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VIBRANT TOPOLOGY GOVERNOR IN MOBILE AD HOC NETWORKS WITH COOPERATIVE COMMUNICATIONS

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Abstract: **Cooperative communication has emerged as a new dimension of diversity to emulate the strategies designed for multiple antenna systems, since a wireless mobile device may not be able to support multiple transmit antennas due to size, cost, or hardware limitations. Capacity optimization of the wireless network is performed by making changes in the physical layer of the network. In this article, we propose a Capacity-Optimized Cooperative (COCO) topology control scheme to improve the network capacity in MANETs by jointly considering both upper layer network capacity and physical layer cooperative communications. Simulations in the network simulator are performed to show the efficiency of the system.**

Cooperative communication has received tremendous interest for wireless networks. Most existing works on cooperative communications are focused on link-level physical layer issues. Consequently, the impacts of cooperative communications on network-level upper layer issues, such as topology control, routing and network capacity, are largely ignored. In this article, we propose a Capacity-Optimized Cooperative (COCO) topology control scheme to improve the network capacity in MANETs by jointly considering both upper layer network capacity and physical layer cooperative communications. Through simulations, we show that physical layer cooperative communications have significant impacts on the network capacity, and the proposed topology control scheme can substantially improve the network capacity in MANETs with cooperative communications.

***Key words*— Capacity-Optimized Cooperative (COCO), MANETs, topology control, MIMO (Multiple-Input, Multiple-Output)**

I. INTRODUCTION

As more and more speed of data transmission is an ever demanding aspect of wireless network. As per previous studies in simple wireless networks mobile agents may not be able to support multiple transmit antennas due to the size, cost and hardware limitations. Using cooperative communication single antennas mobiles in multi-user environment share their antennas in a manner that creates virtual MIMO system and take the advantages MIMO (Multiple-Input, Multiple-Output) systems. A problem of end-to-end delay is caused by Fading (signal attenuation) due to multi-path effects, shadowing and interference etc. in simple wireless networks, in this situation some packets can be lost and needs to be retransmitted. The transmission and spatial diversity that is achieved by cooperative communication helps to reduce the signal attenuation and delay .

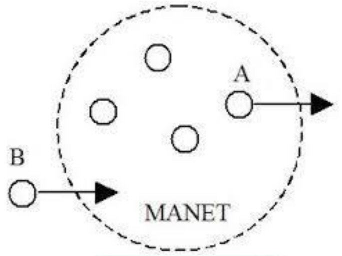
A mobile ad hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless. Ad hoc is Latin and means "for this purpose. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. MANETs are a kind of Wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network.

In mobile ad hoc wireless communication, each node of the network has a potential of varying the topology through the adjustment of its power transmission in relation to other nodes in the neighborhood. In contrast, wired networks have fixed established pre-configured infrastructure with centralized network management system structure in place. Therefore, the fundamental reason for the topology control scheme in MANET is to provide a control mechanism that maintains the network connectivity and performance optimization by prolonging network lifetime and maximizing network throughput. A MANET topology can depend on uncontrollable factors such as node mobility, weather, interference, noise as well as controllable factors such as transmission power, directional antennas and multi-channel communications. A bad topology can impact negatively on the network capacity by limiting spatial reuse capability of the communication channel and also can greatly undermine the robustness of the network. Where network capacity means the bandwidth and ability for it to be used for communication. A network partitioning can occur in a situation where the network topology becomes too sparse. Similarly, a network which is too dense is prone to interference at the medium access
(MAC) layer, the physical layer of the network. So the network should neither be too dense nor too sparse for efficient communication amongst nodes to take place.

The problem identified in contemporary research literature pertaining to topology control in MANET is that most of the topology control algorithms do not achieve reliable and guaranteed network connectivity.

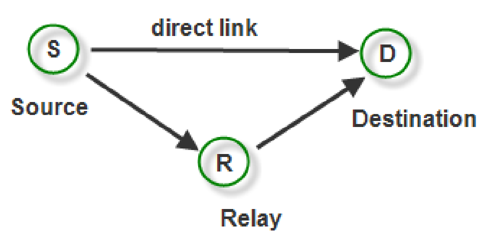
II. TRANSMISSION IN MANETS:

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. A direct transmission utilizes no relays while a multi-hop transmission does not combine signals at the destination. In Fig. 1c, 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 multi antenna transceivers.



Cooperative Communications:

Cooperative transmissions via a cooperative diversity occupying two consecutive slots. The destination combines the two signals from the source and the relay to decode the information. Cooperative communications are due to the increased understanding of the benefits of multiple antenna systems. Although multiple-input multiple output (MIMO) systems have been widely acknowledged, it is difficult for some wireless mobile devices to support multiple antennas due to the size and cost constraints. Recent studies show that cooperative communications allow single antenna devices to work together to exploit the spatial diversity and reap the benefits of MIMO systems such as resistance to fading, high throughput, low transmitted power, and resilient networks. Multi-hop transmission can be illustrated using two-hop transmission. When two-hop transmission is used, two time slots are consumed in the first slot, messages are transmitted from the source to the relay, and the messages will be forwarded to the destination in the second slot. The outage capacity of this two-hop transmission



CAPACITY-OPTIMIZED COOPERATIVE (COCO)

A Capacity-Optimized Cooperative (COCO) topology control scheme to improve the network capacity in MANETs by jointly optimizing transmission mode selection, relay node selection, and interference control in MANETs with cooperative communications. Through simulations, we show that physical layer cooperative communications have significant impacts on the network capacity, and the proposed topology control scheme can substantially improve the network capacity in MANETs with cooperative communications.

III. Problem Statement

Due to the lack of centralized control, nodes in MANETs cooperate with each other to achieve a common goal. The major activities involved in self-organization are neighbor discovery, topology organization, and topology reorganization. Network topology describes the connectivity information of the entire network, including the nodes in the network and the connections between them. Topology control is very important for the overall performance of a MANET

For example, to maintain reliable network connectivity, nodes in MANETs may work at the maximum radio power, which results in high nodal degree and long link distance, but more interference is introduced into the network and much less throughput per node can be obtained. Using topology control, a node carefully selects a set of its neighbors to establish logical data links and dynamically adjust its transmit power accordingly, so as to achieve high throughput in the network while keeping the energy consumption low.

Existing System

Although some works have been done on cooperative communications, most existing works are focused on link-level physical layer issues, such as outage probability and outage capacity. Consequently, the impacts of cooperative communications on network-level upper layer issues, such as topology control, routing and network capacity, are largely ignored. Indeed, most of current works on wireless networks attempt to create, adapt, and manage a network on a maze of point-to-point non-cooperative wireless links. Such architectures can be seen as complex networks of simple links.

Proposed System

We propose a Capacity-Optimized Cooperative (COCO) topology control scheme to improve the network capacity in MANETs by jointly optimizing transmission mode selection, relay node selection, and interference control in MANETs with cooperative communications. Through simulations, we show that physical layer cooperative communications have significant impacts on the network capacity, and the proposed topology control scheme can substantially improve the network capacity in MANETs with the use of Cooperative communications.

IV. Design Modules:

1. Network Scenario Creation

In communication networks, a topology is a usually schematic description of the arrangement of a network, including its nodes and connecting lines. There are two ways of defining network geometry: the physical topology and the logical (or signal) topology. The physical topology of a network is the actual geometric layout of workstations. Logical (or signal) topology refers to the nature of the paths the signals follow from node to node. The number nodes is going to participate in the simulation is decided. Here we conduct experiments to a group of wireless nodes in a network that operates on the AODV protocol. We hence use only a logical topology as it is wireless environment.

2. Node Configuration

Node creation is nothing but the creation of the wireless nodes in the network scenario that is decided. Node configuration essentially consists of defining the different node characteristics before creating them. They may consist of the type of addressing structure used in the simulation, defining the network components for mobile nodes, turning on or off the trace options at Agent/Router/MAC levels, selecting the type of adhoc routing protocol for wireless nodes or defining their energy model. Simulator::node-config accommodates flexible and modular construction of different node definitions within the same base Node class. For instance, to create a mobile node capable of wireless communication, one no longer needs a specialized node creation command.

V. Co-Operative Communications

The basic idea of cooperative relaying is that some nodes, which overheard the information transmitted from the source node, relay it to the destination node instead of treating it as interference. Since the destination node receives multiple independently faded copies of the transmitted information from the source node and relay nodes, cooperative diversity is achieved.

Relaying could be implemented using two common strategies:

- **Amplify-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.

- **Decode-and-forward:**

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. 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 wire.

VI. Topology control

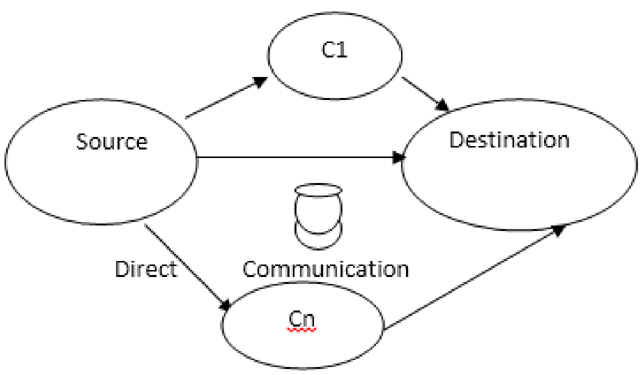
The topology in a MANET is controllable by adjusting some parameters such as the transmission power, channel assignment, etc. In general, topology control is such a scheme to determine where to deploy the links and how the links work in wireless networks to form a good network topology, which will optimize the energy consumption, the capacity of the network, or end-to-end routing performance.

Topology control focuses on network connectivity with the link information provided by MAC and physical layers. There are two aspects in a network topology: network nodes and the connection links among them. In general, a MANET can be mapped into a graph G(V, E), where V is the set of nodes in the network and E is the edge set representing the wireless links. A link is generally composed of two nodes which are in the transmission range of each other in classical MANETs. The topology of such a classical MANET is parameterized by some controllable parameters, which determine the existence of wireless links directly. In traditional MANETs without cooperative communications, these parameters can be transmit power, antenna directions, etc. In MANETs with cooperative communications, topology control also needs to determine the transmission manner (i.e., direct transmission, multi-hop transmission, or cooperative transmission) and the relay node if cooperative transmission is in use. 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 problem Eq. 1 uses the original network topology G, which contains mobile nodes and link connections, as the input. According to the objective function, a better topology $G^*(V, E^*)$ will be constructed as the output of the algorithm. G^* should contain all mobile nodes in G, and the link connections E^* should preserve network connectivity without partitioning the network. The structure of resulting topology is strongly related to the optimization objective function, which is $f(G)$ in Eq. 1. It is difficult to collect the entire network information in MANETs. Therefore, it is desirable to design a distributed algorithm, which generally requires only local knowledge, and the algorithm is run at every node independently. Consequently, each node in the network is responsible for managing the links to all its neighbors only. If all the neighbor connections are preserved, the end-to-end connectivity is then guaranteed. Given a neighborhood graph GN (VN, EN) with N neighboring nodes, we can define a distributed topology control problem as $G^*N = \arg\max f(GN)$, s.t. connectivity to all the neighbors. The objective function $f(G)$ in Eq. 1 is critical to topology control problems. Network capacity is an important objective function. Our previous work [8] 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

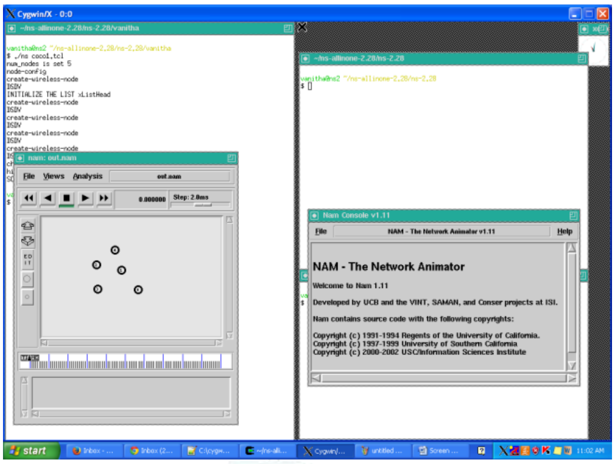
VII. Performance Evaluation:

During simulation time the events are traced by using the trace files. The performance of the network is evaluated by executing the trace files. The events are recorded into trace files while executing record procedure. In this procedure, we trace the events like packet received, Packets lost, Last packet received time etc. These trace values are write into the trace files. This procedure is recursively called for every 0.05 ms. so, trace values recorded for every 0.05 ms. The simulated results support the performance of the system described theoretically.

Architecture Diagram



SIMULATION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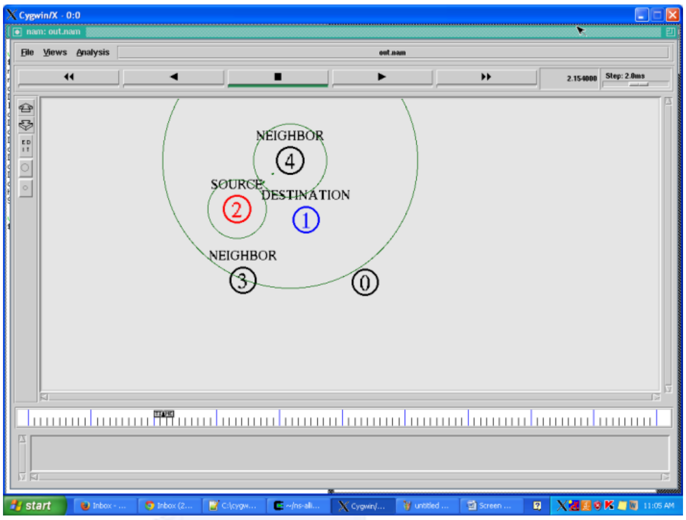
Welcome to Nam 1.11
Developed by UCB and the VINT, SAMAN, and Conser projects at ISI.
Nam contains source code with the following copyrights: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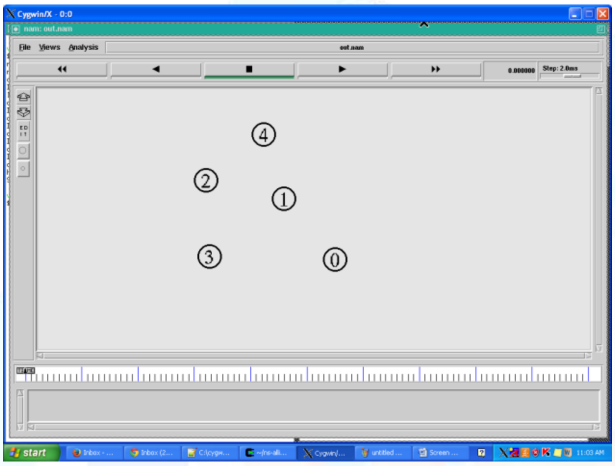

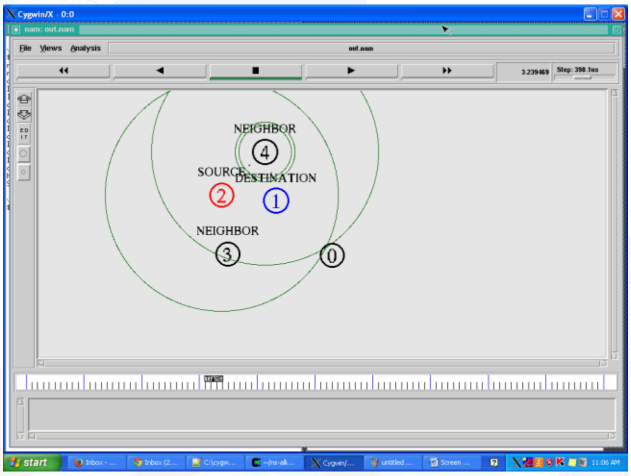
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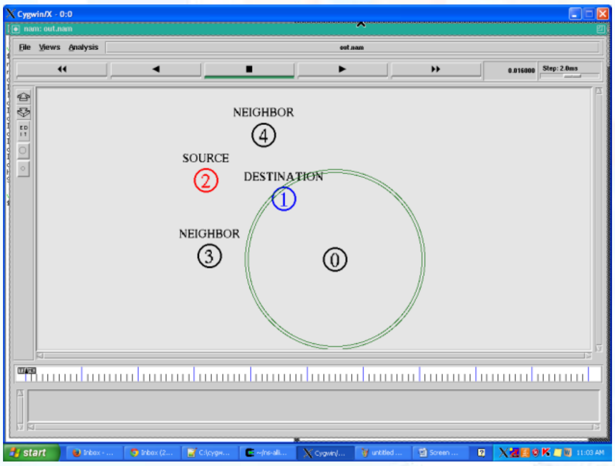
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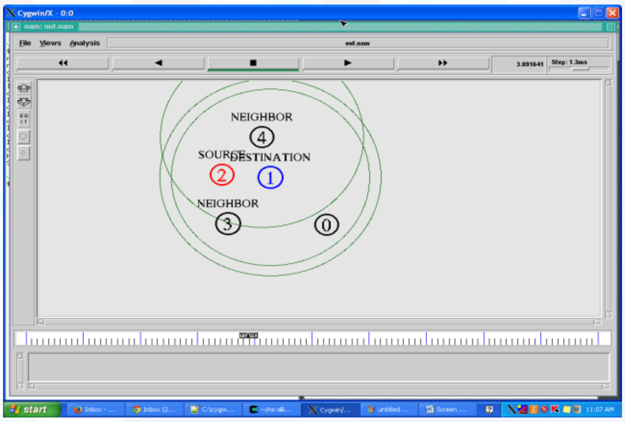
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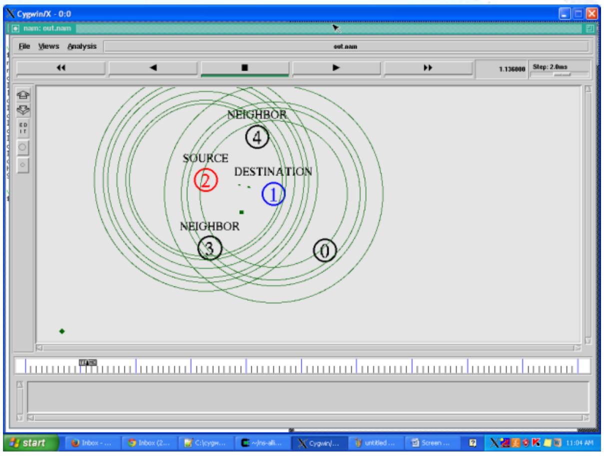
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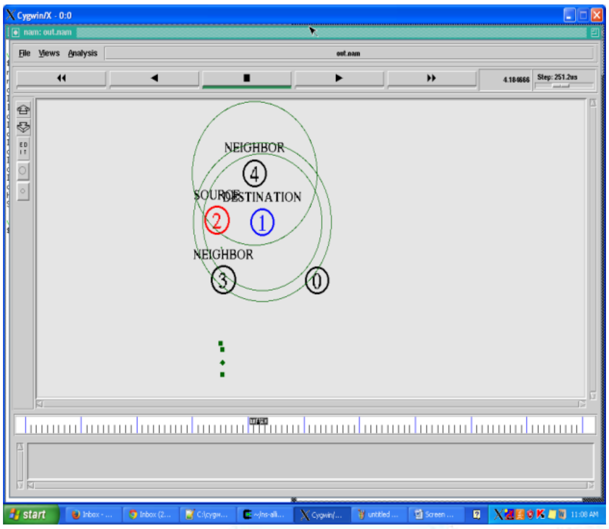

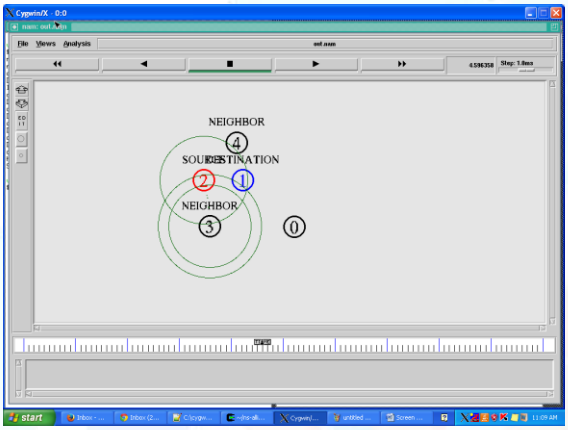

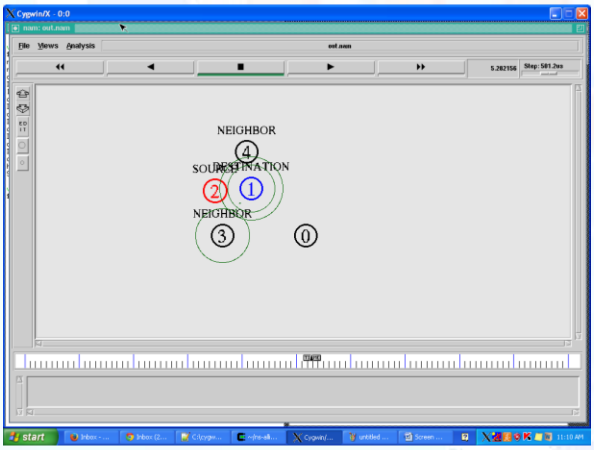

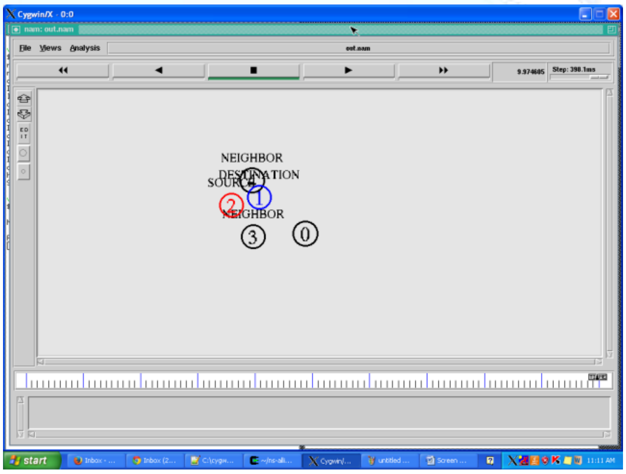

VIII. Conclusion

In this article, we have introduced physical layer cooperative communications, topology control, and network capacity in MANETs. To improve the network capacity of MANETs with cooperative communications, we have proposed a Capacity Optimized Cooperative (COCO) topology control scheme that considers both upper layer network capacity and physical layer relay selection in cooperative communications. Simulation results have shown that physical layer cooperative communications techniques have significant impacts on the network capacity, and the proposed topology control scheme can substantially improve the network capacity in MANETs with cooperative communications.

REFERENCES

[1] J. Laneman, D. Tse, and G. Wornell, “Cooperative Diver-sity in Wireless Networks: Efficient protocols and Out-age Behavior,” IEEE Trans. Info. Theory, vol. 50, no. 12, 2004, pp. 3062–80.

[2] P. H. J. Chong et al., “Technologies in Multihop Cellular Network,” IEEE Commun. Mag., vol. 45, Sept. 2007, pp. 64–65.

[3] K. Woradit et al., “Outage Behavior of Selective Relay-ing Schemes,” IEEE Trans. Wireless Commun., vol. 8, no. 8, 2009, pp. 3890–95.

[4] Y. Wei, F. R. Yu, and M. Song, “Distributed Optimal Relay Selection in Wireless Cooperative Networks with Finite-State Markov Channels,” IEEE Trans. Vehic. Tech., vol. 59, June 2010, pp. 2149–58.

[5] Q. Guan et al., “Capacity-Optimized Topology Control for MANETs with Cooperative Communications,” IEEE Trans. Wireless Commun., vol. 10, July 2011, pp. 2162–70.