A Pattern Based Flooding In Distributed Network System

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Abstract - *Flooding is a familiar routing technique used for disseminating the information to all the other nodes in the distributed network systems such as internet and all-optical networks. Even though flooding is a simple and efficient technique, there are some potential problems such as LSA N-Squared problem, congestion problem associated with flooding. Even though Methods such as designing Hierarchal OSPF network, ODMRP, selective flooding have been proposed to reduce such problems, they do not have adverse effect on the network performance. In order to over come all the problems, an efficient technique called lazy flooding have been proposed in which all the messages are flooded only if the channel status reaches some threshold. Three lazy flooding methods such as threshold flooding, Fibonacci flooding, exponential flooding are proposed for analyzing and improving the network performance. We propose a new lazy flooding technique called logarithmic flooding in order to flood the messages and analyze the performance of the network.*

I. INTRODUCTION

All the network topology information should be constantly updated at each node in the network for correct routing decision to be made by each node for sending the packets from source to destinations .so, flooding plays a vital role for transferring the packets from source to destination. The following sections gives the areas in which flooding are implemented and reduced.

A. Hierarchical OSPF Network

In OSPF networks suppose if there are N routers in a network then each update of information requires an order of N^2 messages to be flooded leading to LSA N-Squared problem.
In order to overcome this problem hierarchical ospf network has been implemented in which the network is partioned into equal size areas and only limited numbers of messages are flooded [1].

B. Link bandwidth,, Router Memory and CPU Cycles

OSPF is based on link-state or SPF-based technique in which all the LSA’s are flooded throughout the network forming link-state database through which the router finds the shortest path.In order to maintain synchronization among the link-state database each router exchanges their LSA’s to each other for every 30 minutes there by increasing the size of the database which increases the link bandwidth and routers memory. If the network becomes large and number of routers in the OSPF network increases, it takes long time to calculate the shortest path there by CPU utilization is also increased [2].

C. QoS Routing

Another method for reducing the management traffic due to flooding is through network aggregation which may lead to increasing the inaccuracy of information .so an analytical model is developed for analyzing the impact of QoS Routing [3].

D. Partial Management Information

In order to asses the wavelength availability for comparing the performance and complexity a decision theory in applied [4].

E. Selective Flooding

Instead of flooding complete link state information which increases the complexity of the network we need to selectively diffuse the link state information based on the computation of preferred paths. This technique of selective flooding is used to reduce the flooding of messages [5].

F. Multicast Routing Protocols

When a message is multicasted from a source to destinations we may come across network delay, congestion problem.so, this flooding problem are also investigated in the multicast routing protocols [6].some of the procedures for reducing message overhead such as TTL protocol, Distributed spanning Join (DSJ) Protocols, Directed Reverse Path Join (DRPJ) protocols have also been proposed[7][8].

G.*ODMRP*

On demand multicast routing protocol is a multicast scheme for reducing the flooding of messages in Ad-hoc networks.ODMRP uses Scoped flooding technique in mesh topology [9].

H. *Two flooding methods*

Self pruning and dominant pruning are used to reduce redundant transmission in ad hoc networks [10].along with these messages two types of update policies have been proposed [11]. A closely related work is [12] in which relation between the link state information and the size and connectivity of the network topology is studied.

I. *All-optical networks*

In all-optical networks such as lucent lambda router [13] all the topology information is transmitted through a separate DCN. So, for a network with N nodes each channel status change results in an order of N^2 messages to be flooded via

DCN, and hence each light path set up needs an order of LN^2 messages to be flooded. Where L is the number of hops the lightpath.These flooding of messages may lead to network delay in response. The delay in response caused by flooding in the DCN of an all-optical network is even worse than that of internet.

When comparing optical networks and internet, all-optical networks we have separate channel for flooding resource information .these networks are sensitive to delay. In case of internet, it does not have separate path for flooding of messages and it gives prior knowledge about the data traffic which is very helpful for routing. In order to cope up with this type of problem a new technique called lazy flooding has been proposed.

J. Lazy Flooding

The concept of lazy flooding is to flood the information to all the other nodes only if channel status reaches some threshold value.

K. Lazy Flooding schemes

Three types of lazy flooding schemes have been proposed.

1) Threshold Flooding

If there are K number of channels, $0<T\leq K$, then number of available channels are flooded only if it is less then or equal to T.

2) Exponential Flooding

For geometric sequence of numbers above the threshold $0<T\leq g1\leq g2\leq \ldots\ldots\ldots gr\leq K$, then number of available channels is flooded if it is less than T or equal to gi.

3) Fibonacci Flooding

The number of available channels is flooded only if it is less than T or equal to any of values of fi ie $[0<T\leq f1<f2\ldots\ldots\ldots\ldots fr\leq K]$.

- *Merits of Lazy flooding*

a. It reduces the number of messages to be flooded as much as possible.
b. Unnecessary construction of light paths can be prevented.
c. The inaccurate link capacity information does not affect load sensitive light path computation.

- *Demerits of Lazy flooding*

a) Link blocking

Some times, due to lazy flooding remote nodes may think that channels are available for light path construction and starts constructing the light path which leads to link blocking.

In order to overcome link blocking a threshold value T has been set and all the messages are flooded only if the number of available channels is less than T.

b) Network Blocking

Some times, channels may be released in a link.but, remote nodes may think that there are no available channels and does not construct the light path. This situation blocks the network for a light path computation.

In order to overcome, the same concept of threshold has been used and blocking probability was shown to be negligible.

d. Discrepancy in link load
Some of the shortest path algorithms such as OSPF assign weight to each link for the computation, and the weight is determined by the link load [14].obviously, lazy flooding does not keep this information updated with each link status update for each OXC on the network.here, Threshold flooding is worst because there is no information when the link capacity is below a threshold.Fibonnacci flooding floods more than Exponential flooding when number of available channels is low.

e. Network global optimization
Due to lazy flooding all the nodes may not have the network topology and resource information.so, the over all light path computation is not optimized. Lazy flooding does not cause degradation in network overall performance.

II. MATHEMATICAL ANALYSIS

Here, we use a M/M/B queuing model. Let λ Request for channels follows a Poisson distribution and μ be Service rate of channels follows an exponential distribution.
B is the total capacity of the channels.
This model imposes a continuous time process {X (t)}.{X (t)}-consists of a set of number of used channels.In order to find the flooding probabilities a markov chain is used in {X (t)}.
Let {Tn} be the stopping time sequence, when ever OXC floods a piece of information

$$T_n=\min \{t>T_{n-1};\ X(t)\neq X(T_{n-1})\}$$

When n=1, 2, 3….
From the above equation we, infer that $x_n=X(T_n)$, n=0, 1, 2…Xn is the number of used channels at a stopping time sequence Tn. So, we find the number of available number of channels $C_n=B-x_n\leq L$. Cn is the number of available channels where B is total capacity, Xn is the number of used channels, L is threshold value .These available number of channels is flooded only if it is less than threshold or equal to any of the values of exponential or Fibonacci values.If Cn>L then, selective flooding is done.So for

A. Threshold flooding
   a. The number of available channels is flooded if $C_n\leq L$.

B. Exponential flooding
   a. The number of available channels is flooded if it is equal to one of the values bk.
   b. bk=k k=0, 1,….L
   c. bk=L+2pow(k-L) k=L=1….,K
   d. Where K=ceil (log (B-L)) +L

C. Fibonacci Flooding
   a. Cn is flooded if it is equal to one of the values of fk.
   b. Where,
   c. fk=k k=0,1…….L
   d. fk=fk-1+fk-2-L+3 k=L+1,L+2,….K.

We first find the stationary distribution of imbedded markov chain and we estimate the probabilities of these methods. In order to find stationary distribution of xn, we compute Transition probability of {xn} and then compute stationary distribution of {xn}.

So for ,

Threshold Flooding

Pt=pr {[ct≤L]}

Exponential Flooding

Pe=pr {uk [ct=bk]}

Fibonnaci Flooding

Pf=pr {uk[ct=fk]}

In All flooding each channel update is flooded at every time sequence Tn.So, the flooding probability is 1.To find out the average number of flooding of lazy flooding .we, first derive for All flooding and analyze for lazy flooding. While comparing lazy flooding with All flooding, lazy flooding has less probability than All flooding.

Here, we use $\rho=\lambda/\mu$ parameter along with threshold and flooding probabilities are compared.

a. If ρ is large then, a number of available channels are small there by flooding increases.
b. In worst case, all the three flooding probabilities have 85% savings.

Due to lazy flooding other nodes in the network does not know the exact capacity of the link. So, we find the mean and variance of the difference between the actual and flooded number of available channels to find out the information distortion.

So, these lazy flooding techniques has the following merits

a. It reduces the number of messages to be flooded as much as possible.
b. Unnecessary construction of light paths can be prevented.
c. The inaccurate link capacity information does not affect load sensitive light path computation.

III SIMULATION ENVIRONMENT

Discrete Event simulation is used to study the impact of different flooding schemes on network performance. In an NSF net,as shown in the Figure 1 we consider 14 nodes in a network and each link is bi-directional and has 20 channels. The request for channels follows a Poisson distribution and conformation for a path follows an exponential distribution .Rejection rate of request for channels is not more than 5%. Any of messaged is to be flooded after a constant flooding delay which is 0.5, 1….5 times of the connection requests.

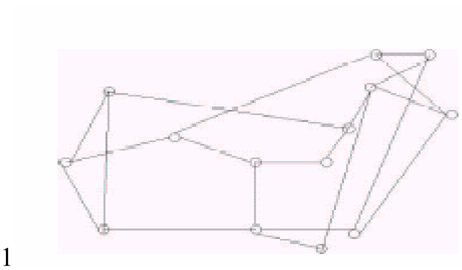


Figure 1

In lazy flooding we study these parameters

a. Network_block_rate
b. Flood frequency
c. Discrepancy block
d. *Network_block_rate*

Network block rate is the ratio of connections rejected to that of the connection request to the network so the network block rate is given as Network_block_rate=R/N

R=number of connections rejected.

N=number of connection requests to the network.

a. *Flooding frequency*

It is the ratio of the total number of floods generated by lazy flooding to that of all flooding.

It is used to measure the reduction in floods using lazy flooding.

a. *Discrepancy block*

Block rate resulted from inaccurate network information because of the difference in the available link capacity

a. Connection may be rejected because one or more links on a path may not have the capacity to accommodate such a connection.
b. Inaccurate database information may also lead to rejection of connection request.

For determining the shortest path we use two routing algorithms

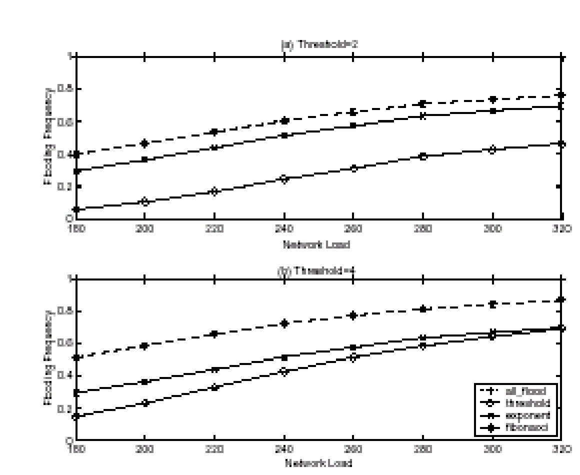
a. Insensitive to the link load
b. Sensitive to the link load

Here, we have the two algorithms to find the shortest path.

a. Algorithm1: Assigning weight=1 and finding the shortest paths.
b. Algorithm2: if the link weight is assigned as weight=pow(2*H+1)α

Where α=1-ct/B

H is the network diameter and link weight increases exponentially with traffic load and we find the shortest path. So the simulation result for Algorithm 1 and Algorithm 2 is given below



IV FUTURE ENHANCEMENT

In the proposed system any of the homogenous patterns such as logarithmic series will be mathematically analyzed and network performance will be improved. Here, in this proposed system, based on the number of channels available and used analytical model will be performed to show that these pattern based flooding has less probability when compared to that of All flooding. All the disadvantages of lazy flooding techniques proposed will be further reduced and improvise the performance of the network.

REFERENCES

[1]A.Aho and D.Lee,"Hierarchial Networks and the LSA N-squared problem in OSPF Routing,"GLOBECOM 2000, Nov 27-Dec. 1 San Fransico, CA
[2] J.T.Moy, RFC 1245, OSPF Protocol analysis", July 1991
[3]G.liu, c.ji and V.chen "network managementinformation for light path assement trade-off between performance and complexity."[4] H.Fujiniki and K.J.Kristensen," The Directed Reverse path Join (DRP) Protocol: An Efficient Multicast Routing Protocol," Computer mmunications, V24, 12, jul.15, 2001
[5]D.G.Kendall,"Some problems in the theory of queues, "Journal of Royal Statical Society, Serialb, p151-185
[6] s.deering and D.cherion,"Multicast Routing in Datagram internet works and Extended Lan,"ACM Transactions on computer Systems, B(2)May(1990)85-110.