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Backpressure with Adaptive Redundancy Mechanism for Networks in Overload

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***Abstract*— To utility maximization in networks where the sources do not employ flow control and may consequently overload the network. In the absence of flow control at the sources, some packets will inevitably have to be dropped when the network is in overload. To overcome the problem by proposing the new method called receiver based flow control method. At first develop a distributed, threshold based packet-dropping policy that maximizes the weighted sum throughput. Next, we consider utility maximization and develop a receiver-based flow control scheme that, when combined with threshold-based packet dropping, achieves the optimal utility. In the flow control scheme creates virtual queues at the receivers as a push-back mechanism to optimize the amount of data delivered to the destinations via backpressure with adaptive redundancy (BWAR), mechanism. It is the novel hybrid approach that remove redundant packets via a timeout mechanism, and that improve energy use. The simulations confirm that BWAR outperforms traditional backpressure at low load, while outperforming back pressure routing schemes at high load.**

***Index Terms*—BWAR, Threshold based packet dropping policy, DTN.**

I. Introduction

Flow control in data networks aims to provide fair allocation of resources and regulate the source rates of traffic flows in order to prevent network overload. In recent years, network utility maximization problems have been studied to optimize network performance through a combination of flow control, routing, and scheduling, whose optimal operations are revealed as the solution to the utility maximization problems. Most studies in network flow control focus on source-based algorithms that require all sources to react properly to congestion signals such as packet loss or delay. However, in the presence of a greedy or malicious source that injects excessive traffic into the network, the throughput of other data flows may be adversely affected or even starved. In such scenarios, source-based flow control may be ineffective.

The problem of maximizing throughput utilities in a network is considered, assuming that all traffic flows do not employ flow control and may overload the network. Flows are categorized into classes so that flows in a class have a shared destination. A class may simply be a flow specified by a source–destination pair, or corresponds to a subset of flows that communicate with a common Web site. A utility function is assigned to each traffic class, and the sum of the class-based utilities is maximized as a means to control the aggregate throughput of flows in each class. The use of class-based utility functions is partly motivated by the need of mitigating network congestion caused by a collection of data flows whose aggregate throughput needs to be controlled. Without flow control at the sources, some packets will be dropped when the network is overloaded. To provide differentiated services to multiple traffic classes, we consider the scenario where the destinations can perform flow control to regulate the received throughput of each traffic class. The question we seek to answer is how to design in-network packet dropping and receiver-based flow control strategies to maximize the sum of class-based utilities and stabilize the network.

In order to resolve the delay inefficiency of backpressure, we propose a novel hybrid approach, an adaptive redundancy technique for backpressure routing, that yields the benefits of replication to reduce delay under low load conditions, while at the same time preserving the performance and benefits of traditional backpressure routing under high traffic conditions. This technique, which we refer to as backpressure with adaptive redundancy (BWAR) ,essentially creates copies of packets in a new duplicate buffer upon an encounter, when the transmitter's queue occupancy is low. These duplicate packets are transmitted only when the original queue is empty. This mechanism can dramatically improve the delay of backpressure during low load conditions for two reasons: (1) with multiple copies of the same packet at different nodes, the destination is more likely to encounter a message intended for it; (2) the algorithm builds up gradients towards the destinations faster and reduces packet looping.

The additional transmissions incurred by BWAR, due to duplication, utilize the available slots which would otherwise go idle, in an effort to reduce delay. This offers a more efficient way to utilize the available bandwidth during low load conditions. In order to minimize the storage resource utilization of duplicate packets, ideally, these duplicate packets should be removed from the network whenever a

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copy is delivered to the destination. Since this may be difficult to implement (except in some kinds of networks with a separate control plane), a practical timeout mechanism is proposed and evaluated for automatic duplicate removal. We also introduce an energy-efficient variant of BWAR in which the number of copies of each packet is bounded.

In [1] an alternative, highly agile approach called backpressure routing for Delay Tolerant Networks (DTN) is considered, in which routing and forwarding decisions are made on a per-packet basis. Using information about queue backlogs, random walk and data packet scheduling nodes can make packet routing and forwarding decisions without the notion of end-to-end routes. To the best of our knowledge, this is the first ever implementation of dynamic backpressure routing in DTNs.

In [2], the problem of optimal scheduling and routingis considered in an ad-hoc wireless network with multiple traffic streams and time varying channel reliability. Each packet transmission can be overheard by a subset of receiver nodes, with a transmission success probability that may vary from receiver to receiver and may also vary with time. We develop a simple backpressure routing algorithm that maximizes network throughput and expends an average power that can be pushed arbitrarily close to the minimum average power required for network stability, with a corresponding tradeoff in network delay. We then show that the optimal packet commodity to transmit at each network node can be determined by a backpressure index that compares the current queue backlog of each commodity to the backlog in the potential receivers. Once a packet from this optimal commodity is transmitted, the responsibility of forwarding the packet to its destination is shifted to the receiver node that maximizes the differential backlog. Responsibility is retained by the original transmitter if no suitable receivers are found on a given transmission attempt.

II. PROPOSED SYSTEM

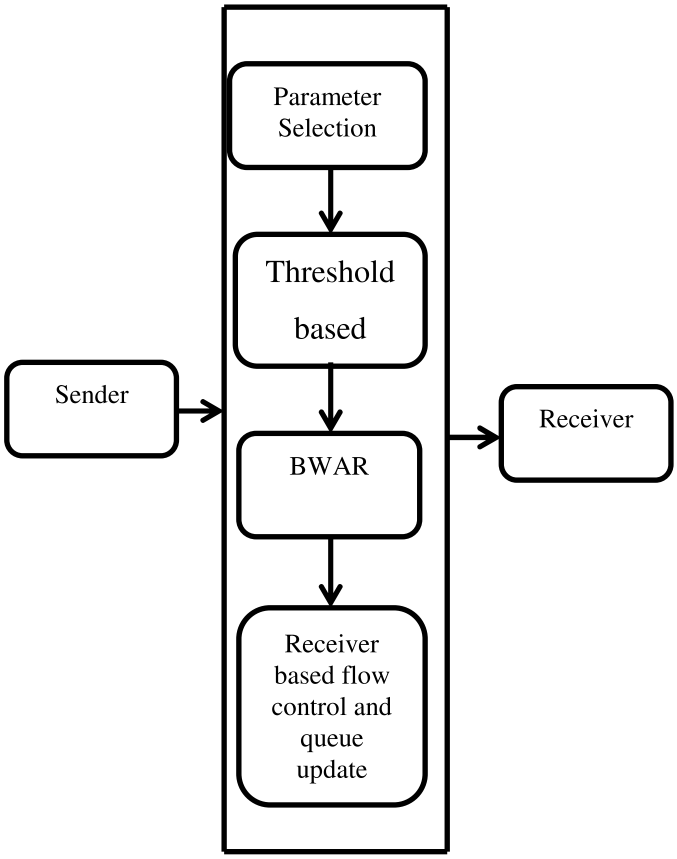

Fig.1. Control Policy

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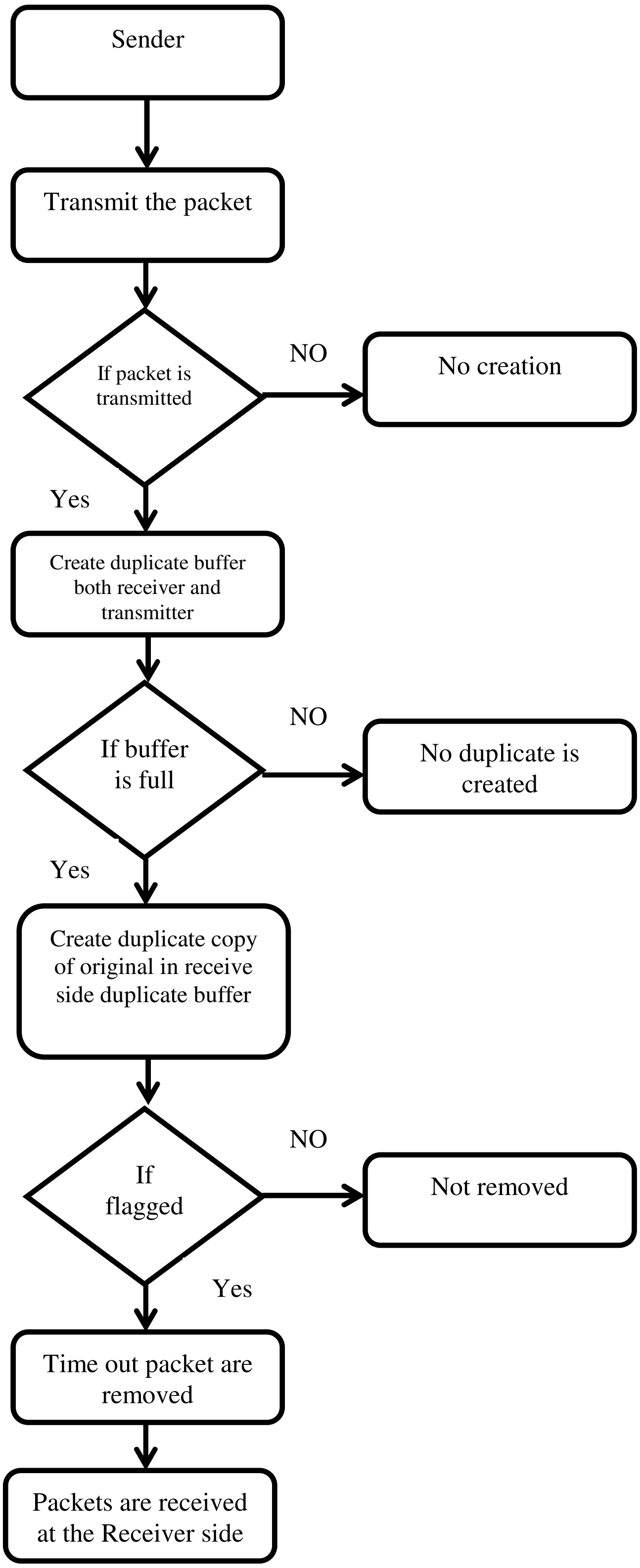

A. Control policy:

The control policy that solves the general utility maximization problem. It has two main features. First, we have a packet-dropping mechanism discarding data from the network when queues build up. An observation is that, in order to optimize throughput and keep the network stable, we should drive the packet-dropping rate to be equal to the optimal queue overflow rate. Second, we need a flow controller driving the throughput vector toward the utility-optimal point.

Parameter Selection:

We choose the positive parameter Vmax, w, V,Q and {ɵc,cɛ C}. Let ε> 0 be a small constant that affects the performance of the UORA policy. We need the parameter of Vmax to satisfy $\nu_{\max} \geq \max_c r_c^* + \epsilon/2,$ where the r_c^* is the solution to the utility maximization for a given exogenous arrival rate vector $(\lambda_n^{(c)})$. This choice of Vmax ensures that the virtual queue can be stabilized when its arrival rate is the optimal throughput . choose the parameter of w value which is calculated by $w \triangleq (\epsilon/\delta_{\max}^2)e^{-\epsilon/\delta_{\max}}$ .Finally we choose the ɵc value , this vlue must be satifid the $h'_c(x) = g'_c(x) - \theta_c \leq 0$ for x>0.

Threshold based packet dropping:

The threshold based packet dropping policy allocate the packet dropping rate at the queue $Q_n^{(c)}(t)$. The packet dropping rate is calculated by the following formula

$$d_n^{(c)}(t) = d_{\max} 1_{[Q_n^{(c)}(t) > D_n^{(c)}(t)]}$$

Where dmax>0 is a constant chosen to satisfy the condition $d_{\max} \geq A_{\max} + \mu_{\max}^{\text{in}}$. $A_{\max} + \mu_{\max}^{\text{in}}$ is the largest amount of data that can arrive at a node in a slot and is an upper bound on the maximum queue overflow rate at any node. In this method ensures that the maximum packet dropping rate d max is no less than the maximum queue overflow rate, so that we can always choose packet-dropping rates to stabilize the network. The Activity diagram is shown in Fig.3.

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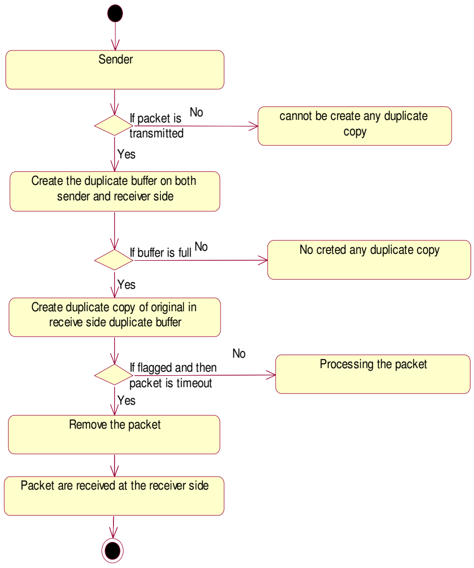

Fig.3. Activity Diagram

III. SYSTEM STUDY

A. *FEASIBILITY STUDY*

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.
Three key considerations involved in the feasibility analysis are

- ♦ ECONOMICAL FEASIBILITY
- ♦ TECHNICAL FEASIBILITY
- ♦ SOCIAL FEASIBILITY

B. *ECONOMICAL FEASIBILITY*

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

C. *TECHNICAL FEASIBILITY*

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

D. *SOCIAL FEASIBILITY*

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

IV. CONCLUSION

To utility maximization in networks where the sources do not employ flow control and may consequently overload the network. In the absence of flow control at the sources, some packets will inevitably have to be dropped when the network is in overload. To overcome the problem by proposing the new method called receiver based flow control method. At first develop a distributed, threshold based packet-dropping policy that maximizes the weighted sum throughput. Next, we consider utility maximization and develop a receiver-based flow control scheme that, when combined with threshold-based packet dropping, achieves the optimal utility. In the flow control scheme creates virtual queues at the receivers as a push-back mechanism to optimize the amount of data delivered to the destinations via backpressure with adaptive redundancy (BWAR), mechanism. It is the novel hybrid approach that remove redundant packets via a timeout mechanism, and that improve energy use. The simulations confirm that BWAR outperforms traditional backpressure at low load, while outperforming back pressure routing schemes at high load.

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