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ADAPTIVE ROUTING IN COMMUNICATION NETWORKS USING CELL BREATHING BASED BACKPRESSURE ALGORITHM

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ABSTRACT

The internet has now played a vital role in transmitting the data through various networks such as wireline or wireless networks. These data are transferred from one node to another node through various networking devices such as bridges, switches, or routers.The implementation of Back-pressure algorithm requires each node to maintain per- destination queues to deliver the packet through different paths which leads to poor delay performance due to routing loops and involves high implementation complexity. A new routing algorithm is designed to minimize the average number of hops used by packets in networks which leads to delay reduction. The shadow queues are updated based on the movement of shadow packets in the network. An additional link called extra link activation is scheduled based on the queue length for transmitting the packets which will reduce the delays and queuing complexity at each node . This may leads to some delay performance and high complexities.

Keywords: Backpressure, Probabilistic Routing, Extra link

1. INTRODUCTION

Networking is the word basically relating to computers and their connectivity. It is very often used in the world of computers and their use in different connections. The term networking implies the link between two or more computers and their devices, with the vital purpose of sharing the data stored in the computers, with each other. The networks between the computing devices are very common these days due to the launch of various hardware and computer software which aid in making the activity much moreconvenient to build and use.When computers communicate on a network, they send out data packets without knowing if anyone is listening. Computers in a network all have a connection to the network and that is called to be connected to a network bus. What one computer sends out will reach all the other computers on the local network.For the different computers to be able to distinguish between each other, every computer has a unique ID called MAC-address (Media Access Control Address). This address is not only unique on your network but unique for all devices that can be hooked up to a network. The MAC-address is tied to the hardware and has nothing to do with IP-addresses. Since all computers on the network receives everything that is sent out from all other computers the MAC-addresses is primarily used by the computers to
filter out incoming network traffic that is addressed to the individual computer.When a computer communicates with another computer on the network, it sends out both the other computers MAC-address and the MAC-address of its own. In that way the receiving computer will not only recognize that this packet is for me but also, who sent this data packet so a return response can be sent to the sender. All computers hear all network traffic since they are connected to the same bus. This network structure is called multi-drop.

A computer network consists of a collection of computers,printers and other equipment that is connected together so that they can communicate with each other.These networks includeswired or wireless networks and the internet. Computer networks devices that originate,route and terminate the data are called network nodes. Nodes can include hosts such as server and personal computers,as well as networking networks. Two devices are said to be networked when a device is able to exchange the information with another devices. Computer networks differ in physical media used to transmit their signals,he communication protocols to organize the networks traffic the networks’s size,topology and organization intent.

A router is a networking device that forwards packets between the networks by processing the routing information included in the packet.The routing information contains the routing table.A backbone network is a part of computer network infrastructure that provides a path for exchange of information between different LAN's or subnets. A backbone can tie together device network within the same building across different building over a wide area. The routing is a process of selecting paths in network along which to send network traffic.Routing is performed through many kinds of networks such as circuit switching and packet switching networks. The packet switching networks routing directs packet forwarding(the transmit or logically addressed networks packet from their source forward their ultimate destination)through intermediate node.

These intermediate networks are routers, bridges, gateways, or switches. The forwarding packets usually suffer from limited performance. The routing process usually directs forwarding on the basis of routing table which maintain a record of the routes to various destinations. Thus constructing routing table which held in the router's memory for efficient routing.Most routing algorithm use only one network path at a time. Multipath routing techniques enable the use of multiple alternative paths. The routes are sorted in the routing table based on priority.

2. RELATED WORK

L.Tassiulas and A.Ephremides[1]The stability of a queueing network with interdependent servers is considered. The dependency among the servers is described by the definition of their subsets that can be activated simultaneously. Multihop radio networks provide a motivation for the consideration of this system. The problem of scheduling the server activation under the constraints imposed by the dependency among servers is studied. The performance criterion of a scheduling policy is its throughput that is characterized by its stability region, that is, the set of vectors of arrival and service rates for which the system is stable. A policy is obtained which is optimal in the sense that its stability region is a superset of the stability region of every other scheduling policy, and this stability region is characterized. The behavior of the network is studied for arrival rates that lie outside the stability region.

M.J.Neely,E.Modiano,C.E.Rohrs[2]A dynamic routing and power allocation for a wireless network with time varying channels. The network consists of power constrained nodes which transmit over wireless links with adaptive transmission rates. Packets randomly enter the system at each node and wait in output queues to be transmitted through the network to their destinations. We establish the capacity region of all rate matrices (λ_{ij}) that the system can stably support - where (λ_{ij}) represents the rate of traffic originating at node i and destined for node j.

A joint routing and power allocation policy is developed which stabilizes the system and provides bounded average delay guarantees whenever the input rates are within this capacity region. Such performance holds for general arrival and channel state processes, even if these processes are unknown to the network controller.Then apply the control algorithm to an ad-hoc wireless network where channel variations are due to user mobility, and compare its performance.

L.Bui,R.Srikant,A.L.Stolyar[3] Theback-pressure algorithm is a well-known throughput-optimal algorithm. However, its delay performance may be quite poor even when the traffic load is not close to network capacity due to the following two reasons. First, each node has to maintain a separate queue for each commodity in the network, and only one queue is served at a time.

Second, the backpressure routing algorithm may route some packets along very long routes. To address both of the above issues, and hence, improve the delay performance of the back-pressure algorithm. One of the suggested solutions also decreases the complexity of the queueing data structures to be maintained at each node.

L.Bui,R.Srikant,A.L.Stolyar[4]An extend recent results on fair and stable resource allocation in wireless networks to include multicast flows, in particular multi-rate multicast. The solution for multi-rate multicast is based on scheduling virtual (shadow) "traffic" that "moves" in reverse direction from destinations to sources. This shadow scheduling algorithm can also be used to control delays in wireless networks.

3. PROPOSED SYSTEM

Adaptive routing is modified to automatically realize the tradeoff with good performance.This routing algorithm is mainly designed to minimize the average number of hops used by packets in the network.The scheduling/routing and decoupling leads to delay reduction when compared with the traditional back-pressure algorithm.Based on the time-slot each node will transmit the packet from source to destination which will maintain a separate queue which is represented based on the queue length if particular link is not routed properly then it will activate another link based on on the routing table and transmit the the packet.Therfore,in this the performance is improved based on the shortest path routing.

All link are activated simulataneously without interfering each other.Therefore the minimum back-pressure algorithm reduces the delay by forcing the flows to go through shorter routes.The shadow packet arrive from outside the network and then exit the network.The shadow queues are updated based on the packet transmitted to the destination.The extra link activation is mainly used to add the additional links for transmitting the packet from peer-to-peer networks or broadcast.They ara updated based on the priority of the packets in the routing table The shadow queues are updated based on the movement of fictitious entities called shadow packets in the network. The movement of the fictitious packets can be thought of as an ex- change of control messages for the purposes of routing and schedule. Ashadownetworkisusedtoup-dateaprobabilisticroutingtablethatpacketsuseupona r-rivalatanode.Thesameshadownetwork,withback-pres-surealgorithm,isusedtoactivatetransmissionsbetwee nnodes.However,first,actualtransmissionssendpack etsfromfirst-in–first-out(FIFO)per-linkqueues,andsecond,potentiallymorelinksareactiv ated,inaddition tothoseac-tivatedbytheshadowalgorithm.Theroutingalgorithm isdesignedtominimizetheaveragenumberofhopsuse dbypacketsinthenetwork.Thescheduling/routingdec oupling,leadstodelayreductioncomparedwiththetra ditionalback-pres-surealgorithm.Eachnodehastomaintaincounters,call edshadowqueues,perdestination.Thisisdone by maintainingaroutingtableperdestination.

3.1 NETWORK COMMUNICATIONS

Computer networks use signals to transmit data, and protocols are the languages computers use to communicate.Protocols provide a variety of communications services to the computers on the network.Local area networks connect computers using a shared, half-duplex, baseband medium, and wide area networks link distant networks.Enterprise networks often consist of clients and servers on horizontal segments connected by a common backbone, while peer-to-peer networks consist of a small number of computers on a single LAN. The routers will used to transmit the packet from one node to another node.

3.2SYSTEM ARCHITECTURE

The data is transferred from source to destination through a particular transmission range which are scheduled based on the routing table. They are updated on the routing table entries and incremented by one. An additional link called extra link is activated for transmitting the data when its fails to reach the destination. Therefore these link will choose the shortest path to reach the destination which will improve the delay performance and minimize the longer paths. They are represented by token bucket where the packets which are reached the destination are stored in shadow queues

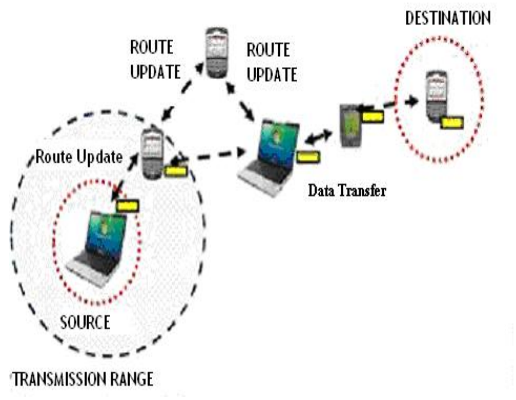

Fig.1 System architecture

3.3 BACKPRESSURE ALGORITHM

Consider time slot t,

INPUT:The packets injected by flow f are deposited into queues {s(f),d(f),H(f)} maintained at node s(f).

Step 1: The network first compute $\mu^*[t]$ that solves the following performance problem

$\mu^*[t]=\arg\max \sum \mu(m,n)P(m,n)[t]$

$\mu \in \tau \quad (m,n) \in L$

where μ is additional link-rate vector and $\mu(m,n)$ is rate over link(m,n)

Step 2: Consider link (m,n) if $\mu^*(m,n)[t]>0$ and $P(m,n)>0$ node m selects a pair of queues,say{m,d,k} and {n,d,k} such that

$Q\{m,d,k\}[t]-Q\{n,d,k\}[t]=P(m,n)[t]$

and transfer packets from queue {m,d,k} to queue {n,d,k} at rate $\mu^*(m,n)[t]$

OUTPUT: Packets transferred to destination for the given time slot t through shortest path and extra link activation.

4. IMPLEMENTATION

4.1 EXPONENTIAL AVERAGING

The concept of shadow queues, will partially decouple routing and scheduling. A shadow network is used to up-date a probabilistic routing table that packets use upon arrival at a node. The same shadow network, with back-pres-sure algorithm, is used to activate transmissions between nodes. However, first, actual transmissions send packets from first-in–first-out (FIFO) per-link queues, and second, potentially more links are activated, in addition to those activated by the shadow algorithm.The shortest path can be specified by using the various routing protocols.Therefore they are scheduled for a certain period to transmit the packet through routing table entries.They are mainly specified to discourage the unnecessarily longer paths.

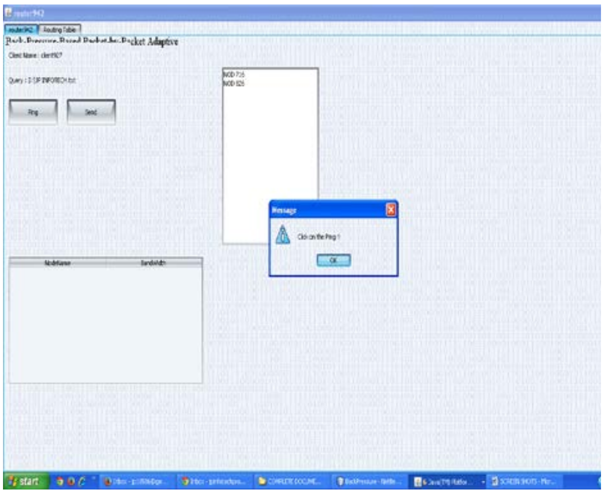

Fig.2 Creating two nodes 716 and 824

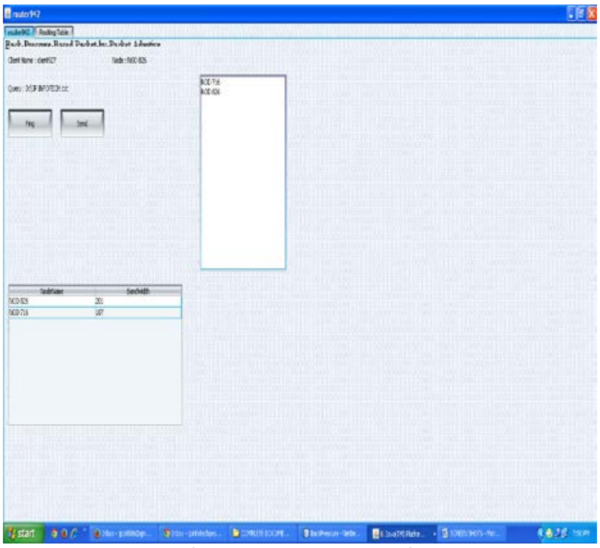

Fig.3 Identifying the Routing Information

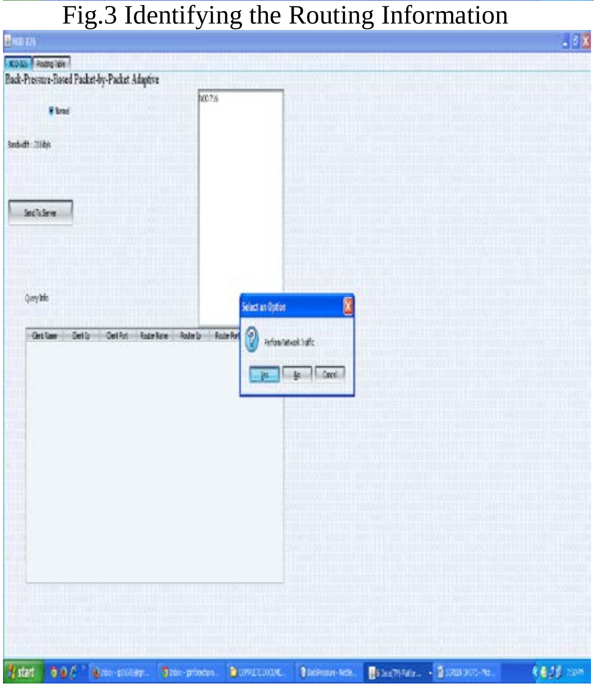

Fig.4 sending node824 to server

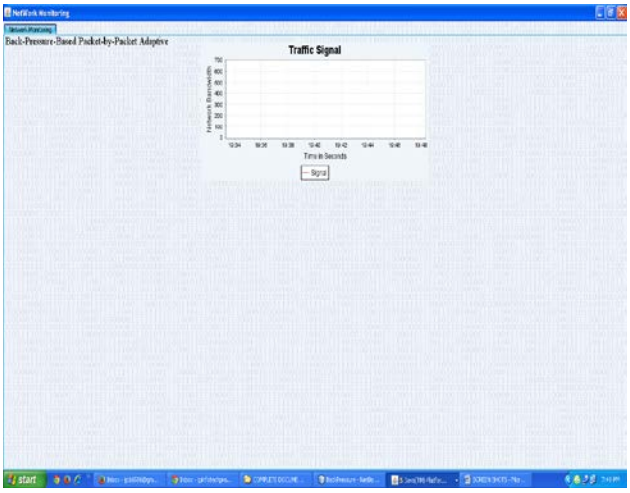

Fig.5 Determining the network traffic

4.2 TOKEN BUCKET ALGORITHM

The average shadow rate and generating random numbers for routing packets may impose a computational overhead of routers, which should be avoided if possible. At each node,for each next-hop neighbor and each destination, maintain a token bucket.These are performed by using a token bucket for transferring the packet from source to the destination.The packet which are transmitting are updated in the probability updater.Thearrivalrateof realpacketsisof coursesmaller.Thus, thedifferencebetweenthelinkcapacityandarrival ratecould beproportionaltoepsilon.

Thus, epsilon should be sufficiently large to ensure small delays while it should be sufficiently small to ensure that the capacity region is not diminished significantly.Each node will maintain a counters called shadow queues for transmitting the packet from source to the destination which are updated in the probabilistic routing table.

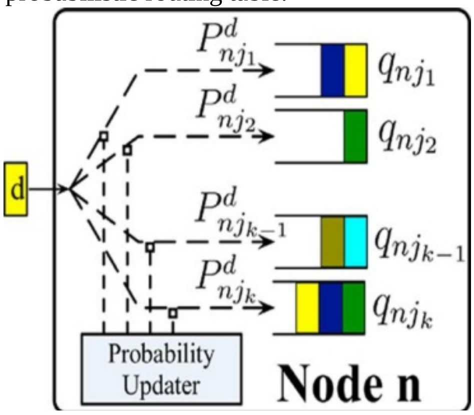

Fig.7 Packet transferring to the queues

4.3 EXTRA LINK ACTIVATION

Under the shadow back-pressure algorithm,

only links with back-pressure greater than or equal to M can be activated. The stability theory ensures that this is sufficient to render the real queues. On the other hand, the delay performance can still be unacceptable. Recall that the parameter M was introduced to discourage the use of unnecessarily long paths. However, under light and moderate traffic loads, the shadow back-pressure at a link may be frequently less than M, and thus, packets at such links may have to wait a long time before they are processed. One way to remedy the situation is to activate additional links beyond those activated by the shadow back-pressure algorithm.
Activatingextralinksthathavelargequeue back-logsleadstobetterperformancethanactivatingana rbitraryset ofextralinks.However,inthiscase,theextraactiva tionproce- duredependsonthestateofrealqueues.

4.4 CHOICE OF THE PARAMETER

The delay at each link to be inversely proportional to the mean capacity minus the arrival rate at the link. In a wireless network, the capacity at a link is determined by the shadow scheduling algorithm. This capacity is guaranteed to be at least equal to the shadow arrival rate. The arrival rate of real packets is of course smaller. Thus, the difference between the link capacity and arrival rate could be proportional to epsilon. Thus, epsilon should be sufficiently large to ensure small delays while it should be sufficiently small to ensure that the capacity region is not diminished significantly.

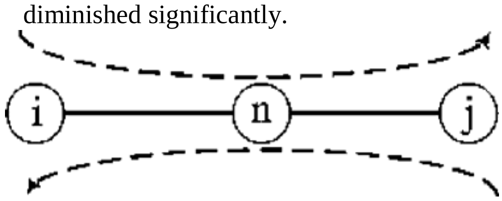

Fig.8 The link representing the arrival rate of node i and node j

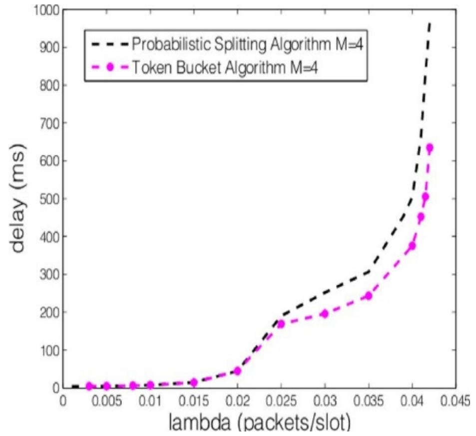

Fig.9 Determing the delay performance

5. CONCLUSION

Thus the packets are routed from source to destination by using probabilistic splitting algorithm and token bucket algorithm which will improve the delay performance and reduce the low implementation complexities through the shortest path. The packet which are transferred are updated in probabilistic routing table. Therefore an extra link called extra link activation is introduced to route the packets from one node to another node based on the priority.

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