Pre-eminent Multi-path routing with maximum resource utilization in traffic engineering approach

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Abstract— *the main objective of the proposed system is providing optimal path and extreme utilization with link state routing. This aims to provide best contribution of traffic engineering with effective load balancing. Elimination of unwanted paths in the form of multiple parameter check with life time guarantee. Here unwanted paths which are which high cost is and which makes high delay over data transaction.This also aims at developing a better protocol which overcomes the problem and issues of PEFT routing. Providing effective traffic splitting without any congestion and overload is the main objective of the system.*

Keywords— traffic engineering, traffic delay, R-OFS.

I. INTRODUCTION

The decentralized network infrastructure is the main success of the internet which uses the bandwidth provisioning over hop by hop links carrying to the network core. In network there are several challenges has been identified such issues are utilization of network resources in traffic engineering approaches. Traffic engineering approaches facilitates data splitting and flow splitting over multiple paths. To effectively avoid congestion, delay and work load, there are several solutions has been proposed. The solutions are multipath routing, best path routing etc., multipath routing has been widely recognized as more efficient than single path routing. Multiple paths are configured between a pair of nodes, and then packets are split among these paths by using label switching or flow based hashing. In richly interconnected networks, multipath routing can provide load balancing, upsurge bandwidth(16)operation and lessen congestion. The next solution was the concept of equal cost multipath routing (ECMP), which selects path over a set of equal cost paths. For better performance link critically based ECMP routing has been proposed. This technique helps to select least link average utilization and hops for ECMPs. Mainly the ECMP based approaches used for load distribution and resource. In order to optimize and allocate traffic over non-uniform links the PEFT routing has been implemented. The PEFT routing simply discovers the path which provides high and optimal resource utilization.

TRAFFIC ENGINEERING:

The approach to traffic engineering has three main steps. Measure, model, and control (17)as illustrated in Fig 1. First, the operator needs to measure the network.0 topology and the offered traffic; second, evaluating possible settings of the link weights requires a way to predict how the IGP configuration affects the stream of traffic. Third, determining on the values of the loads, an automated system or a human operator needs to change the IGP configuration on one or more routers.

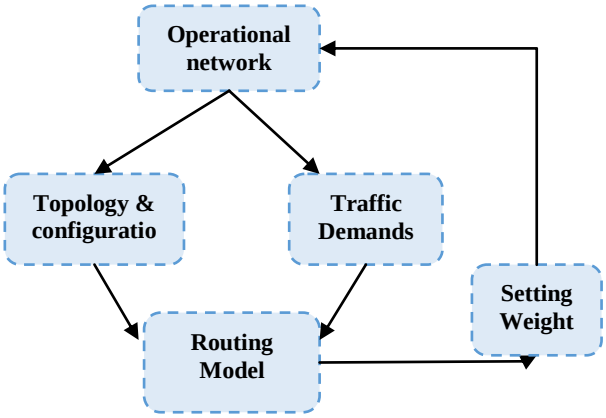


Fig 1: traffic engineering

ECMP:

Equal-cost multi-path (ECMP) is a routing technique for routing packets along multiple paths of the same cost. The forwarding engine identifies paths by next-hop. When forwarding a packet the router must decide which next-hop (path) to use [1].

PEFT:

The Penalizing Exponential Flow-spliTing (PEFT) [2] routing algorithm is just such a protocol which is a Traffic Engineering technique with hop-by-hop forwarding. The routers running PEFT make forwarding and traffic splitting decisions locally and independently of each other. Also, packets can be sentover [2] a set of unfit cost paths but the longer paths are punished based on total link weights along the paths.

Problem definition:

The current thesis formulates the problem of allocating traffic across multiple routing paths with the concern of traffic engineering and lossy network flow optimization problem.

ECMP fails to exploit increased path diversity that can be provided by traffic engineering techniques through the assignment of non-uniform link weights to optimize network resource usage. Traffic flow splitting based on the load is already defined in centralized and decentralized networks. The cost calculation and path finding based on the distance may arise several further problems.

Recent research on network measurement has confirmed that congestion happens even when average link utilization is low and ineffective. Therefore, Data Centres and normal networks are often over provisioned.

The routers running existing flow splitting algorithms make forwarding and traffic splitting decisions locally and independently of each other. Also, packets can be sent over [2] a set of unfit cost paths but the longer paths are punished based on total link weights along the paths.

Decentralized networks may suffer from insufficient access control and dynamic equal routing in order to limit high resource wastage. Every network topology has the link between every hop, the link of the two hops determines the available paths. The availability and cost should be pre calculated and analysed for data transmission selection over multipath routing.

II - EXISITNG METHODOLOGY

Equal-cost multi-path (ECMP):

Introduction:

One traffic engineering method is Equal Cost Multipath (ECMP) that enables the usage of multiple equal cost paths from the source node to the destination node in the network.

Equal-cost multi-path (ECMP) [1] is a routing technique for routing packets along multiple paths of equal cost. The sending engine finds paths by next-hop. When sending a packet the router [1] must decide which next-hop (path) to use.

Advantages:

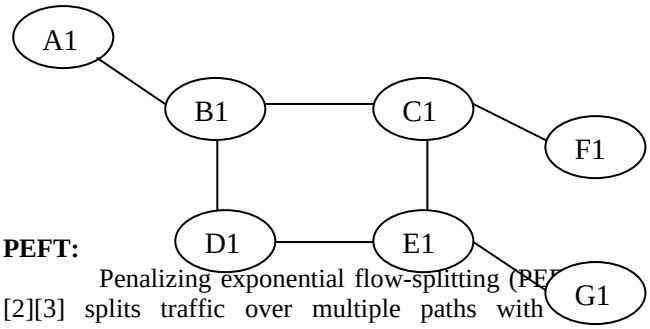
- The advantage is that the traffic can be split more evenly to the whole network avoiding congestion and increasing bandwidth.
- ECMP is also a security method, since during link flop, traffic flow can be transferred quickly to another equal cost path without severe loss of traffic.

Drawbacks:

- ECMP may not propose any actualbenefit over best-path routing.
- ECMP interrelateundesirably with new routing algorithms where the physical topology of the system varies from the logical topology.

ECMP routing technique:

In Equal Cost Multipath model, all links are observed as having identical weights, so no weights. For example the below diagram, A1needs to direct packet to G1. With shortest path algorithm A1mightdiscover both A1B1C1E1G1 and A1B1D1E1G1. A1be going toselect the first discovered one, assuming A1B1D1E1G1. Let's say if the block is on the link among B1 and C1, then B1 could select D1 as the beginning of an alternate path. But the disadvantage is:
1) if the congestion is between C1 and E1, then B1 will have no effective action to reroute.



PEFT:

Penalizing exponential flow-splitting (PEF [2][3] splits traffic over multiple paths with exponential penalty on longer path.

The PEFT algorithm performs two functions as follows:

- link-cost function
- link utilization function

III - PROPOSED METHODOLOGY

R-OFS PROTOCOL:

The **RELIABLE –OPTIMAL FLOW SPLITTING PROTOCOL** extends from the above PEFT technique. The proposed routing protocol performs the following functions with the additional parameters.It finds the traffic problem and its impact of packet delay by applying the probe concept.The protocol calculates the cost by considering the distance between hops and the three kind of delay. Finally it matches the throughput over multiple paths.

It proposes methods which allow individual network nodes to locally characterize the congestion and traffic impact which helps for the throughput declaration and aggregate this information for the source nodes.

About Protocol:

To overcome these limitations, have developed the Reliable Optimal Flow Splitting. R-OFS applies on-demand routing techniques to avoid traffic overhead and improve scalability.

The Presented is a reliable multipath routing protocol R-OFS based on flow splitting mechanism in network. This set up multi-level hierarchical cluster so that the traffic can be allocated reasonably in cluster head and acknowledged distributed to procure the congestion avoidance. It is also convenient to resume the lost packets by navigating the path with optimal link selection. In order to communicate properly, a reliable splitting mechanism based on local traffic information is proposed. With the definition of QoS descriptive vector *DV*, QoS multipath routing can be implemented by local QoS link selection and packet scheduling based on priority. Traffic aware multipath allocation using this reliability protocol enables the router to send data's effectively.

LINK-STATE ROUTING PROCESS:

The link state routing process for data centres. A link-state routing protocol runs in a single independent system. The AS can also be called the administrative domain because all routers are under the same operational administration. A router running the link-state routing protocol [4] sends link-state advertisements (LSA) to other routers. Each router builds a topology called a link-state database of the network based on information of the received LSAs and gives it as an input to the link-state algorithm such as Shortest Path First (SPF). The algorithm computes the shortest paths in the network. The shortest paths are then used in the building of the routing table for the router. The shortest path algorithm developed by Dijkstra is the topic of the following sections.

Proposed algorithm: link-state algorithm proposed:

This algorithm advertises information about the entire topology. Link-state routing works by having the routers tell every router on the network about its closest neighbours.

Dijikstra:

Djikstra's algorithm [5] solves the problem of finding the shortest path from the source to thedestination. One can find the shortest paths from a source to all points in a graph at a time, this problem is called single-source shortest paths problem.

DELAY ALGORITHMS:

The following steps represent the process involved in the delay calculation. The delay, which are categorized into three type. One is queuing delay, propagation and transmission delay over every link.

Queuing Delay:

The queuing delay is the period, a workdelays in a queue pending it can be completed. It can move from packet to packet. For example, if 100 packets reach at a blank queue at a time,the packet which one is first transferred will agonize no queuing delay, although the last packet transferred will suffer a comparativelyhuge queuing delay (it waits for the other nine packets to be transferred). Hence, when describing queuing delay, one normally uses statistical methods, such as regular queuing delay, change of queuing delay, and the chance that the queuing delay beats some specified value.

QUEUING DELAY

Declarations:

Q = Average time spent waiting in queue
T 1= Packet arrival time to the queue
T 2= Packet exit time to the queue

Formula: (calculation of queuing delay)

- Let **Q= T2-T1**

Transmission Delay:

Transmission delay is a task of the packet's length and it doesn't means the distance of a pair of nodes. This delay is relational to the packet's length in bits.

TRANSMISSION DELAY

Declarations:

D_T is the transmission delay
N is the number of bits, and
R is the rate of transmission (say in bits per second)

Formula: (calculation of transmission delay)

- Let$\mathbf{D_T = N / R}$

Propagation Delay:

Propagation delay is defined as the quantity of time it takes forsome number of bytes to be transferred through a node. Propagation delay is the space between the two nodes divided by the propagation haste.

PROPAGATION DELAY

Declarations:

P is Propagation delay
d is the distance (distance between two nodes)
s is the speed.

Formula: (calculation of propagation delay)

- Let **P = d/s**

Total delay is calculation of three types of delay. It's showed in fig1,

Total Delay = $P+D_T+Q$

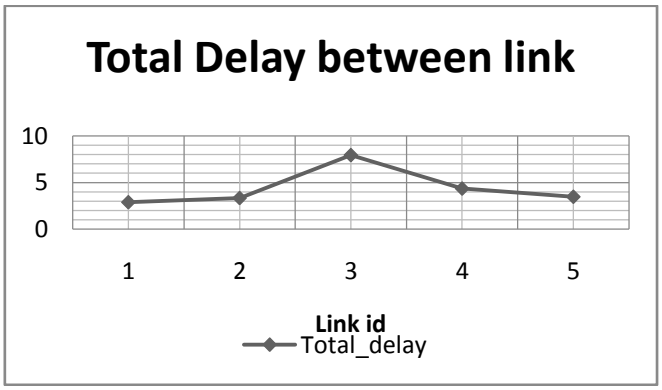


Fig 1: total delay

ROUTING ALGORITHM

Consider the transfer of a packet with the endpoint T at a node ni. To reduce the chance that packets [1] are snooped over anexact link, a randomization process for packet deliveries [6]. In this way, the earlier next hop HS for the source node S is recognized in the first stage of the procedure. Then, the procedureaimlesslychoose a nearby node in Cni

TwithoutHS as the next hop for the present packet transmission. The prohibiting of HS for the next hop [6] selection avoids transmitting two sequential packets in the similarconnection, and the randomized choose prevents assailants from simplyforecasting [6] routing paths for the coming transmitted packets.

The number of items in the history record for packet transfers to destination nodes is j nj [6] in the poorest case. In order to well look up the history record for anendpoint node, it preserves the past record for each node in a hash [6] table. Before the present packet is directed to its destination node, it must randomly collect a neighbouring node without the used node for the preceding packet. Once a neighbouring node is selected, by the hash [6] table, it wants Or1Þ to determine whether the selected neighbouring node for the present packet is the same as the one used by the earlier packet. Therefore, the time difficulty of probinganappropriate neighbouring node is Or1Þ.

IV –PERFORMANCE METRICES

QoSMetrices

The aim of QoS is to offerassurances on the capacity of a network to deliver expectedoutcomes. Components of network presentation within the scope of QoS [7]regularlycontain availability (uptime), bandwidth (throughput), latency (delay), and error rate.

Delay

Delaymentions to the distance of time needed to transfer a packet from source to destination over the internetwork. Delay build upon severalfeatures, as well as the bandwidth of intermediary network links, the port queues at every router beside the path, network blocking on all intermediary network links, and the physical distance to be moved.

Throughput

It mentions to exactly how many bits are actually transferred between two computers. It defines the actual measured bits per second that one computer can send to another at a particular time. The throughput rate may change over the time based on the current condition in the network.

The factors that impact throughput are type of data being transferred, protocols used to transfer data, the topology used and the network devices in the route being used.

Bandwidth

Bandwidth refers to the number of bits per second that can be sent by a device. Simply, it refers to the speed of the link. Bandwidth is a rating of the maximum attainable throughput on a link; routes through links with greater bandwidth do not necessarily provide better routes than routes through slower links.

End- To-End Latency

For every message, the period at which it was directed from source and the period at which this message reached in destination were recorded. **Middling end-to-end latency [7]** is the average value of over all the messages received at the destination.

Message Loss Rate

The fraction of the number of messages that be there not reached at the destination to the number of messages that be there sent from the source was the message loss rate.

V –IMPLEMENTATION AND RESULTS

Modules:

1. Network construction:

Client-server computing or networking is a distributed application architecture that partitions tasks or workloads between service suppliers (servers) and service supplicants, called clients. Often clients and servers operate over a computer network on separate hardware. A server machine is a high-act host that is running one or more server programs which share its resources with clients. A client also shares any of its resources; Clients therefore initiate communication sessions with servers which await (listen to) incoming requests. The followings are the parameters to construct a network.

- Node Name
- Host Number
- IP Address

2. Topology Construction:

Here it uses mesh topology because of its shapeless nature. Topology is built by receiving the names of the nodes and the connections between the nodes as input from the user. Thoughreceivingall of the nodes, their related port and IP address is also gotten. For sequential nodes, the node to which it should be connected is also established from the user. Though adding nodes, comparison will be done so that there would be no node duplication. Then it identifies the source and the destinations.

The node information consists of node names and the weight between them.

3. Routing scheme:

Routing protocols used in traditional wired and wireless networks are based on shortest path algorithm such as the Dijkstra's algorithm. Here the equal cost multipath technique has been proposed to identify and distribute the packets into equal cost paths, which will provide two advantages, one is load balancing and another one is path utilization. But the enhancement of the proposed system should also include the following considerations to calculate the delay.

4. Link-state routing

The basic conception of link-state routing is that every single node makes a plot of the link to the network, viewing which nodes are linked to which additional nodes. Every node then independently

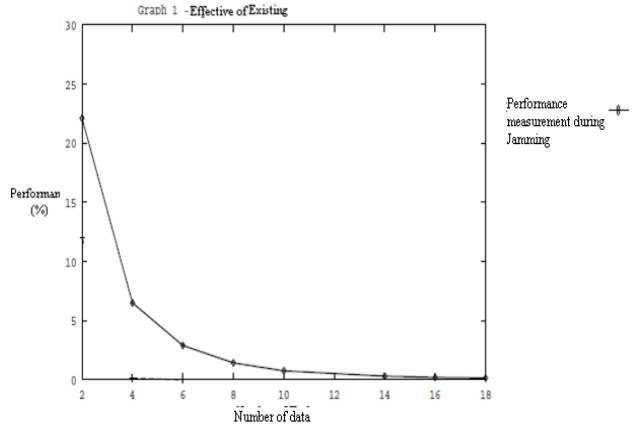
calculates the next best logical path from it to eachlikely destination in the network.

5. Message transmission:

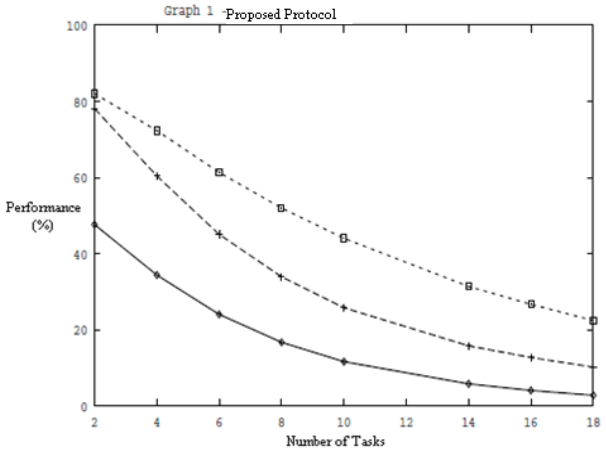
In this module it transmits the message from source to destination. Here choose a destination and select a shortest path for that destination. Shortest path is calculated by Dijkstra Algorithm. It will take minimum node cost an account to find the path between a source and destination. The shortest path is updated in the routing table. The source obtains the shortest path from the routing table itself. After receiving a message the destination will send an acknowledgement to the corresponding source.

RESULT:

The following figure shows the performance of the existing protocol. The measurement based on the number of packets and the performance has been measured by the percentage. The effective and the performance were high when the number of packets was low. When the congestion probability level increases the performance was reduced slightly is the main drawback to overcome those issues the proposed R-OFS protocol has been implemented.



Evaluation of Existing ECMP protocol



Evaluation of Propose congestion aware routing with R-OFS

VI. CONCLUSION AND FUTURE ENHANCEMENT

The proposed congestion aware routing has successfully implemented using R-OFS. In the system the probe concepts has been implemented to identify the reliability and efficiency of the path. There are several existing protocol tried to overcome the traffic engineering problem using the portfolio theory the existing system has implemented the theoretical based approach rather than the implementation. Due to optimality and inefficiency problem the proposed system has been implemented. The current system works well in the network environment which facilitates the effective congestion aware traffic allocation with the high reliability protocol.

I have studied the tricky of traffic distribution in multiple-path routing algorithms inbeing there of extraordinary traffic or congestion whose effect can only be characterized statistically. The thesis has offeredapproaches for every network node to probabilistically characterize the local effect of anactive congestion attack and for data sources to incorporate this information into the routing algorithm.

Priority based packet scheduling can further to abate the control overhead and network congestion. Propagation delay has calculated to identify the real traffic and congestion environment. The difference between the transaction and the propagation delay has considered in the thesis. Active network technique is introduced for Cluster-mesh-forward to distributed perform active packet acknowledgment and lost packet recovery.

This proposed work is implemented in mesh topology. In future work implement it to wireless network. There are various delay calculation, but the proposed system was implemented three delays. So will done the delay calculation using another delays.

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