CONGESTION IDENTIFICATION AND AVOIDANCE APPROACH TO INTERNETWORKING FOR TRAFFIC ENGINEERING MECHANISM

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ABSTRACT

The 21st century evolved with digital way of accessing the information and communication process because of revolutionary innovation in computation technology. Globally to the people the technology innovation provides a pass of move towards E-governance to M-Governance. In growing Asian countries the raising population and accessing level of multimedia element in the internet usage put up a bench mark in competition with the east in using internet facilities. As a result internet environment is gain with traffic fueling issues at their backbones. This research article proposes a method to solve traffic issue by identifying congestion corners and reactive routing using proposed Node Reputation Approach for internet service providers to avoid traffic fueling without altering the existing resources in use and also promote quality of service at Asian countries especially China, India, Japan, Taiwan, Malaysia, Singapore etc.

KEYWORD:

Internet backbone, Quality of service, Bayesian approach, congestion.

I. INTRODUCTION

Internet technology acts as a pseudo organs of human life in day to day activity. A short decade ago internet serves only as a global connect for communication process. As a steady revolutionary growth to the digital era in the beginning of 21st century gave birth to a giant child information and communication technology. Information and communication technology gives a new face to communication medium in the form of VoIP, social networking etc. The above stated fact ends with traffic fueling in internet backbone. Absence of central consortium to focus on internet backbone in worldwide scenario the service providers alters the existing resources by laying down link and increases the link capacity. Hence by identifying the above issues, this research article aims to solve the problem with effective way of utilizing the existing resources without any modification and proposing an effective way of traffic averting by constructing best algorithmic approach to the Traffic Engineering mechanism.

I.I Traffic fueling issues in the internet

The internet backbone is a collection of thousand autonomous systems with multiple ISP providers in our global network communication. Quality of service providing to internet in real world scenario is a key issue because the usage of internet is significantly rising in a multiple factor today. New technological adaption and absence of regulatory body is a big challenge to ensure quality of service. Rapid increase over multimedia application such as voice and video element also facilitate the customer to access over it leads to enormous traffic fueling especially in growing Asian countries. The Figure [1] taken from internet world statics report neatly represent increasing number of users in quarterly year basis indicates a change in the in traffic engineering mechanism for good quality and service.

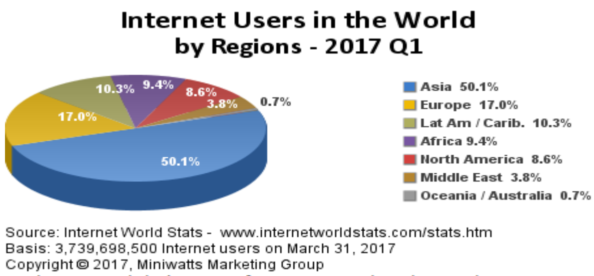

Figure 1: Statistical Report of Internet Users in Asian Continent

I.II Essential need for Quality of service in Asian Countries

Internet backbone for connectivity and communication exist at the behest of the users. We can classify the aspect in to two category user value and network operator value. User value relies on network transport in terms of latency, throughput and reliability. The network operator values lies in providing service to customer under specific constraints such as Quality of service and operational efficiency. In recent days the enriched density of multimedia content enforces internet backbone to surpass heavy traffic. The figure [2] an info graphic picture from CISCO VNI FORECAST for 2014- 2019, clearly forecasting traffic issues in the internet backbones. Considering all the facts here proposing anew logical approach instead of traditional method currently used in internet backbone that facilitate some considerable remedy and impact for traffic fueling problems.

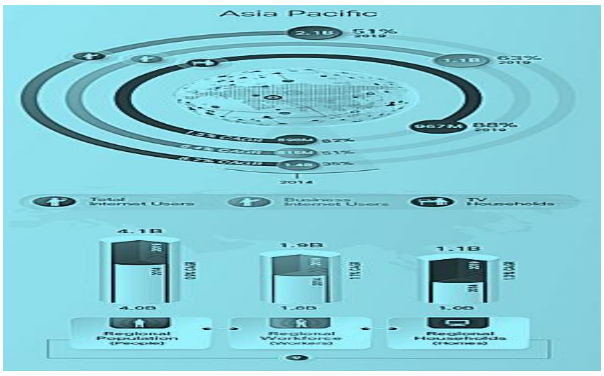

Figure 2: Cisco VNI Forecast Info graphic report

I.II.I Traffic Engineering

The solution for the traffic fueling issues is accomplished with Traffic Engineering Mechanism. Traffic Engineering mechanism deals especially with the issue of Performance evaluation and performance optimization of IP networks, Traffic engineering encompasses the application of technology and scientific principles to the measurement, characterization, modeling and control internet traffic. But historically, effective traffic engineering mechanism is difficult to achieve in real world working scenario. This is due to limited functional capability of conventional IP technology. By considering all the facts this research proposing an effective Traffic Engineering mechanism process for existing traffic issues.

II. EXISTING TRAFFIC ENGINEERING APPROACH

The conventional Traffic Engineering mechanism demonstrates with a simple network (shown in Figure [3]). The stated graph simulated with necessary traffic flows taken from the real world scenario.

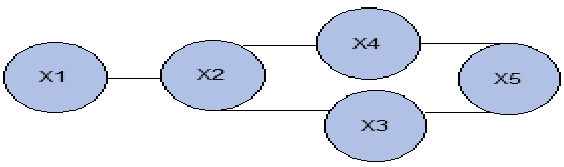

Figure 3: Sample Network Graph

The sample network simulated with necessary condition probability tables using successful traditional Bayesian approach contains needed parameter to find hot corner that causes traffic in the network. Node in the network are discrete then the conditionalprobability distribution represented as conditional probability trees, The Child is destined node and parent node is source nodes in simulation conventional systematic approaches.

The conditional probability Distribution for the node X1, X2, X3, X4, X5 is represented below,

<u>Case 1</u>: Node X1
Let for Node X1 the Values are,

P(x1=0) is of 0.5

P(x1=1) is of 0.5

<u>Case 2</u>: Node X2

The calculated value for X2 distribution(X2=0) & P(X2=1) are,

X1	**P(X2=0)**	**P(X2=1)**
0	1	0
1	0.01	0.99

Table: 1 Probability distribution table for X2

<u>Case 3</u>: Node X3

The Calculated Value for X3 distribution, P(X3=0) & P(X3=1) is derived as below.

X2	**P(X3=0)**	**P(X3=1)**
0	1	0
1	0.9	0.1

Table: 2 Probability distribution table for X3

<u>Case 4</u>: Node X4

The Calculated Value for X4 distribution, P(X4=0) & P(X4=1) is derived as below.

X2	**P(X4=0)**	**P(X4=1)**
0	1	0
1	0.1	0.9

Table: 3 Probability distribution table for X4

<u>Case 5</u>: Node X5

The Calculated Value for X5 distribution, P(X5=0) & P(X5=1) is derived as below.

X3	**X4**	**P(X4=0)**	**P(X4=1)**

0	0	1	0
0	1	0.01	0.99
1	0	0.2	0.8
1	1	0.01	0.99

Table: 4 Probability distribution table for X5

Calculating minimum congestion for conventional system using the below equation,

$$PR(R=v/i) = \frac{PR(i \quad R=v)\ PR(R=v)}{PR(i)} \qquad –[1]$$

In that PR(R=v/i) the above equation represent the probability of random variable “R” consist Value “v” with given indication “i”, Rather of routing the necessity over the congested routes, routes that suit current traffic necessity and capacity of the network are selected. Hence apply Bayes’ rule for conventional system simulation gives out with two possible route cases as results,

<u>Routing Path Case1</u>:

Route X1 →X2→ X4→X5

By using equation [1] traditional conventional system route path resulted with the congestion value of 0.991.

<u>Routing Path Case 2</u>:

Route X1 →X2→ X3→X5

By using equation [1] traditional conventional system route path resulted with the congestion value of 0.108.

The cases for congestion possibility to the Route X1 →X2→ X4→X5 are more congested when comparing with X1 →X2→ X3→X5. By the above stated process congestions are identified in the network for Traffic Engineering mechanism to the existing real world scenario.

II.I Drawbacks in Existing approach

i. The first drawback in the traditional approach is, it computes conditional probability distribution for the entire specified nodes in the network without considering topological structure. So the internet backbones size automatically increases for n node computing and number of Conditional probability distribution falls in a high ratio lead to complexity in nature.

ii. The N square problems to find the corners in the large internet backbones still a drawback for existing conventional approach

iii. Existing approach fails to find path failure in the network.

The above stated drawback in current scenario for Asian countries automatically resulted with a need for a new approach to solve Traffic Engineering issues and helps the user to explore the benefit of traffic free computing in the stated region.

III. PROPOSED APPROACH FOR TRAFFIC ENGINEERING

The proposed prototype identifies congestion corners with the physical topology as it is the case in the most enterprise networks. Therefore proposed approach constructed with keen observation from existing conventional approach drawbacks,

1) Congestion identification is the first process while framing the proposed approach in a way of restoring the operating state of the network at internet backbone operations to the urban areas of the Asian continent.

2) Congestion avoidance to the internet is the second objectives to operate internet backbones without congestion for Traffic Engineering mechanism.

Hence the proposed approach construct with two process of flows, first is to calculate the node value responsible for identification of congestion and second is to promote reactive routing for congestion avoidance problems in the internet backbones.

III.I Node Reputation Approach

Node Reputation Approach is aiming towards existing traffic problems in Asian countries. The goal of operational networks i.e. internet backbone is accomplished by identified congestion and routing traffic in a way to utilize network resource efficiently and reliably. Considering all necessary requirement the principle of Node Reputation Approach framed on identify the congestion corners with the physical topology instead of fully relaying on Conditional probability distribution. In this approach congestion corner is measured in terms of node reputation value in the network. The node value identified by using linear formulation process, when one link to other, it is effectively casting a vote for other node. The most voted node is a reputed node in the network. The reputed node posses with high numeric value i.e. Node Reputation value to indicate congestion occurrences in the network. Once congestion is identified the reactive routing process is initiated for traffic free routing. Node Reputation Approach comprises of two working modules for Traffic Engineering Mechanism.

Modules for Node Reputation Approach

1. Node Reputation Approach Value Computation
2. Node Reputation Approach Reactive Routing

III.II Node Reputation Approach Value Computation

This model computes the NRA Value (Node Reputation Approach Value) as an output and input in the form of Graph V= (N, L) featuring the IP networks, where N is set of nodes and L is the set of link. L in (k) and L ot(k), the number of edges throw in and out of the node k, from the above NRA value associated with each node in the network from that path selection to be decided. The NRA Value computation algorithm steps is shown below,

Node Reputation Approach Value Computation Algorithm

Step 1: The NRA value Compute starts with taking a directional graph with link and capacities represent as link k→m & m→k each with own capacity.

Step 2: To compute we are in need of some necessary variables they are as, k used to represent value NRA (k), α is a constant value between 0 & 1, β_k is the share of NRA value of node that link to k.

Step 3: While next is Simulating the graph for NRA approach, ST_ibe the source node and DT_ibe the destined node, i was the set of point to point demand.

Step 4: An initialization of elements of the matrix for NRA to 1.

Step 5: Then for each i value vary from 1 to 0 steps up by 1.

Step 6: To Compute NRA Value computing set β to zero.

Step 7: All nodes of m the edges (m,k) = 1 repeat then Add NRA(m)/ Lot(m) to β Next m.

Step 8: After that set NRA (k)-(1-α) =$\alpha\beta_k$ and go to step 5.

Step 9: return.

III.III Node Reputation Approach Route Selection Process

The Route selection module compute flows from source to destination identification as a first process. The path selection considers the NRA Value from the above algorithm for taking choice about path chosen to transfer data between source and destination. So here NRA route selection module deliver s a stated path needed to avoid congestion corners in internet backbone.

Node Reputation Approach Path Selection Algorithm

Step 1: Start the approach with stated graph already used for NRA Value Computation process.

Step 2: Initialize the NRA Value computation algorithm process to calculate the NRA Value of the node.

Step 3: Then simulate the node in the network for finding the Feasible Route FRT between the source and destination i.e. ST_itoDT_i .

Step 4: The next stage is of NRA Route selection fit with all feasible Route ∈ FRT.

Step 5: After feasible path allocation calculate $\sum_k$ NRA (k) for that k $\notin ST_i \& DT_i$.

Step 6: A check needed weather k ∈Route, NRA (k) > 0.

Step 7: If the stated condition for NRA (k) value is greater then go to Step 4.

Step 8: The last stage of the processing is of using selected the path with minimum $\sum_k$ NRA (k) value given by Computing Congest index (route) = $\sum_k$ NRA (k) where k is a node that present in Route and NRA (k)>0 and k $\notin ST_i$ & DT_i.

Step 9: Stop the process.

The size of the node in the internet backbones are non-predictable due to that NRA uses an approximate, Iterative computation of NRA values. It reflects each node is assigned with an initial startup value and NRA value for nodes are calculate in several computation circles based on the formulation stated in NRA approach.

IV. SIMULATION OF NODE REPUTATION APPROACH

The Node Reputation Approach efficiency is obtained by simulation process for various iterations. The graph taken for simulation is shown in Figure [4].The existing traffic flows in the network are listed below, NRA approach takes the exist traffic to identify congestion corners and calculated NRA value is also listed below. Each node is assigned a Start NRA value 1 and also a constant value 0.8 for good result.

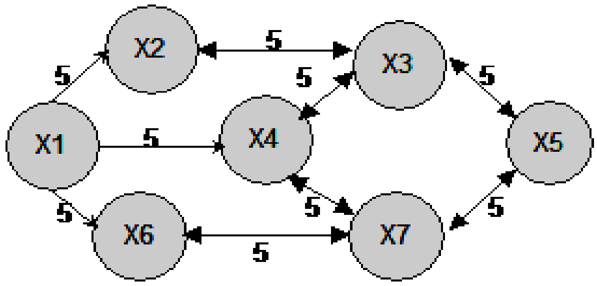

Figure:4 Graph for Proposed Approach

No of Iterations	NODE VALUES						
	X1	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**
0	1	1	1	1	1	1	1
1	0.1	0.7	1.8	1	0.7	0.7	1.8
2	0.1	0.7	1.4	1.2	1.1	0.7	1.4
3	0.1	0.6	1.7	1	0.9	0.6	1.7

Table: 5 Node Reputation Approach Values

Hence from the above tabled figures the X3 and X7 are most congested node in the network due to its high NRA value then X4 also having high Node Rep value. As a case arise a new flow from node X3→X1 the route selected are listed below as follows,

Route→ X3→X4→X1, X3→X2→X1,

X3→X4→X7→X6→X1.

FEASIBLE ROUTE	SIMULATION VALUE FOR NODE REPUTATION APPROACH
X3→X4→X1	NRA(X4) = 1
X3→X2→X1	NRA(X2) = 0.6
X3→X4→X7→X6→X1	NRA(X4+X7+X6) =3.4
X3→X5→X7→X6→X1	NRA(X5+X7+X6) =3.4

Table: 6 Node Reputation Value for Feasible Routes

So from the above case NRA approach selects route X3→X2→X1due to its low computing value compared to others. As a result NRA favors the data transmission from X3→X1only through X3→X2→X1 but in some cases the route derived may be long than the shortest available route. It simply gives a result that less queuing delay comparing shortest route. As a result the NRA favors value of node and chooses the route with minimum congestion value.

V. PERFORMANCE MEASUREMENT OF NODE REPUTATION APPROACH

The observation of Node Reputation Approach effectively indicates the congestion corners in the networks in an optimized way when compare with existing mechanism working in the real world scenario. It indicate the congest corners without knowledge of shortest route and network link weight but with assist of network topology. As an output it will perform well against route breakup, loopy routes and also overcome the N square issues. So it promotes the service provider by increasing link weight for the traffic fueling. It is a dual approach mechanism for finding the best route in a traffic fueling routes. Hence the quality of routing is improved in future perspective and also when we simulate the two approach for performance factor the observation shows positive sign towards the proposed approach for implementing in internet backbones. The result below obtained is carried out for number of traffic flows to average time taken for data transmission by both the approach.

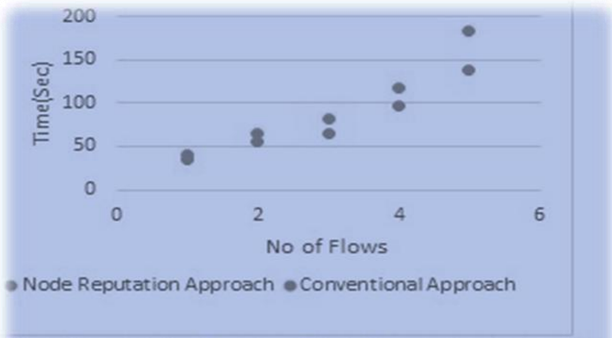

Fig 5: Comparision Results of Node Reputation Approach

VI. CONCLUSION

In Global point of view the Asian countries contributed half of world's total population widely participates in using internetworking facility in a high ratio. A recent survey by internet world statistics reporting that the Asian country contribution in using internet facility is about 48.2 % and remaining 51.8 % is rest of world. Beside this a survey report by ASEAN gives a statistical report that the average interne speed used in Asian country was 17.5 Mbps is on a rising mode recent days. Hence by observing all the facts our NRA approach simply reflects systematic process and mechanism of traffic fueling issues without increasing speed capacities by the internet service providers for the operational IP networks. The future scope of this approach with some prototype module modification it can be upgraded to Mobile Ad-hoc networks.

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