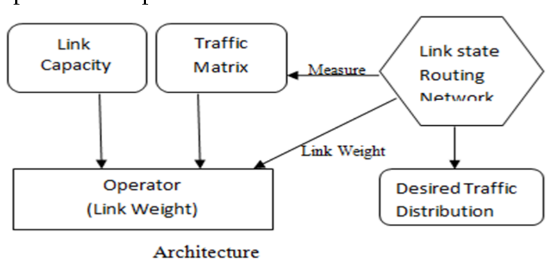

Fig 1.Architechture of PEFT

Link Capacity**:** Capacity of the links in which the offered traffic is to be calculated and sent through it.
Operator*:* Operator which computes the link weights and sent to the network (link state routing).
Network: Link state routing measures the traffic or congestion which occurs and sends the traffic to the traffic matrix.
Traffic Matrix*:* Traffic matrix has the equation which calculates the congestion and split across the various links. This splitting is done by the operator and again sent it to the link state routing for distribution to the destination.
Desirable Traffic Distribution: Traffic distribution which is desired by the link state routing for sending it to the destination.

2) DEFT (Distributed Exponential Flow splitting): DEFT split the traffic evenly over multiple paths. It is link based flow splitting, it achieves nearer optimal value. On convex, on smooth optimization Methods for weight computation and traffic splitting. This method cannot prevent the occurrence of cycle It is link based flow splitting. So divide the packet over two equal paths.A link state routing protocol has three components. First one is Weight Computation. The second is Traffic splitting and the third is data forwarding.

B. Proposed System:

1) PEFT: We develop a new link state routing protocol PEFT (Penalizing Exponential Flow splitting), that splits traffic over multiple paths with an exponential penalty on longer paths.PEFT achieves optimal TE and demonstrating that link-weight computation for PEFT is highly efficient. We observe a 15% increase in the efficiency of capacity utilization by PEFT over OSPF. Furthermore, an exponential traffic-splitting penalty is the only penalty that can lead to this optimality result. The corresponding best link weights for PEFT can be efficiently computed. Optimal traffic distribution is realized by dividing an arbitrary fraction of traffic over many paths. This can be supported by the forwarding mechanism in multiprotocol label switching (MPLS) .It achieves the optimal solution.

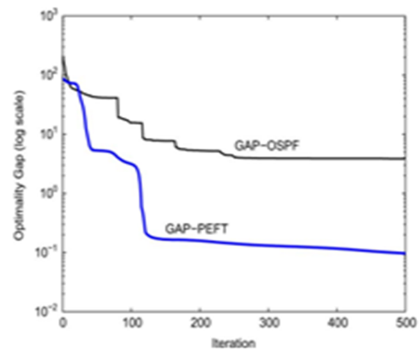

Fig 2.Comparision of the drop in optimality gap between OSPF and PEFT

Link-state: Routers make routing decisions based on knowledge of the network topology and the weights associated with the links.
Hop-by-hop: Each router, based on the destination address, controls only the next hop that a packet takes.
Optimal: The routing algorithm minimizes some cost function (e.g. minimize total delay) determined by the network operator. The problem of guiding network traffic through routing to minimize a given global cost function is called traffic engineering (TE).

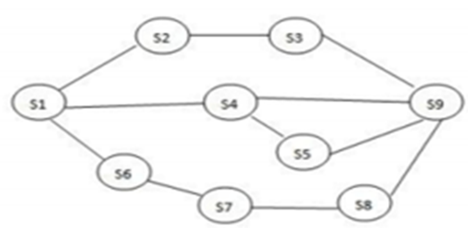

Fig 3.Ip network

Open shortest path first (OSPF) is one of the most popular routing protocol in today's network. Concept behind OSPF is to forward packet with the help of shortest path only from any source to any destination. In OSPF, with the help of hello packet, nodes will come to know about neighbors. Then with the help of Dijkshtra's algorithm it will calculate shortest path from each and every node to another. But the major problems are the chosen path is not robust under change in traffic or network state. Also optimizing link weight in OSPF to the group traffic is NP-Hard problem [2]. For better understanding of OSPF will see its working with the help of fig. 3

Suppose G=<V,E>, where V is the vertices and E is the edge. If S1 wants to send packet to destination S9 it will first check the shortest path. S1-> S4-> S9 will be the shortest path by hop-by-hop method. It means S1 will send the packets to S9 through S4. If the traffic is more on the same path then also it will continue to send the traffic through same path. It means the final path in OSPF to send the packet is S1 ->S4 ->S9. With the help of OSPF, next protocol is tried to develop by Ari lappetelainen, which is Equal cost multi-path (ECMP) routing in IP network.ECMP split the traffic over equal cost multipath. This protocol tried to utilize resources [11]. But it is not able to split the traffic equally [1]. Also it will not useful if the equal cost paths are not present to a particular destination node. For better understanding will take an example with reference to Fig. 3. In ECMP, S1 will send the packet to S9. First it will check whether it have equal cost path is present to S9. If paths are present then it will send through multiple paths which have equal cost to destination S9.But ECMP will not calculate current flow on link at runtime.

Next protocol is LB-SPR; Load balanced shortest path routing using OSPF with the help of two phase forwarding mechanism. It optimized for arbitrary traffic pattern. When a packet arrives to its source router it will forward the packet to next intermediate router with the help of current load on the link along with the preference of shortest path. Suppose the packet arrives from node S1 to intermediate node S4.S4 will check whether the load on link S4 ->S9 is more. If not then packet directly send s to S9 otherwise it will change the next intermediate node, which link does not have traffic. Likewise this protocol forwards the packet in two phases. First phase is from source node S1 to intermediate node S4 and second is from intermediate node S4 to destination node S9. Process of changing next intermediate is happening on each intermediate node. The major consideration is to find out next intermediate node with the consideration of current load on link [4].

At last will see the next protocol which is DEFT: Distributed exponentially weighted flow splitting. This is link based protocol with the database synchronization is major issue. Consider the same example. S1 is source and S9 is destination. The S1 has total three links so it will split the traffic in three parts towards the destination. DEFT will not think much more about shortest path. In DEFT utilization is more but problem regarding required delay of packets to reach destination.

Network	**Description**
Open Shortest Path First(OSPF)	OSPF is a routing protocol for IP. It is a link-state protocol, as opposed to a distance-vector protocol. A link-state protocol makes its routing decisions based on the states of the links that connect source and destination machines.
Open Shortest Path FirstVersion2 and version3 (OSPFv3 and OSPFv2)	OSPFv3 expands on OSPFv2 to provide support for IPv6 routing prefixes and the larger size of IPv6 addresses.
Distributed Exponential Flow Splitting	The routers can direct traffic on non-shortest paths, with an exponential penalty on longer paths. DEFT leads not only to an easier-to-solve optimization problem, but also to weight settings that provably perform no worse than OSPF.
Penalizing Exponential Flow-splitting (PEFT)	In PEFT, packet forwarding is just the same as OSPF destination-based and hop-by-hop. The key difference is in Traffic splitting. OSPF splits traffic *evenly* among the shortest paths, and PEFT splits traffic along all paths but penalizes longer paths (i.e., paths with higher sums of link weights) exponentially

III. CONCLUSION

This paper proves that Optimal traffic engineering, in fact, can be achieved by link-state routing with hop-by-hop forwarding, and the right link weights can be computed efficiently, as long as flow splitting on non-shortest paths is allowed but properly penalized.

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We also show uniqueness of the exponential penalty in Achieving optimal TE Before concluding this paper, we would like to highlight that Optimization is used in three different ways in this paper. First and obviously, it is used when developing algorithms to solve the link-weight computation problem for PEFT.Sometimes a restrictive assumption in the protocol can be perturbed at low cost and yet turn a very hard network management problem solve efficiently. It can be achieved better TE and faster weight computation.

IV. ACKNOWLEDGEMENT

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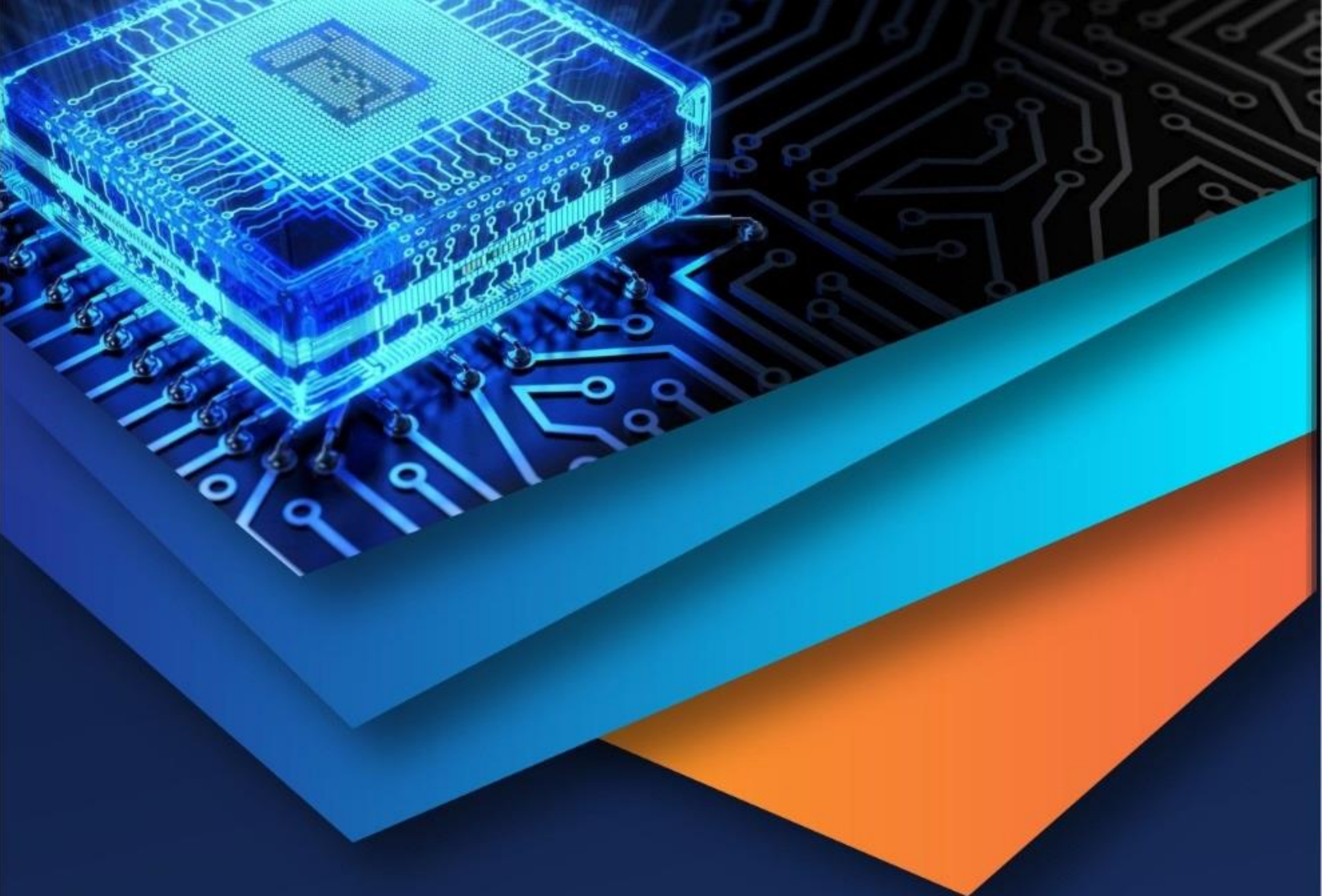

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