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Wireless Networks Joint Relay Assignment for Cooperative Communications

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Abstract: In the mobile access network such as a WLAN, each user expects to obtain a maximum bandwidth or throughput so as to improve the QoS of different applications. As the cooperative significance can get better the spatial diversity in the wireless network, this determination assist to increase the transmission throughput for each user in the WLAN. These new problems also use dissimilar relay project strategy with shared relay assignment (SRA) by which, the same relay can (but does not have to) be used by more than one source. our solutions apply to the cases where there are both one-to-one and many-to-one traffics. In addition, we expect our work to inspire a lot of follow-up researches since the notion of SRA can be generalized. More specifically, let us call a set of source nodes that communicate with the same destination node a group.

Keywords: Relays, Throughput, Approximation algorithms, Cooperative, communication, Bismuth, Approximation methods, Mobile computing

1. Introduction

In [1] In the mobile access network such as a WLAN, each user expects to obtain a maximum bandwidth or throughput so as to improve the QoS of different applications. As the cooperative significance can develop the spatial diversity in the wireless network, this determination assist to increase the transmission throughput for each user in the WLAN. Now, we consider a common situation below the WLAN outlook. In support of instance, in a manage WLAN, present has the occasional access points (APs), and also puts in some relay nodes. Several terminal users willunite with one same AP by the preceding association control method for Internet access, which belongs to many-to-one (M21) traffic. In this application, the system will run aessential executive algorithm to select/assign relays to the users to reach the different QoS performances, such as max-min throughput or max-total.. Hence, it is of immense significance to affect the relay task for M21 traffic in cooperative wireless networks.

This unstable load results in excessive bandwidth allocation between users. We examine to the unbalanced load and unfair bandwidth allocation can be greatly alleviated by intelligently associate users to APs, termed group manipulate, relatively than having users acquisitively associate APs of best received signal strength. In this study, we present an efficient algorithmic explanation to reveal the user-AP associations that confirm max-min fair bandwidth distribution This solution guarantees the fairest bandwidth allocation in terms of max-min fairness. Then, by utilizing a rounding technique we obtain an efficient integral association. In exacting, we provide a 2-approximation algorithm for unweighted greedy users and a 3-approximation algorithm for weighted and enclosed - insist users. In addition to bandwidth fairness, we also consider time fairness and we show it can be solved optimally[2].

Spatial diversity be capable of achieveby exploit the antenna on other procedurecall relay nodes, in the network under the cooperative communication scheme. Thus, the cooperative communication becomes one of the emerging technologies for the next-generation mobile systems. In scenarios where a source (e.g., a mobile phone) and a destination (e.g., the base station) communicate with each additional in two hops or less, there are two main supportive modes, namely amplify-and-forward (AF) and decode and- forward (DF), respectively In the mobile access network such as a WLAN, every user expect to attain a maximum bandwidth or throughput to improve the QoS of dissimilar applications. As the cooperative communication can improve the spatial diversity in the wireless network, this determination help to increase the transmission throughput for each user in the WLAN. Now, we consider a common situation under the WLAN scene. For example, in a managed WLAN, there has a small amount of access points (APs), and additionally put in some relay nodes. Several terminal users will connect with one same AP using the previous association control method for Internet access, which belongs to many-to one (M21) traffic.

2. Related Work

A Simple Cooperative Diversity Method Based on Network Path Selectionwas proposed by A. Bletsas, A. Khisti, D. P. Reed, and A. Lippman Cooperative diversity has been recently proposed as a way to form virtual antenna arrays that provide dramatic gains in slow fading wireless environments. However, most of the proposed solutions require distributed space–time coding algorithms, the careful design of which is left for future investigation if there is more than one cooperative relay. We propose a novel scheme that alleviates these problems and provides diversity gains on the order of the number of relays in the network. Our scheme first selects the best relay from a set of available relays and then uses this “best” relay for cooperation between the source and the destination. We develop and analyze a distributed method to select the best relay that requires no topology information and is based on local measurements of the instantaneous channel conditions. This method also requires no explicit communication among the relays. The success (or failure) to select the best available path depends on the statistics of the wireless channel, and a methodology to evaluate performance for any kind of wireless channel statistics, is provided. Information theoretic analysis of outage probability shows that our scheme achieves the same diversity-multiplexing tradeoff as achieved by more complex protocols

Fairness and load balancing in wireless lans using association controlwas proposed by Y. Bejerano, S.-J. Han, and L. E. Li, Recent studies on operational wireless LANs (WLANs) have shown that user load is often unevenly distributed among wireless access points (APs). This unbalanced load results in unfair bandwidth allocation among users. We observe that the unbalanced load and unfair bandwidth allocation can be greatly alleviated by intelligently associating users to APs, termed association control, rather than having users greedily associate APs of best received signal strength. In this study, we present an efficient algorithmic solution to determine the user-AP associations that ensure max-min fair bandwidth allocation. We provide a rigorous formulation of the association control problem that considers bandwidth constraints of both the wireless and backhaul links. Our formulation indicates the strong correlation between fairness and load balancing, which enables us to use load balancing techniques for obtaining near optimal max-min fair bandwidth allocation.

An approximation algorithm for the generalized assignment problem, was proposed by D. B. Shmoys and _E. Tardos, The generalized assignment problem can be viewed as the following problem of scheduling parallel machines with costs. Each job is to be processed by exactly one machine; processing job j on machine i requires time pif and incurs a cost of c,f, each machine / is available for 7", time units, and the objective is minimize the total cost incurred. Our main result is as follows. There is a polynomial-time algorithm that, given a value C, either proves that no feasible schedule of cost C exists, or else finds a schedule of cost at most C where each machine / is used for at most 27", time units. We also extend this result to a variant of the problem where, instead of a fixed processing time p,r there is a range of possible processing times for each machine-job pair, and the cost linearly increases as (he processing time decreases. We show that these results imply a polynomial-time 2-approximation algorithm to minimize a weighted sum of the cost and the makespan, i.e.

Capacity theorems for the relay channel,was proposed by T. Cover and A. EL Gamal The relay channel was introduced by van , and has also been studied by Sato [4]. In a timesharing approach was used to find inner bounds for C. Outer bounds were found in and However, C was established only for relatively degenerate channels. The model that motivates our investigation of degraded relay channels is perhaps best illustrated in the Gaussian case (see Fig. 3 and the example in Section IV). Suppose the transmitter x1 has power P, and the relay transmitter has power Pz. The relay receiver yi sees xi +zi, zr~ N(0, N,). The intended receiver y sees the sum of the relay signal x2 and a corrupted version of y,, i.e., y = x,+y, + ,721 z2-N(O,N,). How should x2 use his knowledge of x, (obtained through yr) to help y understand x

3. CC focused(121) one to one traffic

The research in CC has focused only on one-to-one traffic, but not on many-to-one traffic. Relay assignment where multiple independent s-d pairs competed for a set of relay nodes. In exact, they implicit that a relay node could be recycled by only one s-d pair—a policy which we would refer to as dedicated relay assignment or DRA. Although their work considered the prospect of sharing a relay node by multiple s-d pairs, they prove that every relay node should be assigned to only one s-d pair so as to achieve the MTT objective. In other words, the DRA procedure should also be forced for MTT. In addition, they used extreme subjective bipartite matching to solve the problem in polynomial time. We will refer to this problem as 121-DRA-MTT.

Relay allocation considerably affects the presentation of the cooperative communication, which is an emerging technology for the future mobile system. Previous studies in this area have mostly focused on assigning a dedicated relay to each sourcedestination pair for one-to-one (121) traffic. However, many-to-one (M21) traffic, which is also common in many situations been well studied. This paper addresses the shared relay assignment (SRA) crisis for M21 traffic. We originate two new optimization troubles: one is to maximize the minimum throughput among all the basis (hereafter called M21-SRA-MMT), and additionalis to enlarge the total throughput over all the sources while maintaining some degree of fairness (hereafter called M21-SRA-MTT) [3]. As the optimal solutions tp the two problems are hard to locate, we intend two approximation algorithms whose performance factors are 5.828 and 3, correspondingly, based on the rounding mechanism. Extensive simulation results show that our algorithms for M21-SRA-MMT can considerably improve the minimum throughput compare with existing algorithms, while our algorithm for M21-SRA-MTT can attain the close-to-optimal performance.

In [4]Recently, cooperative communications, in the form of having each node equipped with a single antenna and exploit spatial diversity via some relay node's antenna, is shown to be a capable approach to enlarge data rates in wireless networks below this communication paradigm, the choice of a relay node (among a set of available relay nodes) is critical in the general network concert. In this document, we examine the relay node project problem in a cooperative ad hoc network environment, where multiple source-destination pairs compete for the similar pool of relay nodes in the system. Our intention is to consign the accessible relay nodes to different source-destination pairs so as to maximize the minimum data rate among all pair. The main role of this document is the development of an optimal polynomial time algorithm, called ORA, that achieves this objective. A novel idea in this algorithm is a "linear marking" procedure, which maintains linear difficulty of each iteration. We provide a formal proof of optimality for ORA and use numerical results to demonstrate its capability.

4. WLAN (M21)many to one traffic

In this project, We study several new relay assignment problems for M21 traffic , under the same default assumption of at most one relay node per s-d transmission pair. These new problems furthermore use dissimilar relay task policies including shared relay assignment (SRA) by which, the same relay can (but does not have to) be used by more than one source. our solutions apply to the cases where there are both one-to-one and many-to-one traffics. In addition, we expect our work to inspire a lot of follow-up researches since the notion of SRA can be generalized.

Aprocedure model where a relay node can be shared by multiple source-destination pairs and in attendance aequivalent formulation for the capacity computation. Our objective is to find a relay assignment to enlarge the total capacity of the network. As the main part, we develop an optimal relay assignment algorithm to resolve this problem in polynomial time. We also show that our algorithm has several attractive properties[5].

The system architecture of as shown in Fig.1. Relay assignment significantly affects the performance of the cooperative communication, which is an emerging technology for the future mobile system..In AP using the previous association control method for Internet access, which belongs to (M21) traffic

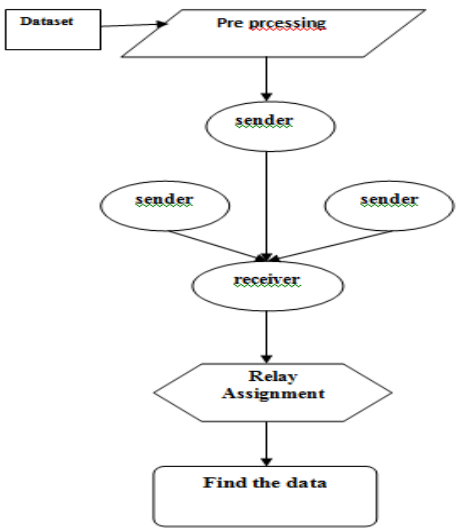

Fig.1. System architecture

4.1. Mobile Access Network:

In the mobile access system such as a WLAN, each user expectto achieve a maximum bandwidth or throughput so as to progress the QoS of different applications. As the cooperative communication can develop the spatial diversity in the wireless network, this will help to increase the transmission throughput for each user in the WLAN. Now, we consider a common situation under the WLAN scene. For instance, in a manage WLAN, there has a few access points (APs), and also put in some relay nodes. Several terminal users (e.g., laptops or Wi-Fi-compatible devices) will connect with one same AP using the previous association control method for Internet access, which belongs to many-toone (M21) traffic.

4.2. Relay Assignment:

In the RA-MM algorithm, the third (i.e., time allocation) step determines the transmission time for all the source nodes in a proportional manner. Though this method can provide the approximate performance guarantee (in the worst case), it does not care for the different capacities among these transmission pairs. Thus, this section designs an improved algorithm, called IRA-MM, so as to enhance its minimum throughput of all the sources compared with that by the RA-MM algorithm.

4.3. One to One Traffic

Multiple self-reliant s-d pairs competed for a set of relay nodes. In precise, they implicit that a relay node could be used by only one s-d pair—a policy which we would refer to as dedicated relay assignment or DRA. Under such an assumption, they proposed an optimal algorithm, called ORA, based on linear marking to maximize the minimum throughput (MMT) among all the sources in a network. We will refer to this problem as 121-DRA-MMT. relay assignment for multiple s-d pairs to maximize the total throughput (MTT) over all the sources in a network. Although their work consider the option of allocation a relay node by multiple s-d pairs, they prove that each relay node should be assigned to only one s-d pair so as to achieve the MTT objective

4.4. Many to One Traffic:

Some default assumption of at most one relay node per s-d transmission pair. These new problems also use different relay assignment policies including shared relay assignment (SRA) with which, the similar relay can be used by more than one basis. For example, source nodes s2 and s3 will share the relay node r2 to cooperatively communicate with the destination nodes d1 and d2, respectively. More specifically, we focus on two new problems: M21-SRA-MMT and M21-SRA-MTT. Note that, first, in several practical wireless applications, multiple source nodes may associate with one common destination node (which serves as a sink or access point), so it is meaningful to study relay assignment for M21 traffic

5. Algorithm Explanation:

The algorithm we will present is called Deticated Relay Assignment (DRA) algorithm. Initially, DRA algorithm starts with a random feasible relay node assignment. By feasible, we mean that each source-destination pair can be assigned at most one relay node and that a relay node can be assigned only once. Such initial feasible assignment is easy to construct, e.g., direct transmission between each source-destination pair (without the use of a relay) is a special case of feasible assignment. Starting with this initial assignment, DRA adjusts the assignment during each iteration, with the goal of increasing the objective function Cmin. Specifically, during each iteration, DRA identifies the source node that corresponds toCmin. Then, DRA helps this source node to search a better relay such that this “bottleneck” capacity can be increased

Algorithm Dedicated Relay Assignment

1: t = 0.
2: Each user i randomly chooses a feasible bi (0) ?
bi, ¯bi
3: t = t + 1.
4: **for** each user i ? I
5: **if**t ? Ti then
6: bi (t) = f di (p, t - 1) bi (t - 1)¯bi bi.
7: **end if**
8: **end for**
9: **Go** to Line 3.

6. Future Enhancement:

In Future work Cooperative transmission can greatly improve communication system performance by taking advantage of the broadcast nature of wireless channels and cooperation among users. In this paper, we have proposed two auction mechanisms, the SNR auction and the power auction, to distributively coordinate the relay power allocation among users.

7. Conclusion

In this paper, we have studied two new shared relay (node) assignment (SRA) problems for many-to-one (M21) traffic in the context of cooperative wireless communications, namely M21-SRA-MMT and M21-SRA-MTT, in order to maximize the minimum and total throughputs. We have designed two rounding-based algorithms (RA-MM and RAMT), whose worst-case performance is guaranteed by their approximate factors of 5.828 and 3, to maximize the minimum and total throughputs respectively. We have also proposed the variation of RA-MM to improve the average-case performance while guaranteeing the worst-case performance. Our simulations show that the proposed algorithm for M21-SRA-MMT can achieve about 66 percent improvement in the minimum throughout compared with ORA, while the proposed algorithm for M21-SRA-MTT can achieve close-to-optimal performance

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