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ANALYSIS OF MIMO NETWORKS WITH PERFORMANCE CONSIDERATIONS

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Abstract— In wireless networks, designing the distributed scheduling algorithm to achieve the maximal throughput is a challenging problem because of the complex interference constraints among different links in networks. Maximal-weight scheduling (MWS) algorithm is also throughput-optimal, but it is difficult to implement in the distributed wireless networks. And to get the maximal throughput we use the distributed greedy protocol like IEEE 802.11,but we does not get the maximal throughput with these protocol . So here we implement the distributed CSMA(carrier sense multiple access) algorithm to get the maximal throughput. And this CSMA algorithm is combined with congestion control to get maximum utility and fairness of the competing flows. The distributed CSMA is a modular MAC layer algorithm and this can be combined with different protocols in the various layers like transport and network layer etc... to get maximum throughput and the resource utilization in the wireless networks.

Keyword: CSMA, maximum throughput, congestion control, utility, joint scheduling

INTRODUCTION

We have addressed the question of providing maximum throughput by using distributed scheduling, which has the open problem. For that we consider a simple distributed scheduling strategy i.e. Maximal Scheduling and prove that it attains a guaranteed fraction of the maximum throughput region in distributed wireless networks. The maximum throughput is depends on “interference degree” of the network which is the maximum number of sessions that interfere with any given session in the network and do not interfere with each other. Depending on the nature of communication, transmission aggressiveness, propagation models and the guaranteed fraction can be lower bounded by the maximum number of link degrees in underlying topology, or even by constants that are independent of the topology. The guarantees fraction also holds in wireless networks with multicast communication and different number of frequencies.

On the other hand, a number of low-complexity but suboptimal scheduling algorithms have been proposed in the literature. By using a distributed greedy protocol similar to IEEE 802.11, [9] shows that only a fraction of the throughput region can be achieved (after ignoring collisions). The fraction depends on the network topology and interference relationships. Different from Maximal Scheduling, the Longest-Queue-First (LQF) algorithm [10] takes into account the queue lengths of the nonempty queues. It shows good throughput performance in simulations. In fact, LQF is proven to be throughput-optimal if the network topology satisfies a “local pooling” condition [10],or if the network is small [13]. In general topologies, however, LQF is not throughput-optimal, and the achievable fraction of the capacity region can be characterized as in [10].

In wireless networks, it is important to efficiently utilize the network resources and provide fairness to competing data flows. We design the Medium access control (MAC) protocol for wireless networks through the network utility maximization (NUM) framework. The network-wide utility maximization problem was formulated, using the collision/persistence probabilistic model and aligning utility with total social welfare. By adjusting the parameters in the utility objective functions of the NUM problem, we can also control the efficiency and fairness of radio resource allocation. For that we develop two distributed algorithms to solve the utility-optimal random-access control problems.

METHODOLOGY

To get maximum throughput and utility maximization in the wireless networks here I implement the CSMA algorithm. In that

A. Here consider the general interference model. Assume there are K nodes in the network, where each node is an ordered (transmitter–receiver) pair. The network is associated with a conflict graph (or “CG”, G= {v,e}), where v is the set of vertices (each of them represents a link) and e is the set of edges. If there is an edge between nodes then those two nodes can't transmit at the same time. This model includes the “node-exclusive model” and “two-hop interference model” mentioned as two special cases. Assume that the network has independent sets (“IS,” not confined to “maximal independent sets”), denote the IS by a vector.

B. CSMA protocol

This model makes two simplified assumptions. Those are

(1). It assumes that if two links conflict, because of their simultaneous transmissions would result in incorrectly received packets, then each of the two links hears when the other one transmits. In the (2)nd assumption, this sensing is instantaneous.

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Consequently, collisions can be avoided. The (1) assumption implies that is there no hidden nodes (HN). This is possible if the range of carrier-sensing is large enough.

The (2) nd assumption is violated in actual systems because of the finite speed of light and of the time needed to detect a received power. Since the detailed balance equations hold, the CSMA Markov chain is time-reversible. In fact, the Markov chain is a reversible “spatial process,” and its stationary distribution is a Markov random field. (That is, the state of every link is conditionally independent of all other links, given the transmission states of its conflicting links.).

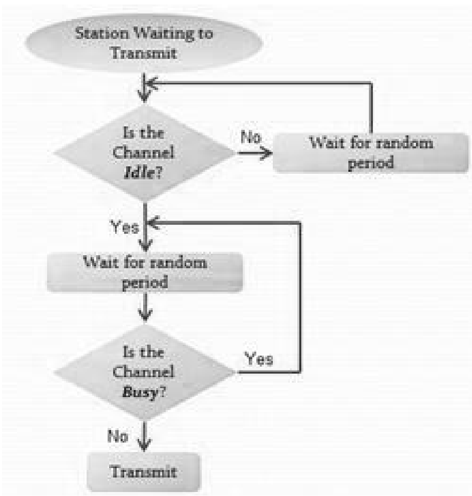


Fig 1: Flow chart for the CSMA algorithm in wireless networks

Here (i).carrier sensing scheme is used.

(ii).If a node want to transmit the data then first listen to the channel for predetermined amount of time whether or not the another node is transmitting the data within the wireless range. If the channel is sensed as busy then the node is waiting for the random period of time. If the channel is sensed as idle then the node transmits the data to the destination through that channel.

(iii).The state of the channel is idle or busy which is depend on the CS mechanism.

In that three algorithms are implemented.

(1).Adjusting the Transmission aggressiveness depending on the queue length.

(2).combine the scheduling and congestion control.

(3).Enhancing the TA for reduces the queue delays.

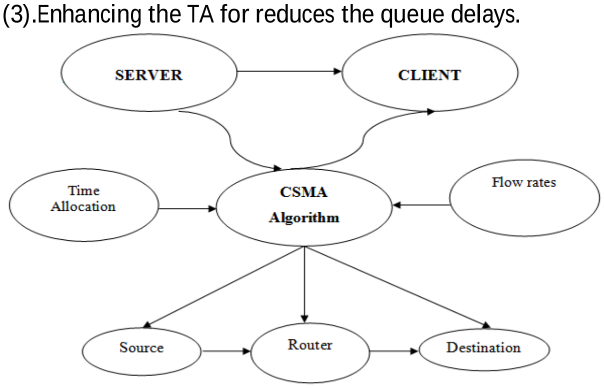
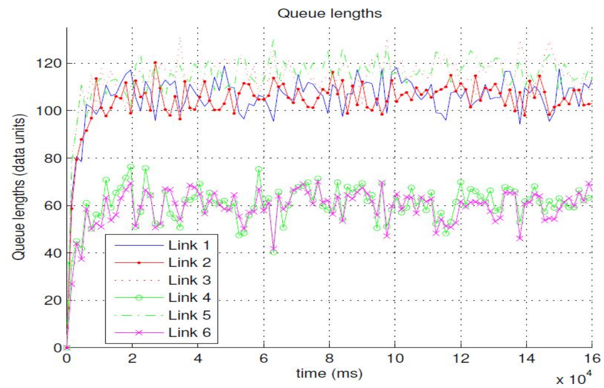


Fig 2: Data flow Diagram

The key to the CSMA algorithm is adjusting the transmission aggressiveness depends on the queue length or link weight.

RESULT

Depending on Queue lengths we can adjust the TA; Because of that we get the maximum through put in the Distributed wire less network.



DESIGN ANALYSIS

A few recent works proposed throughput-optimal algorithms for certain interference models. Each node only uses its local information (e.g., its backlog). No explicit control messages are required among the nodes. It is based on CSMA random access, which is similar to the IEEE 802.11 protocol and is easy to implement. Time is not divided into synchronous slots. Thus, no synchronization of transmissions is needed.

In the present system efficiently utilize the network resources and provide fairness to competing data flows .By sensing time to not zero, the back off time is usually chosen to be a multiple of mini-slots, where each mini-slot cannot be arbitrarily small. We have combined that algorithm with congestion control to approach the maximal utility and showed the connection with back-pressure scheduling .Reducing the queuing delay. Approaching the Utility by using Joint Scheduling and Congestion Control algorithm.

CONCLUSION

Here we proposed a distributed CSMA scheduling algorithm and showed that, under the idealized CSMA, it is throughput-optimal in wireless networks with a general interference model. We have utilized the product-form stationary distribution of CSMA networks in order to obtain the distributed algorithm and the maximal throughput. Furthermore, we have combined that algorithm with congestion control to approach the maximal utility and showed the connection with back-pressure scheduling. The algorithm is easy to implement, and the simulation results are encouraging.

The adaptive CSMA algorithm is a modular MAC-layer component that can work with other algorithms in the transport layer and network layer. For example, it is

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combined with optimal routing, any cast, and multicast with network coding. We also considered some practical issues when implementing the algorithm in an 802.11 setting. Since collisions occur in actual 802.11 networks, we discussed a few recent algorithms that explicitly consider collisions and can still approach throughput optimality.

Our current performance analysis of Algorithms is based on a separation of time scales, i.e., the vector is adapted slowly to allow the CSMA Markov chain to closely track the stationary distribution. The simulations, however, indicate that such slow adaptations are not always necessary. In the future, we are interested to understand more about the case without time-scale separation.

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