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EVALUATION TO ANALYSIS FIND THE SCHEDULING IN LEAST INTERFERENCE EFFECT ALGORITHM BASED ON MANET

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Abstract – Scheduling enables concurrent reception and cancellation of interference, which minimizes the computational complexity. The scheduling avoids traffic demands for the receiver. We proposing heuristic algorithm for rectify the traffic demands and path loss. The algorithm based on the Interference Effect of the link. We use Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) for avoid collision while transmission between multiple transmitter and single receiver. We simulate the algorithm in Wireless Mobile Ad-hoc Network with lower computational complexity.

Index terms - MANET, scheduling, Interference effect, CSMA/CA.

1. NTRODUCTION

Planning in ad hoc wireless networks determines the groups of transceiver pairs, i. H. Connections to be activated at a specific time. The interference model used in concurrent connection activation specifies both the design and the performance of the scheduling algorithm. An interference avoidance model that allows a receiver to decode only one transmission at a time by considering all other transmissions as interference has been widely used in connection planning algorithms. If the neighboring programs overlap in time, a collision occurs and the reception is unsuccessful. However, the scheduling algorithms that avoid such overlaps in time and space limit the capacity of ad hoc wireless networks. The interference cancellation model aims to solve this problem by allowing multiple transmissions in the same neighborhood simultaneously by decomposing all the signals in a composite signal at the receivers. Among many interference suppression techniques, SIC appears to be the most promising due to its simplicity, overall system robustness, and existing prototypes. SIC is based on decoding and subtract the signals in train from the composite received signal, starting with the strongest signal, assuming that the SINR is above a threshold in each stage. SIC improves the performance of wireless networks by allowing simultaneous reception and interference suppression operations. The scheduling algorithms projected for SIC-based wireless networks moreover use the Column Generation Method (CGM) or extend the protocol interference model previously used for interference-based communication. CGM- based heuristic algorithms are based on the decomposition of the Linear Linear Programming (LP) problem with an exponential number of variables, where each variable represents the time that a subset of links, the Restricted Master Problem (RMP), and the Price Issue (PP). The RMP starts with only a small subset of the possible join sets and may contain new join sets that match the solution of the PP. The exponentially complex PP is approximated by a greedy heuristic algorithm or simulated annealing. However, CGM-based heuristic algorithms still exhibit exponential worst-case complexity due to the possibility of an exponential number of iterations.

TDMA (Time Division Multiple Access), with only one communication scheduled at a time, has regularly been used as conflict-free scheduling in interference-free wireless entry- level multiple access networks. Although simple and easy to implement, TDMA results in suboptimal channel utilization because it does not exploit the capability of multiple transmission detection. On the other hand, SIC-based single hop multiple right of entry wireless networks still require an efficient scheduling algorithm because in practice a receiver node can only decode a certain number of transmissions simultaneously.

In this paper, we study the throughput performance of a CSMA based uplink WLAN with a SIC technique under path loss, Rayleigh fading and log-normal shadowing by developing an analytical model. To make the analytical model tractable under the physical interference model, we consider a simplified CSMA protocol instead of the detailed CSMA/CA protocol of IEEE 802.11 standard. The objective is to quantify the throughput gain obtained from the SIC technique and provide some insights on the impact of parameters of network and wireless channel on the performance of SIC technique. We consider a single channel and single rate WLAN.

This algorithm is based on decomposing the original problem into the Restricted Master Problem (RMP) and the Pricing Problem (PP) and iteratively generating the variables of the RMP based on a greedy heuristic algorithm that approximates the exponentially complex PP. Heuristic CGM- based heuristics have been proposed for frequency-controlled fixed rate and ultra- wideband (UWB) adaptive rate networks. Although the main structure of the RMP in our proposed algorithm is similar to the formulation of the PP, the heuristic algorithm proposed for PP is different due to the requirement to include the decode order of concurrent transfers in SIC-based networks. The main innovations of this paper are the proposal to use CGM in the planning of SIC-based networks, the proposal of the heuristic algorithm after the proof of the hardness of the CGM method and the proof of the superior performance of the proposed CGM-based heuristic algorithm compared to the previously proposed methods.

The aim of this letter is to propose a novel efficient heuristic scheduling algorithm with the aim of minimizing the time required to meet the given traffic requirements of the links, defined as the schedule length, in SIC based ad hoc wireless networks. To meet networks. The proposed algorithm is based on the successive integration of the feasible connections into the planned connection set.

2. SYSTEM MODEL AND ASSUMPTIONS

The system model and assumptions are given as follows:

The ad hoc wireless network includes L- directed links. Link i have traffic demand from fi packets. The connection traffic requirements may either be for single-hop networks or calculated using end-to-end traffic requirements in a multi-hop network with predetermined routing.

A central controller executes the scheduling algorithm based on the given network topology, the traffic requirements, and the channel properties of the links. This centralized framework can be used in the communication of the most static routers with bandwidth requests, which typically change slowly over time in wireless mesh networks (WMNs), or as the upper limit to the performance of a distributed algorithm.

A typical multi-user communication scenario of an uplink synchronous CSMA with a pair of cooperating users, e.g. {1, 2}, .. {k, i}, .., {K-1, K} and base station receiver {d} system using the proposed cooperative scheme. The time is partitioned into frames that are further subdivided into time slots. The traffic demand may be defined as either the number of packets to be transmitted in each frame or calculated as detailed from the long-term average data transmission rate.

The transmission power and rate of the connections are the same for all connections in the network. Let Pij be the received power at the receiver of the j-th connection from the transmitter of the i-th connection. We assume that shrinkage is slow so the channel gain between each transmitter and receiver is fixed during the frame. This is a common assumption used in the earlier formulations of minimum length planning in ad hoc wireless networks.

A node cannot receive and send at the same time and simultaneously send to more than one node. The signal distance from SIC is perfect. This is a common assumption used in the earlier formulations of SIC-based wireless network planning because residual interference does not alter the scheduling algorithm framework.

3. PROPOSED SYSTEM FOR MULTIUSER TRANSMISSION SCHEME

In the proposed Carrier Sense Multiple Access (CSMA) based Medium Access Control (MAC) protocols are popular for WLANs. The current WLANs have adopted an IEEE 802.11 based CSMA with a collision avoidance MAC protocol (CSMA / CA). In the CSMA system, time k can be divided into three modes for user k: idle, busy and send. During the idle mode, the medium is free and all the users try to access the medium to send their data packets. At the same time, the users mating with sending users receive and decode the transmitted signals. During the second period, the mating users forward the decoded data using their partner's spreading sequences.

An SIC-enabled receiver may decode multiple transmissions simultaneously in the order of decreasing signal strength from a composite signal. Let S be the amount of simultaneously transmitting compounds. Let's arrange the links in the set S so that the received signal strength at the receiver of the connection i is reduced so that P1i≥ P2i ≥ ... ≥ PMi and M is the number of the links with received signal strength at the receiver of link i higher than Pii. For successful reception of link i, the sequential SINR criteria are then given as

$$\frac{P_{ki}}{\sum_{j\in S\setminus[1,k]} P_{ji} + N_0} > \beta, \qquad \text{-----(1)}$$

for all k ∈ [1, M] and

$$\frac{P_{ii}}{\sum_{j\in S\setminus\{1,2,\ldots,M,i\}} P_{ji} + N_0} > \beta \qquad \text{-----(2)}$$

where N0 is the background noise and β is the SINR threshold corresponding to a certain packet error probability as a function of packet length, modulation, channel coding, diversity and receiver design.

4. SCHEDULING FOR DELAY MINIMIZATION AND MINIMUM LENGTH

Based on the system model, a signaling structure of the proposed two-user scheme and scheduling problem aims to minimize the schedule length while meeting the traffic requirements and the SINR sequential restrictions on the connections.

4.1 NP-Hardness of the Problem

The minimum length planning problem for SIC-based ad hoc wireless networks is NP-heavy. Consider the network instance where no two links share a common node; the received power at each connection i ∈ [1, L], ie Pii, is greater than the received power at the receiver of the connection i from the transmitters of the remaining connections, ie Pji, j ≠ i, so that no SIC is needed become; Each connection has a packet to transfer. The minimum length planning is then equivalent to the minimum length scheduling problem, which turns out to be NP-heavy by reducing the problem instance to the NP hard graph coloring problem.

4.2 Throughput model

Let Ps v is the probability that the transmission of the user k is successful when the users in set v transmit simultaneously. Thus, the throughput of the user k can be expressed as Where, £ is the efficiency of a successful data packet transmission which can be obtained as £ ¼ Ld/L , where Ld is the transmission time of a data packet in mini-slots. The main challenge in computing the average throughput from this throughput model is to compute the value of Ps for each v €I.

4.3 Least Interference Effect (LIE) Algorithm

The proposed scheduling algorithm is a greedy algorithm that generates the maximum possible set of links in each timeslot by including the link that iteratively minimally affects the transmission of the already scheduled links. The decision to have a minimal impact on the number of connections already scheduled is based on a new metric known as Interference Effect (IE). The IE of a feasible connection is defined as the total SINR drop of the connections that are already included in the scheduled set, if that connection is included. In fact, the throughput improvement for increasing the maximum decoding capability of the AP from 2 to 3 packets is insignificant in CSMA based wireless networks. For SIC operation, the bits of the strongest signal are decoded and the strongest signal is reconstructed from these bits, then the strongest signal is subtracted from the combined signal and then the bits of the second strongest packet are decoded from the residue and so on. Selecting the feasible connection with minimal IE at each iteration allows for the inclusion of a larger number of connections, thereby reducing the plan length. Let S be the set of connections already included in the scheduled set for a timeslot. I refer to the connection that is considered for inclusion in the planned set S First, the feasibility of inclusion of compound i in S is tested. The feasibility test begins with the verification of the SINR sequential constraints given in Equations (1) and (2) for the connection i by ordering the received services at the receiver of the connection i from the sender of the connections in S. If these conditions are fulfilled, then for each connection j ∈ S satisfying the sequential SINR restrictions is checked by including Pij in her received power set. If the restrictions for at least one connection are not met, the connection i is considered unworkable for inclusion in the set S. Otherwise, the IE of the possible connection i for inclusion in the set S is defined as

$$IE_i^S = \sum_{j \in S} \frac{P_{jj}}{\sum_{\substack{l \in S \\ P_{lj} < P_{jj}}} P_{lj} + N_0} - \frac{P_{jj}}{\sum_{\substack{l \in S \cup \{i\} \\ P_{lj} < P_{jj}}} P_{lj} + N_0} \quad \text{----(4)}$$

The IE of an infeasible link is set to ∞ in the algorithm.

ALGORITHM

Input: Links in [1, L], fi, Pij for i,j ∈ [1, L] Output: Schedule of link transmissions

1: LS = [1, L];
2: while LS ≠ ∅ do
3: S = ∅; U = LS;
4: pick an arbitrary link i ∈ U;
5: S = S + i; U = U − i;
6: while U ≠ ∅ do
7: if mini∈U IESi < ∞ then
8: k = arg mini∈U IESi ;
9: S = S + k; U = U − k;
10: else
11: break;
12: end if
13: end while
14: include S in the schedule;
15: for every i ∈ S, fi = fi − 1;
16: remove all i ∈ S with fi = 0 from LS;
17: end while

5. SIMULATION RESULTS

The aim of this section is to evaluate the performance of the proposed scheduling algorithm for different network sizes and environments compared to the optimal scheduling and algorithms previously proposed. The optimal scheduling is obtained by the Integer Linear Programming formula with an exponential number of variables, each variable corresponding to the time associated with a feasible subset of the links and labeled OPT. The scheduling algorithms previously proposed for SIC-based wireless networks are greedy algorithms that generate a link subset for each timeslot, taking into account the interaction of each link with others in a simultaneity graph. The order in which the links are selected determines the type of algorithm. The interference number of each connection is defined as the total number of incoming and outgoing edges in the simultaneity graph. Once a link is selected, it is included in the scheduled sentence, the links that interfere with that link are included in the interference set, and the links that potentially can be included in the scheduled sentence remain in the candidate set. Smallest degree first (SDF), recursive Largest Ridge (RLF) and link order (LO) algorithms then prefer the connection with minimum perturbation number in the candidate set, maximum perturbation amount in the perturbation set and difference of the outgoing and outgoing incoming failure numbers in the candidate set respectively. Because this simultaneity graph does not take into account the cumulative effects of interference, we also include an additional mechanism to verify the feasibility of the final planned set in the algorithm. By varying the number of users in WLAN, we compute the per user average throughput for the systems without and with the SIC technique and then the throughput gain from the SIC technique is calculated.

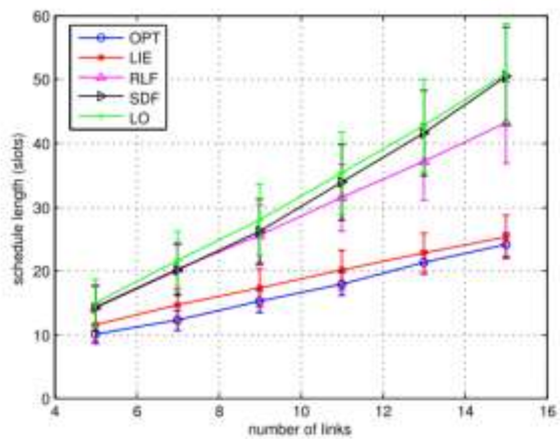

Fig 5.1: Schedule length of scheduling algorithms for different number of links

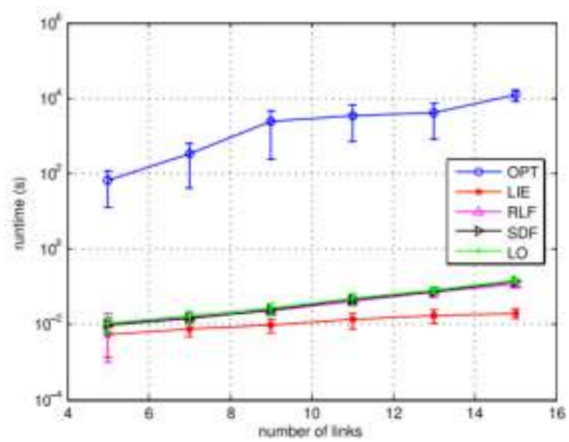

Fig 5.2: Runtime of scheduling algorithms for different number of links.

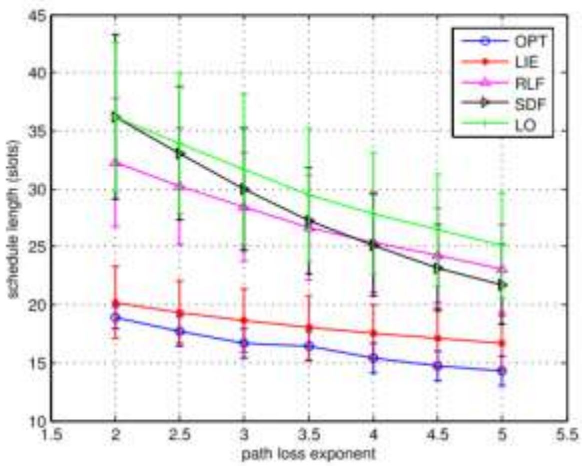

Fig 5.3: Schedule length of scheduling algorithms in a 10–link network for different path loss exponents.

Figs 5.1 and 5.2 show the average and standard deviation of the schedule length and runtime of the scheduling algorithms for different numbers of connections. The value of γ is set to 2. The proposed LIE algorithm performs much closer to optimal scheduling with a much lower schedule length than the earlier proposed scheduling algorithms at a much smaller average run time. The average runtime of the algorithms using an extended protocol interference model is greater than that of the LIE algorithm due to the requirement to check the suitability of each possible node subset in each iteration.

Fig 5.3 shows the average and standard deviation of the planning length of the scheduling algorithms in a network with 10 links for different path loss exponents. As the path loss exponent increases, the plan length of all algorithms decreases due to the decrease in interference between the higher attenuation links. The proposed LIE algorithm is still much closer to the optimal solution and much better than the previously proposed algorithms for all path loss exponents. However, the throughput gain from the SIC technique decreases with increasing the data transmission rate. We also find that, in a WLAN, SIC technique with the maximum decoding capability of 2 packets is sufficient to achieve a very close throughput to the maximum achievable throughput by SIC technique.

6. CONCLUSION

We investigate the design of an efficient heuristic scheduling algorithm with the goal of minimizing the schedule length given the traffic requirements of the links in ad hoc wireless networks with SIC. We determine the throughput gain provided by the SIC technique in a CSMA based WLAN. The numerical results show that the SIC technique improves throughput in a CSMA based WLAN significantly. However, the improvement depends on the network size, wireless channel parameters, and MAC layer and physical layer parameters. We show that the proposed algorithm is very close to the optimal design with a much smaller plan length than the previously proposed heuristic algorithms that use an extended protocol interference model for SIC at much smaller average runtime through extensive simulations. In the future, we plan to extend this algorithm for ad hoc variable and variable performance networks.

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