Mobile Prediction Assisted Back-Pressure-based Routing in Communication Networks

Arun C P
M. Tech Dept. of CSE
NSS College of Engineering
Palakkad, Kerala, India

Usha K
Associate Prof. Dept of CSE
NSS College of Engineering
Palakkad, Kerala, India

ABSTRACT
The study suggests a back-pressure based communication network process. To make the best communication between the source and destination, system introduces mobile prediction and a light-weight routing algorithm. The mobile prediction algorithm facilitates knowing where a particular mobile node will be located in a near future time. The routing algorithm makes use of packet pointers so as to reduce processing overload and space. As a result this provides the better performance in delay, routing success ratio and accuracy.

Keywords
Mobile Prediction, Back-pressure, Routing

1. INTRODUCTION
The back-pressure algorithm introduced in early seventies has been widely studied [1][2]. The powerful consideration for this is that the routing algorithm can lead to comparative poorer delay action made to routing loops. Furthermore, the concept of the back-pressure algorithm needs every node to preserve per-destination queues that can be demanding for a wire line or wireless router. Motivated by these considerations, re-examine the back-pressure routing algorithm in this paper and design a new algorithm that has much superior performance and low implementation complexity.

2. PROPOSED SYSTEM
To avoid the problem in existing system, system performs the concept t of packet pointers. To update a probabilistic routing table that packets use upon arrival at a node the shadow network can be used. Also a similar shadow network, with back-pressure algorithm, is accustomed to turn on transmission between nodes. Here it uses the FIFO scheduling. Routing algorithm is created to minimize the mean number of hops used by packets in the network. This idea, forward the scheduling/routing decoupling, leads to put off reduction compared with the traditional back-pressure algorithm. Each node has to declare counters, called packet pointers, via destination. This is very identical to the aspect of keeping a routing table per destination. However, the original queues at every node are per-next-hop queues in the fact of networks that do not hire network coding. When network coding is in a job, per-previous-hop queues may be inevitable, but this is a prerequisite established by network coding, not by our algorithm. The algorithm can be applied to wireless networks. Widespread simulations show expressive advancement in slow execution compared to the back-pressure algorithm.

2.1 The Algorithm
In this paper, we address the high delay and queuing complexity issues. The computational complexity issue for wireless networks is not addressed here. We simply use a graph-theoretic based algorithm. The algorithm requires the same queue structure that the back-pressure algorithm uses. It also calculates the back-pressure at each link using the same way. The difference between these two algorithms only lies in the methods to pick a schedule. Let be the set of links within the interference range of link including itself. At each time-slot, the algorithm picks a link with the maximum weight first and removes links within the interference range of link. Then, it picks the link with the maximum weight in the updated set, and so forth. Additionally, the algorithm reduces computational complexity with a price of the reduction of the network ability location. While these studies point out that there can be some reduction in throughput owing to use of new algorithm in certain special network topologies, it appear to execute accurately, and so it can be taken here for simulations. The back-pressure algorithm explores all paths in the network and, as a result, may choose paths that are unnecessarily long, which may even contain loops, thus leading to insufficient action[2][3][5][7]. We discourse this problem by recommending a cost function that measures the total amount of resources used by all flows in the network. Specially, we add up traffic loads on all links in the network and use this as our cost function. The main target is to reduce this cost subject to network capacity constraints..

2.2 Mobile prediction algorithm
Here we give an overview of the mobile prediction algorithm used to predict the future location of a mobile node. The locality of a mobile node can be identified from the cell information in case of a communicating device such as mobile phone. Additionally, we can make use of location services like GPS to get a more accurate value.

The mobile prediction algorithm presented here uses a graph-theoretic approach to predict the future location of a node. Mathematical models are made use to find repeating patterns in mobile node activity. In addition to this, the signal strength and GPS location variation are used to identify the movement of a node. This information gives a rough picture about the direction of node movement. This, when combined with graph based prediction, gives a location prediction that is at acceptable range.

In case of an ad-hoc network such as a WiFi link, it is difficult to track the location due to unavailability of cell information. In this case, we rely upon the GPS module of the system, if present. If no GPS module is present, the node is skipped from applying the mobile prediction algorithm.

2.3 The Queuing Algorithm
The system uses a queuing algorithm to effectively propagate packets through intermediate nodes [4][9]. The algorithm is designed in such a way that it avoids congestion in nodes, while not compromising on packet processing speed. Normally, real packets are queued in a node before processing. This approach requires considerable amount of

space as well as processing time. The reason is that an entire packet is being queued. Instead of this, we use an approach in which pointer to a packet is queued, rather than the real packet itself.

The use of packet pointer makes it easy to carry out the process of queuing since the entity is very small. Once queuing is done using pointers, real packets are processed as per the order of pointers. Although the processing power requirements of packets remain same as that of a normal approach, queuing phase becomes easier and less complex.

2.4 Adaptive Routing Algorithms

Now we discuss how a packet is routed once it arrives at a node [3][9][10]. Let us define a variable to be the number of shadow packets "transferred" from node to node for destination during time-slot by the shadow queue algorithm. Let us denote by the expected value of, when the shadow queuing process is in a stationary regime; let denote an estimate of, calculated at time. At each time-slot, the a packet arriving at node for destination is inserted in the real queue for next-hop neighbor with probability

$$P^d_{nj}[t] = \frac{\hat{\sigma}^d_{nj}[t]}{\sum_{k:(nk)\in\mathcal{L}} \hat{\sigma}^d_{nk}[t]}.$$

Thus, the estimates are used to perform routing operations: In today's routers, based on the destination of a packet, a packet is routed to its next hop based on routing table entries. Instead, here the number of shadow packets is used to probabilistically choose the next hop for a packet. Packets waiting at link are transmitted over the link when that link is scheduled.

2.5 Advantages of Proposed System

The adaptive routing algorithm can be modified to automatically realize this tradeoff with good delay performance. The routing algorithm is designed to minimize the average number of hops used by packets in the network. This essence, progressive with the routing decoupling, leads to defer reaction compared with the traditional back-pressure algorithm. Also, the mobile prediction algorithm suggested helps to predict the mobile node location effectively, thereby making the network traffic control easier.

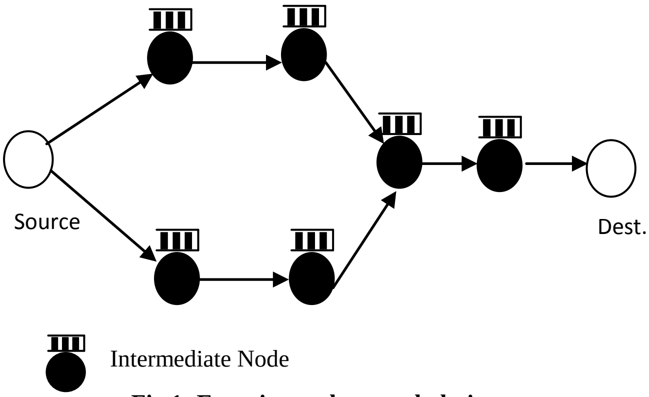
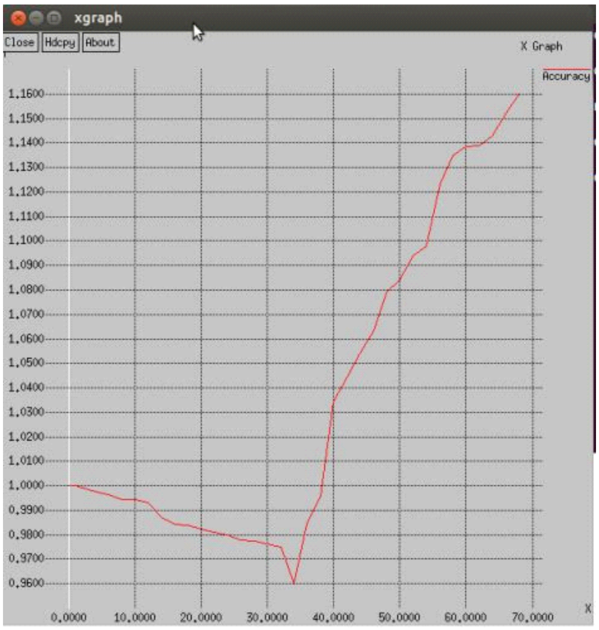


Fig 1: Experimental network design

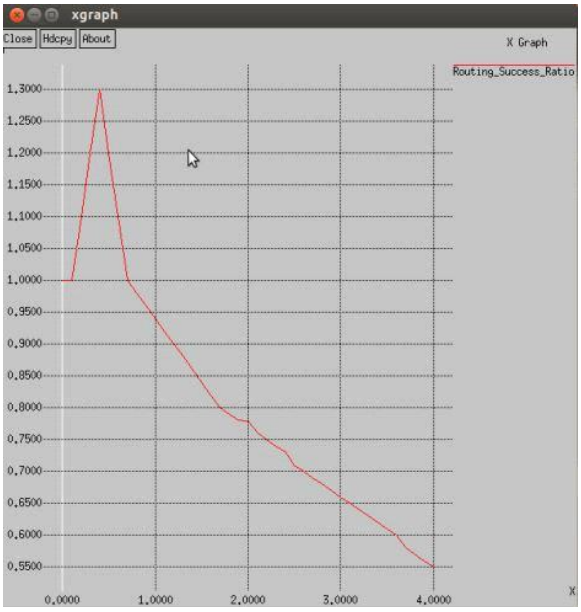
3. RESULT

Results can be summarized as follows:



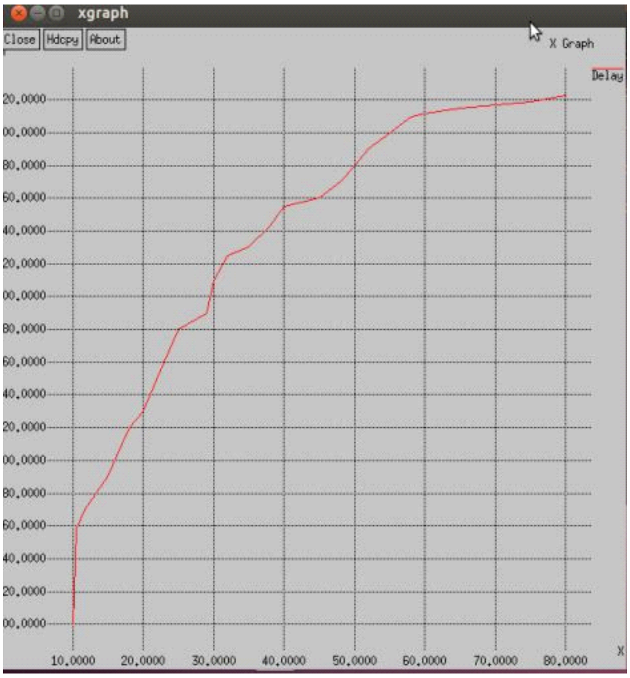
3.1 Accuracy

From the graph, it can be seen that accuracy of the packet delivery varies highly. At the point of starting, the accuracy level is maintained at 1. When congestion occurs, the accuracy level deteriorates and reaches up to 0.96. Once the system starts to build the back pressure and re-establish the route, the accuracy is regained. It now raises upto 1.16. This shows that the back pressure technique is highly reliable in view of accuracy of packet delivery



3.2 Routing success ratio

Routing success ratio indicates the rate of successful delivery of packets at destined node. A higher value of routing success ratio indicates poor delivery of packets, and vice versa. From the graph, it can be seen that the ratio stands at 1 at the start time, but when congestion occurs, the ratio will rise, indicating poor packet delivery. But, once the system regains the route by back pressure technique, the ratio starts to lower, which indicates strong packet delivery.



3.3 Delay

As evident from the graph, the delay of packet delivery increases with time. This delay keeps on increasing even after the system recovers from congestion. This indicates that back pressure is causing some performance problem by delaying the packet delivery.

4. CONCLUSION

The study proposes a back-pressure based routing for communication networks, which effectively de-couples the scheduling and routing algorithm of the legacy back-pressure algorithm. Also, the concept of shadow queue introduced here considerably reduces the queue buffer size needed at each node. This model also reduces the memory requirement of each node. The mobile prediction algorithm adds the capability of mobile node prediction. The system thus combines the advantage of legacy back-pressure algorithm along with the advantage provided by mobile node prediction.

5. REFERENCES

[1] L. Tassiulas and A. Ephremides, “Stability properties of constrained queueing systems and scheduling policies for maximum throughput in multihop radio networks,” IEEE Trans. Autom. Control, vol. 37, no. 12, pp. 1936–1948, Dec. 1992

[2] Eleftheria Athanasopoulou, LocX.Bui, Tianxiong Ji and R. Srikant,“Back-Pressure-Based Packet-by-Packet Adaptive Routing in Communication Networks,” IEEE/ACM transactions on networking, vol. 21, no. 1, february 2013

[3] L. Bui, R. Srikant, and A. L. Stolyar, “Novel architectures and algorithms for delay reduction in back-pressure scheduling and routing,” in Proc. IEEE INFOCOM Mini-Conf., Apr. 2009, pp. 2936–2940.

[4] L. Bui, R. Srikant, and A. L. Stolyar, “A novel architecture for delay reduction in the back-pressure scheduling algorithm,” IEEE/ACM Trans. Netw., vol. 19, no. 6, pp. 1597–1609, Dec. 2011.

[5] L. Bui, R. Srikant, and A. L. Stolyar, “Optimal resource allocation for multicast flows in multihop wireless networks,” Phil. Trans. Roy. Soc., Ser. A, vol. 366, pp. 2059–2074, 2008.

[6] L. Ying, S. Shakkottai, and A. Reddy, “On combining shortest-path and back-pressure routing over multihop wireless networks,” in Proc. IEEE INFOCOM, Apr. 2009, pp. 1674–1682.

[7] S. Katti, H. Rahul, W. Hu, D. Katabi, M. Medard, and J. Crowcroft, “XORs in the air: Practical wireless network coding,” Comput. Commun. Rev., vol. 36, pp. 243–254, 2006.

[8] M. Effros, T. Ho, and S. Kim, “A tiling approach to network code design for wireless networks,” in Proc. Inf. Theory Workshop, 2006, pp. 62–66.

[9] H. Seferoglu, A. Markopoulou, and U. Kozat, “Network coding-aware rate control and scheduling in wireless networks,” in Proc. ICME Special Session Netw. Coding Multimedia Streaming, Cancun, Mexico, Jun. 2009, pp. 1496–1499.

[10] S. B. S. Sengupta and S. Rayanchu, “An analysis of wireless network coding for unicast sessions: The case for coding-aware routing,” in Proc. IEEE INFOCOM, Anchorage, AK, May 2007, pp. 1028–1036.