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Optimized Clustering Mechanism for Qos Aware Route Discovery in Manet

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ABSTRACT: *Cooperative communication, which utilizes nearby terminals to relay the overhearing information to achieve the diversity gains, has a great potential to improve the transmitting efficiency in wireless networks. With high-power nodes, MANETs can improve network scalability through load balanced technique, dynamic channel selection, and broadcasting robustness. However, the delay and throughput of power heterogeneous MANETs can be severely impacted by high-power nodes. To deal with the complicated routing access interactions induced by relaying and leverage the benefits of such cooperation, an efficient Cooperative Optimized Clustering Routing Protocol (COCRP) is needed. To reduce the interference raised by high-power nodes, routing protocol COCRP is developed to avoid packet forwarding via high-power nodes. The COCRP is composed of two parts: first one is additional coverage ratio, which is the ratio of the number of nodes that should be covered by a single broadcast Cluster Head to the total number of neighbours; and second one is connectivity factor, which reflects the relationship of network connectivity and the number of neighbours of a given node. This approach combines the advantages of the neighbour coverage knowledge and the probabilistic mechanism, which can significantly decrease the number of retransmissions so as to improve the delay and throughput, and can also improve the routing performance.*
Keywords **:** *Dynamic Channel Allocation,COCRP,Cluster Head,performance. Quality of Service,Load Balancing,*

INTRODUCTION

The history of wireless networks started in the 1970s and the interest has been growing ever since. During the last decade, and especially at its end, the interest has almost exploded probably because of the fast growing Internet. The tremendous growth of personal computers and the handy usage of mobile computers necessitate the need to share information between computers. At present, this sharing of information is difficult, as the users need to perform administrative tasks and set up static, bi-directional links between the computers. This motivates the construction of temporary networks with no wires, no communication infrastructure and no administrative intervention required. Such interconnection between mobile computers is called an Ad hoc Network. In such environment, it may be necessary for the mobile computers to take help of other computers in forwarding a packet to the destination due to the limited range of each mobile host's wireless transmission.

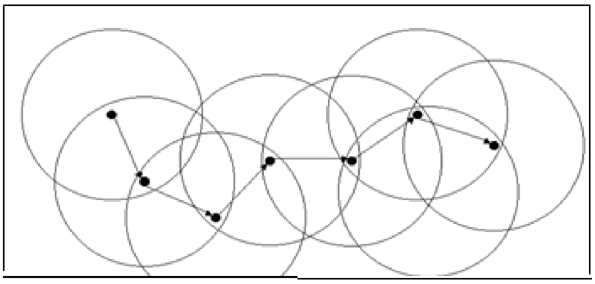


Fig 1.1 Basic Structure of Ad hoc Network.

Ad hoc networks are emerging as the next generation of networks and defined as a collection of mobile nodes forming a temporary (spontaneous) network without the aid of any centralized administration or standard support services. An ad hoc network is usually thought of as a network with nodes that are relatively mobile compared to a wired network. Hence the topology of the network is much more dynamic and the changes are often unpredictable oppose to the Internet which is a wired network. This fact creates many challenging research issues, since the objectives of how routing should take place is often unclear because of the different resources like bandwidth, battery power and demands like latency. The routing protocols used in ordinary wired networks are not well suited for this kind of dynamic environment.

MANET (Mobile Ad hoc Network)

A self-configuring infrastructure less network of mobile devices is connected by wireless links. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Mobile Ad Hoc Networks (MANETs) are an emerging type of wireless networking, in which mobile nodes associate on an extemporaneous or ad hoc basis. MANETs are self-forming and self-healing, enabling peer-level communications between mobile nodes without reliance on centralized resources or fixed infrastructure.

OVERVIEW OF THE PROJECT

Mobile ad hoc networks (MANETs) have been an important class of networks, providing communication support in mission critical scenarios including battlefield and tactical missions, search and rescue operations, and disaster relief operations. Group communications has been essential for many applications in MANETs. The typical number of users of MANETs has continuously increased, and the applications supported by these networks have become increasingly resource intensive. This, in turn, has increased the importance of bandwidth efficiency in MANETs. It is crucial for the medium access control (MAC) protocol of a MANET not only to adapt to the dynamic environment but also to efficiently manage bandwidth utilization. In general, MAC protocols for wireless networks can be classified as coordinated and uncoordinated MAC protocols based on the collaboration level. In uncoordinated protocols such as IEEE 802.11, nodes contend with each other to share the common channel. For low network loads, these protocols are bandwidth efficient due to the lack of overhead. However, as the network load increases, their bandwidth efficiency decreases. Also, due to idle listening, these protocols are in general not energy efficient. On the other hand, in coordinated MAC protocols the channel access is regulated. Fixed or dynamically chosen channel controllers determine how the channel is shared and accessed. Coordinated channel access schemes provide support for quality of service (QoS), reduce energy dissipation, and increase throughput for dense networks. Some of the key challenges in effective MAC protocol design are the maximization of spatial reuse and providing support for non-uniform load distributions as well as supporting multicasting at the link layer. Multicasting allows sending a single packet to multiple recipients. In many cases, supporting multicasting services at the link layer is essential for the efficient use of the network resources, since this approach eliminates the need for multiple transmissions of an identical payload while sending it to different destinations. High power nodes also generally have advantages in power, storage, computation capability, and data transmission rate. As a result, research efforts have been carried out to explore these advantages, such as backbone construction and topology control. On the other hand, the large transmission range of high power nodes leads to large interference, which further reduces the spatial utilization of network channel resources. Because of different transmission power and other factors (e.g., interference, barrier, and noise), asymmetric or unidirectional links will exist in MANETs. Existing research results show that routing protocols over unidirectional links perform poorly in multihop wireless networks. However, the existing routing protocols in power heterogeneous MANETs are only designed to detect the unidirectional links and to avoid the transmissions based on asymmetric links without considering the benefits from high-power nodes. Hence, the problem is how to improve the routing performance of power heterogeneous MANETs by efficiently exploiting the advantages and avoiding the disadvantages of high-power nodes, which is the focus of this project.

RELATED WORK

Mobile Adhoc network (MANET) is a wireless network of mobile devices without any infrastructure. An important problem receiving increased consideration recently is load balancing. Many protocols are developed under non uniform load distributions for improving bandwidth, energy efficiency, throughput etc. Group communications has been essential for many applications in MANETs. The typical number of users of MANETs has continuously increased, and the applications supported by these networks have become increasingly resource intensive. This, in turn, has increased the importance of bandwidth efficiency in MANETs. It is crucial for the medium access control (MAC) protocol of a MANET not only to adapt to the dynamic environment but also to efficiently manage bandwidth utilization. Integrating spatial reuse into a MAC protocol drastically increases bandwidth efficiency. On the other hand, due to the dynamic behavior in MANETs, the traffic load may be highly non-uniform over the network area. Thus, it is crucial that the MAC protocol be able to efficiently handle spatially non-uniform traffic loads. Uncoordinated protocols intrinsically incorporate spatial reuse and adapt to the changes in load distribution through the carrier sensing mechanism. However, coordinated protocols require careful design at the MAC layer, allowing the channel controllers to utilize spatial reuse and adapt to any changes in the traffic distribution. Similar to cellular systems, coordinated MANET MAC protocols need specialized spatial reuse and channel borrowing mechanisms that address the unique characteristics of MANETs in order to provide as high bandwidth efficiency as their uncoordinated counterparts. Due to node mobility and the dynamic nature of the sources in a MANET, the network load oftentimes is not uniformly distributed. Dynamic channel allocation and channel handoff algorithms dynamically adjust the number of channels accessed by base stations proportional to their load and help keep bandwidth efficiency and service rate high simultaneously even under non-uniform load. However, such algorithms either require centralized control or frequent message exchanges between base stations or thus are not directly applicable to MANETs. However, these approaches are not scalable, as the complexity of the optimal dynamic channel allocation problem has been shown to be NP-hard.

PROPOSED SYSTEM

A dynamic channel allocation strategy that sets operating conditions on the fly for efficient resource utilization for MANETs was developed. In addition with this, cooperative load balancing algorithm was proposed for smoothing out the non- uniformity in the load distribution and combine it with the dynamic channel allocation strategy. The preliminary concept of dynamic channel allocation for TRACE systems was introduced to extend the concept and analyze the non-uniform load distribution problem from both the perspective of member nodes and the cluster heads. A collaborative load balancing algorithm was proposed for TRACE framework. By combining the dynamic channel allocation and collaborative load balancing algorithms, the CDCA-TRACE protocol that has the highest bandwidth efficiency among the TRACE family of protocols was developed. This concept aims to achieve efficient bandwidth and energy utilization for MANETs and focuses specifically on the MAC and the routing layers.

CDCA-TRACE Routing Protocol

Although MH-TRACE incorporates spatial reuse, it does not provide any channel borrowing or load balancing mechanisms and thus does not provide optimal support to dynamically changing conditions and non-uniform loads. Hence, the dynamic channel allocation and cooperative load balancing algorithms to MH-TRACE were developed to create the new protocol CDCA- TRACE a novel MAC protocol that maintains the same energy efficiency and channel regulation principles of MH-TRACE while enabling dynamic and scalable channel assignment in addition to cooperative load balancing. Instead of message exchanges between the channel regulators (CHs), CDCA-TRACE utilizes spectrum sensing to keep track of channel usage in nearby clusters. This feature minimizes the overhead found in dynamic channel allocation schemes for cellular networks and makes CDCA-TRACE suitable for MANETs. CDCA-TRACE also incorporates cooperation among the member nodes to improve the distribution of the load among the CHs and complements dynamic channel allocation to enhance the service rate.

Dynamic Channel Allocation for TRACE

The channel controllers continuously monitor the power level in all the available channels in the network and assess the availability of the channels by comparing the measured power levels with a threshold. If local load increases local capacity, provided that the measured power level is low enough, the channel coordinator starts using the channel with the lowest power level measurement. Once the channel coordinator starts using the channel, its transmission increases the power level measurement of that channel for nearby controllers, which in turn prevents them from accessing the same channel. Similarly, as the local network load decreases, controllers that do not need some channels stop the transmissions in that channel, making it available for other controllers.

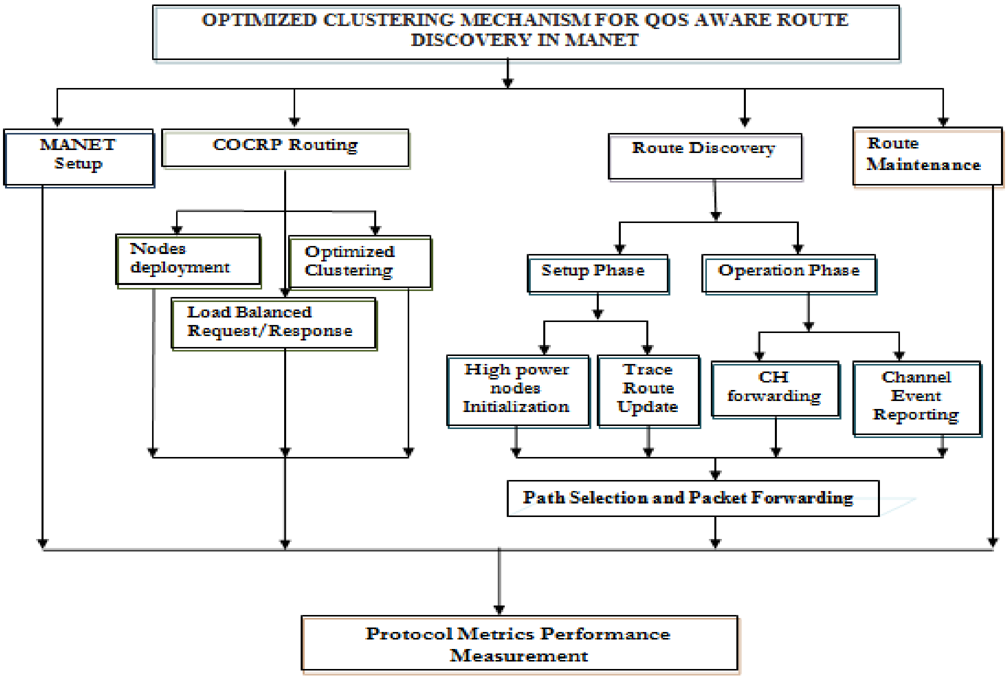
Cooperative Load Balancing for TRACE

The underlying idea of the cooperative load balancing algorithm is that the active nodes can continuously monitor the channel usage and switch from heavily loaded coordinators to the ones with available resources. These nodes can detect that the channels available at the channel coordinator are depleted and shift their load to the channel coordinators with more available resources. The resources vacated by the nodes that switch can be used for other nodes that do not have access to any other channel coordinators. This increases the total number of nodes that access the channel and hence increases the throughput.

Cooperative Optimized Clustering Routing Protocol (COCRP)

Cluster based routing is a MANET routing schemes in which various clusters of mobile nodes are formed with each cluster having its own cluster head which is responsible for routing among clusters. QoS routing utilizes the more powerful nodes as backbone nodes. The routing area is divided into several small, sized clusters. One CH node is maintained in each cluster, and the routing among CH node is very efficient and simply based on location information and cell structure. A source discovers a route to destination in an on-demand way, and most of the routing activities are among CH nodes. In this clustering, a cooperative coupling relationship is established between nodes. This reduces the number of routing hops and makes the routing more efficient and reliable, since B-nodes have large bandwidth, transmission range, and are more reliable. COCRP consists of two core components. The first component (Component A) is used to tackle the unidirectional link and to construct the hierarchical structure. The second component (Component B) is the routing, including the route discovery and route maintenance. There are two types of nodes in the networks: CH nodes and member nodes (CM nodes). CH nodes refer to the nodes with high power and a large transmission range. CM nodes refer to the nodes with low power and a small transmission range. Here, focus is on the routing components in COCRP, including the route discovery and route maintenance. In the route discovery, the route to the destination can be obtained effectively based on dynamic grouping. In the route maintenance procedure, cases such as route failure are detect.

SYSTEM ARCHITECTURE DIAGRAM



SYSTEM MODELS

They are five models available according to the GloMoSim simulator.

- MANET Framework Setup
- Proposed TRACE Protocol Implementation
- Proposed COCRP Route Discovery Protocol
- Protocol Configuration Setup
- Performance Evaluation

MANET Framework Setup

To create a structure for the routing process in an ad hoc network that includes setting up of node placement, node partition, transmission range etc. Simulation framework is formulated by linking all layers and sub layers into a single process because this can't get results by running each and every layers. Framework includes topology design like grid based or random or uniform or user specification.

Proposed TRACE Protocol Implementation

To improve the network performance and to address the issues of dynamic channel allocation and cooperative load balancing with respect to high-power nodes, a proposed TRACE routing protocol for power heterogeneous MANETs. In MH-TRACE, certain nodes assume the roles of channel coordinators, here called cluster-heads. All CHs send out periodic Beacon packets to announce their presence to the nodes in their neighborhood. When a node does not receive a Beacon packet from any CH for a predefined amount of time, it assumes the role of a CH. This scheme ensures the existence of at least one CH around every node in the network. The proposal considers both the advantages and disadvantages of high power nodes. In addition, some realistic factors have been taken into consideration, including unidirectional links and the dynamic coupling relationship between cooperative nodes in cluster. Moreover in addition consider a technique to make these protocols energy-aware in order to increase the operational lifetime of an ad hoc network.

Proposed COCRP Route Discovery Protocol

Proposed Route Discovery Protocol is very evident that two major factors mobility and cluster formation need to be considered to assure better network performance. Clustering means a way to reconfigure all nodes into small virtual groups according to their regional vicinity and is defined as cluster head and cluster member that are determined with the same rule. This clustering algorithm consists of two mechanisms, cluster formation and cluster maintenance. In cluster formation, nodes communicate with neighbor nodes so the proposed protocol selects the neighbors as per a neighbor selection scheme through the location data must be obtained through node-to-node communication. Recall that high- power nodes with a larger transmission range will create large interference areas and low channel spatial utilization. In such case, the proposed protocol is to avoid packet forwarding via high- power nodes. Because the RREP packet is delivered using unicast, the bidirectional links will be used.

Protocol Configuration Setup

Configure some attributes whichis supported to execute the routing protocol like Number of nodes, Mobility, Mac protocol, Simulation time, Band width, Transmission range etc… by setting these kinds of attributes to execute out routing protocol with layers interaction. To set the layer wise results in the configuration process is developed. In GloMoSim, the driver entity(in./main/driver.pc) reads the input file descriptor, establishes partitions, allocates memory for node information, calls appropriate functions depending on the read input values such as simulation time and node placement, and finally starts simulation by sending a Start Sim message to the partition Entity Name instance of the GLOMO Partition entity type (defined in the glomo.pc file).

Performance Evaluation

First, to specify the necessary input parameters in the Config.in file as said above. For our simulation procedure, to specific about certain parameters as mentioned below to enable hassle free simulation.

SYSTEM REQUIREMENTS

Hardware Requirements	
Processor	Intel Pentium
Processor Speed	2.4 GHz
Memory (RAM)	512MB
Hard disk	40GB
Software Requirements	
Operating System	Windows 8
Simulator Tool	GloMoSim
Language	C and JAVA
Development Kit	JDK1.7
Platform	Independent

FUTURE ENHANCEMENT

As a result of the experiments, it is concluded that increasing the node density up to some point results in higher system lifetime. However, after this point, high density leads into poor network performance. With this result, it shows that there should be an optimal density which gives the maximum possible performance. In the future, the problem of finding the maximum lifetime shortest path without in-network aggregation can be analyzed. It is better to generalize the model to consider more issues such as interference, packet loss, etc.

CONCLUSION

In this paper to explore the efficient use of resources in MANETs at the MAC and the routing layers. The cooperation and information sharing between the nodes both in the MAC and Network layers of the protocol stack leads to more efficient use of resources in MANETs compared to competition based architectures. The techniques described in this dissertation lead to substantial savings in energy consumption and spectrum usage. The proposed novel based MAC protocol, CDCA-TRACE, which combines dynamic channel allocation and cooperative load balancing algorithms into the TRACE framework. A proposed a light weight dynamic channel allocation algorithm and a cooperative load balancing algorithm. The dynamic channel allocation works through carrier sensing and does not increase the overhead. It has been shown to be very effective in increasing the service levels as well as the throughput in the system with minimal effect on energy consumption and packet delay variation. The cooperative load balancing algorithm has less impact on the performance compared to the dynamic channel allocation algorithm. The two algorithms that can be used simultaneously maximize the improvements in the system. The combined system has been shown to perform at least as well as the systems with each algorithm alone and performs better for many scenarios.

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