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Power Optimization in MIMO-CN with MANET

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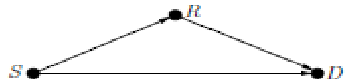
Abstract : *Cooperative communication has derived an interest for wireless network. Most existing works on cooperative communications are focused on link-level physical layer issues such as topology control, routing and network capacity are largely ignored Although there have been extensive studies on applying cooperative networking in multi-hop ad hoc networks, most works are limited to the basic three-node relay scheme and single-antenna systems. These two limitations are interconnected and both are due to a limited theoretical understanding of the optimal power allocation structure in MIMO cooperative networks (MIMO-CN) In Proposed system we use Cooperative diversity. It is a cooperative multiple antenna technique for improving or maximizing total network channel capacities for any given set of bandwidths which exploits user diversity by decoding the combined signal of the relayed signal and the direct signal in wireless multi hop networks.*
Keywords - *BB-CPR Algorithm, Co-Operative Networks, MIMO, MANET with Co-Operative Communication, Relaying strategies*

I. Introduction

Data and voice communication systems play increasingly important roles in the military, government, and civilian sectors. Since the original development of the Transmission Control Protocol (TCP) and the Internet Protocol (IP) in the early 1970s, computer networks have advanced significantly. The simultaneous deregulation of conventional telephone systems spurred a wide array of new telephony services The Concept of Co-Operative networking [1], [2] captured its roots back to the 1975s Where information theoretic studies were first conducted in [3] [4] under the theme of “Relaying Channels”. Many Interesting problems for co-operative networks have been actively researched such as Throughput optimal scheduling [5], network Maximization [6] distributed routing [7] and MAC layer protocol design [8].Cooperation alleviates certain networking problems, such as collision resolution and routing, and allows for simpler networks of more complex links, rather than complicated networks of simple links. Therefore, many upper layer aspects of cooperative communications merit further research, e.g., the impacts on topology control and network capacity, especially in mobile ad hoc networks (MANETs), which can establish a dynamic network without a fixed infrastructure. We study the structural properties of the optimal power allocation in MIMOCN with per-node power constraints [9]. More specifically, we show that the optimal power allocations at the source and each relay follow a matching structure in MIMO-CN. This result generalizes the power allocation result under the basic three-node setting to the multi-relay setting, for which the optimal power allocation structure has been heretofore unknown. We further quantify the performance gain due to cooperative relay and establish a connection between cooperative relay and pure relay [10]. Finally, based on these structural insights, we reduce the MIMO-CN rate maximization problem to an equivalent scalar formulation. Cooperative communication typically refers to a system where users share and coordinate their resources to enhance the information transmission quality. It is a generalization of the relay communication, in which multiple sources also serve as relays for each other. Early study of relaying problems appears in the information theory community to enhance communication between the source and destination

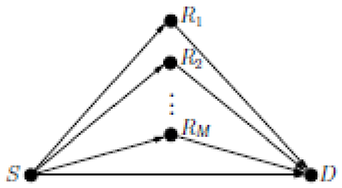
The basic three node relay scheme is shown in figure.1where the message is retransmitted from source S to destination D is relayed by node R, which can overhear the message. A Common cooperative approach in this situation in relaying assignment i.e. we choose only one of the neighboring nodes as relay for which the three-node relay scheme can be applied, now further improvement the system performance as shown in figure-2. I.e. single antenna system.



1. The basic three-node relay scheme.

Fig-1 Basic Three node Relay Scheme

Fig-2 a Co-Operative Network with Multiple Relays



. A cooperative network with multiple relays.

In current scenario on co-operative networks with MIMO enabled nods remain limited. In cooperative networks, it is interesting to explore the idea of deploying multiple antennas at each node. Figure.2 indicates that all single antennas relay R1…., Rm as single virtual relay node with M antennas.

Cooperative diversity is a cooperative multiple antenna technique for improving or maximizing total network channel capacities for any given set of bandwidths which exploits user diversity by decoding the combined signal of the relayed signal and the direct signal in wireless multihop networks. A conventional single hop system uses direct transmission where a receiver decodes the information only based on the direct signal while regarding the relayed signal as interference, whereas the cooperative diversity considers the other signal as contribution. That is, cooperative diversity decodes the information from the combination of two signals. Hence, it can be seen that cooperative diversity is an antenna diversity that uses distributed antennas belonging to each node in a wireless network. Note that user cooperation is another definition of cooperative diversity. User cooperation considers an additional fact that each user relays the other user's signal while cooperative diversity can be also achieved by multi-hop relay networking systems. Actually we investigate that consideration the optimal power allocation at the source and each relay to maximize the end-to-end achievable rate of multi-relay MIMO-CN.now let us focus on the various relaying strategies like (AF-Amplify forward) and (DF-Decode and forward) In amplify-and-forward, the relay nodes simply boost the energy of the signal received from the sender and retransmit it to the receiver. In decode-and forward, the relay nodes will perform physical-layer decoding and then forward the decoding result to the destinations. If multiple nodes are available for cooperation, their antennas can employ a space-time code in transmitting the relay signals [12]. It is shown that cooperation at the physical layer can achieve full levels of diversity similar to a MIMO system, and hence can reduce the Interference and increase the connectivity of wireless networks. The main results and contribution of this work as follows.

A-Matching Structure
B-Analysis of channel structure
C-Relaying link like PR-CR
D-Rate maximizing Problem
E- Optimization of BB-CPR algorithm

II. Related work

Since the benefits of co operating networking were recognized [1],[2],several initial attempts on extending cooperative networking to MIMO have been reported [12]-[17].Well tang and hua first considered the optimal relay amplification matrix for the basic three-node MIMO-CN under the assumption that the source relay channel state information(CSI) is unknown.

A cooperative link consists of separate radios encoding and transmitting their messages at the physical layer in coordination; these nodes could be a single source and relay, or they can be a group or relays, or both. In “Cooperative Communications in Existing Network Architectures,” the first network model is a MANET with an existing clustered infrastructure, in which cooperative transmission is centrally activated and controlled by the cluster access points (AP).

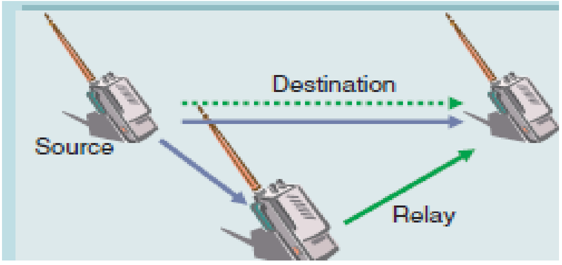


Fig-3 Relaying Scheme in MANET

The simplest AF algorithm for a single source and relay produces an equivalent one-input, two-output complex Gaussian noise channel with different noise output levels. In a cluster-based MANET, all terminals communicate through a cluster head or access point (AP). In such scenarios, the AP can gather information about the state of the network, e.g., the path losses among terminals, select a cooperative mode based upon some network performance criterion, and feed back its decision on the appropriate control channels.

III. System Design And Architecture

System design provides an overall understanding and provides a detail procedural flow of information. System design goes through two phases of development [13].

- Logical design
- Physical design
- Input design

A data flow diagram shows the logical flow of information within the system. It describes the various sources of input, output, database and the procedure's needed to meet the end user's requirements.

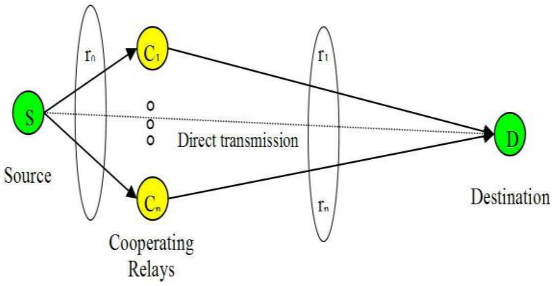


Fig.2 Basic System Architecture

A-Input Design

The input design is the link that ties the information system into the user's world. Input design specifies what type of data is required to enter the system for processing. Input is been decided based on the user requirements

1-Controlling the amount of input required.
2-Avoid delay.
3-Avoiding errors in data.
4-Avoiding extra steps.
5-Keeping the process simple.

Input design is aimed at reducing the chances of mistakes of errors. As human beings are prone to errors there is always the possibility of occurrence of chance of errors. Adequate validation checks are incorporated to ensure error free data storage.

B-Physical Design

Physical design is the output design, which is the most important feature of the information system. When the output is not of good quality then the user will be averse to use the new system. There are various types of output. The term "output" in any information system may mean either printer or displayed information. So during the design of the output careful investigation was made as to what type or form or output is been expected from the system as to satisfy the end user.

C-Logical Design

Logic design of an information system is analogous to an engineering blue print of an automobile. It outlines the major processes and how they are related to each other. The system is been designed based on various users' requirements. The various inputs, outputs and databases are designed in this phase. In the logic design the various sources of input needed to build the system are analyzed and the databases are all pre-planned.

IV. Manet with Co-operative Communication

With physical layer cooperative communications, there are three transmission manners in MANETs: direct transmissions, multi-hop transmissions and cooperative transmissions. Direct transmissions and multi-hop transmissions can be regarded as special types of cooperative transmissions. Here we are having a two different pattern. Direct Transmission and multihop transmission.

Direct transmission

A direct transmission utilizes no relays while a multi-hop transmission does not combine signals at the destination

Multihop transmission

The cooperative channel is a virtual multiple-input single-output (MISO) channel, where spatially distributed nodes are coordinated to form a virtual antenna to emulate multiantenna transceivers.

V. Improving Network Capacity Using Topology Control in Manet's With Cooperative communication

To improve the network capacity in MANETs with cooperative communications using topology control we can set the network capacity as the objective function in topology control problem every node is in charge of the connections to all its neighbors. If all the neighbor connections are guaranteed, the end-to-end connectivity in the whole network can be preserved. The other aspect that determines network capacity is the path length. As topology control is to determine the existence of wireless links subject to network connectivity, the general topology control problem can be expressed as

$G^* = \arg\max f(G)$ …. (1)

s.t. network connectivity.

The objective function $f(G)$ in Eq. 1 is critical to topology control problems. Network capacity is an important objective function. Our previous work shows that topology control can affect network capacity significantly. In the following section, we present a topology control scheme with the objective of optimizing network capacity in MANETs with cooperative communications

There are different definitions for network capacity. Two types of network capacity are introduced in the first one is transport capacity, which is similar to the total one-hop capacity in the network. It takes distance into consideration and is based on the sum of bit-meter products

An end-to-end transmission that traverses more hops will import more data packets into the network. Although path length is mainly determined by routing limits dividing a long link into too many hops locally. The limitation is two hops due to the fact that only two-hop relaying are adopted. The figure illustrates that original topology a MANET with 30 nodes randomly deployed in some area.

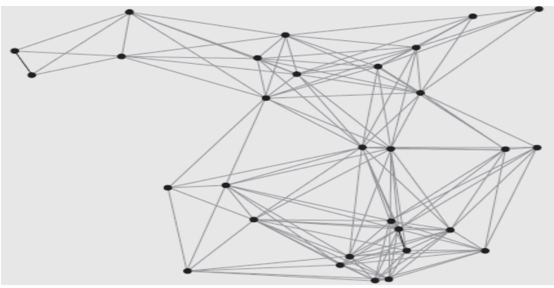


Fig-5-30 Nodes Randomly Deployed in MANET

VI. BB-CPR Algorithm

Basically notification is taken from BB-CPR algorithm for perfect numerical result. And also provide an overview on using BB to solve PO-PR-SIM. We refer readers to [18], [20] for procedure proceeds iteratively as follows. During the initial step, an upper bound on the objective value is obtained by solving CPR System.

A more detail description of BB/CPR is shown in algorithm.

Initialization:

1. Let the optimal solution $\psi* = \emptyset$ and the initial lower bound $LB = -\infty$.
2. Determine partitioning variables (variables associated with CPR) and derive their initial bounding intervals.
3. Let the initial problem list contain only the original problem, denoted by $P1$.
4. Construct CPR based on the partitioning variables. Denote the solution To CPR as $\psi 1$ and its objective value as the upper bound $UB1$.

Main Loop:

5. Select problem Pz that has the largest upper bound among all problems In the problem list.
6. Find a feasible solution ψz by solving Problem Pz. Denote the objectiveValue of ψz by LBz.
7. If $LBz > LB$ then let $\psi * = \psi z$ and $LB = LBz$. If (1+_) $LB \geq UB$ Then stop with the (1−_)-optimal solution $\psi *$; else, remove all problems Pz_ having (1 + _)LBz_ $\geq UB$ from the problem list.
8. Compute relaxation error for each partitioning variable.
9. Select a partitioning variable having the maximum relaxation error and Divide its bounding interval into two new intervals by partitioning at its Value in ψz.
10. Remove the selected problem Pz from the problem list, and construct two new problems $Pz1$ and $Pz2$ based on the two partitioned intervals.
11. Compute two new upper bounds $UBz1$ and $UBz2$ by solving the CPR For $Pz1$ and $Pz2$, respectively.
12. If $(1 + e)$ $LB < UBz1$ then add problem $Pz1$ to the problem list. If (1 + e) $LB < UBz2$ then add problem $Pz2$ to the problem list.
13. If the problem list is empty, stop with the $(1 - e)$-optimal solution $\psi *$.Otherwise, go to Step 5.

VII. Conclusion and Future investigation

In this Paper we have introduced Physical layer cooperative communications, topology control, and network capacity in MANETs. For improving the network capacity of MANETs with cooperative communications. We also analyzed the BB/CPR algorithm for every node in MANET. Future work is in progress to consider dynamic traffic patterns in the proposed scheme to further improve the performance of MANETs with cooperative communications

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