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Improve Cooperative Load Balancing And Dynamic Channel Allocation For Routing with Cluster Based Moblie Ad hoc Network

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Abstract—*Mobile ad hoc networks (MANETs) are becoming increasingly common, and typical network loads considered for MANETs are increasing as applications evolve. This, in turn, increases the importance of bandwidth efficiency while maintaining tight requirements on energy consumption, delay and jitter. Coordinated channel access protocols have been shown to be well suited for highly loaded MANETs under uniform load distributions. However, these protocols are in general not as well suited for non-uniform load distributions as uncoordinated channel access protocols due to the lack of on-demand dynamic channel allocation mechanisms that exist in infrastructure based coordinated protocols. In this paper, we present a lightweight dynamic channel allocation mechanism and a cooperative load balancing strategy that are applicable to cluster based MANETs to address this problem. We present protocols that utilize these mechanisms to improve performance in terms of throughput, energy consumption and inter-packet delay variation (IPDV).Through extensive simulations we show that both dynamic channel allocation and cooperative load balancing improve the bandwidth efficiency under non-uniform load distributions compared to protocols that do not use these mechanisms as well as compared to the IEEE 802.15.4 protocol with GTS mechanism and the IEEE 802.11 uncoordinated protocol.*

Index Terms—Mobile ad hoc networks, bandwidth efficiency, distributed dynamic channel allocation

1-INTRODUCTION

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 have 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 utilization.In general, MAC protocols for wireless networks can be classified as coordinated and uncoordinated MAC protocols based on the collaboration level.Low network loads, these protocols are bandwidth efficient due to the lack of overhead. However, as the network load 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.

Extensively deployed cellular networks also use a coordinated MAC protocol in which the channel access is regulated through fixed base stations.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 .

Integratin 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.MAC layer, allowing the channel controllers to utilize spatial reuse and adopt 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

The responsibility of the MAC layer is to coordinate the nodes' access conflicts. In a multi-hop network, obtaining a high bandwidth efficiency is only possible through exploiting channel reuse opportunities.In multi-hop wireless networks, CSMA techniques enable the same radio resources to be used

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. In this paper we propose two algorithms to cope with the non-uniform load distributions in MANETs:a light weight distributed dynamic channel allocation (DCA) algorithm based on spectrum sensing,and a cooperative load balancing algorithm in which nodes select their channel access providers based on the availability of the resources.We apply these two algorithms for managing non-uniform load distribution in MANETs into an energy efficient real-time coordinated MACprotocol, named MH-TRACE. In MH-TRACE, the channel access is regulated by dynamically selected cluster heads (CHs). MH-TRACE has been shown to have higher throughput and to be more energy efficient compared to CSMA type protocols.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 non-uniform loads. Hence, we apply the dynamic channel allocation and cooperative load balancing algorithms to MH-TRACE, creating the new protocols of DCA-TRACE,CMH-TRACE and the combined CDCA-TRACE.

2-RELATEDWORK

in distinct locations, leading to increased bandwidth efficiencies at the cost of possible collisions due to the hidden terminal problem. Different channel reservation techniques are used to tackle the hidden terminal problem. Karn use an RTS/CTS packet exchange mechanism before the transmission of the

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data packet. 802.11 distributed coordination function(DCF) uses a similar mechanism. Although this handshake reduces the hidden node problem, it is inefficient under heavy network loads due to the exposed terminal problem.Several modifications to the RTS/CTS mechanisms have been proposed to increase the bandwidth efficiency including use of multiple channels .However, these approaches attempt to solve the problem of channel assignment when there is a single intended destination of each transmission, and they do not cover group communication. In many cases, using link layer multicasting/broadcasting increases the efficient use of network resources. military field communications and inter vehicle communication systems make use of broadcast services. In this scenarios where the destination of the generated packet is not a specific node in the local neighborhood but all the nodes in the immediate neighborhood of the transmitter. The IEEE 802.11 standard defines and allows link layer broadcasting services for both infrastructure and ad hoc modes. In ad hoc broadcast communication mode, the IEEE 802.11 MAC DCF specification disables the RTS/CTS mechanism as well as acknowledgments (ACKs).There is no MAC-level recovery or re-transmission for broadcast frames. The broadcast performance of IEEE 802.11 has been studied through simulations as well as analytically.In coordinated MAC protocols, channel assignment is performed by channel coordinators. Spatially separatedcoordinators can simultaneously use the same channels with the channel reuse concept.

The types of strategies for on-demand dynamic channel allocation used in cellular systems can be divided into two categories: centralized and distributed schemes. In centralized dynamic channel allocation schemes, the available channels are kept in a pool and

Although quite effective in maximizing channel usage, these systems have a high overhead and cannot be applied to MANETs due to the lack of high bandwidth and low latency links between the cluster heads for coordination.Distributed dynamic channel allocation for cellular networks has also been studied extensively. In distributed dynamic channel allocation, each cell is assigned a number of channels. These channels can be exchanged among adjacent cells through message exchange mechanisms between the channel regulators (cell towers) in an on demand basis. This approach, too, is not directly applicable to MANETs. Unlike in the cellular case, in MANETs, the message exchanges between the channel regulators also consume network resources. Due to node mobility and the dynamic behavior of the network, the large overhead associated with the frequent message exchanges may overwhelm the network and decrease the bandwidth efficiency.Load balancing has also been studied within the context of heterogeneous networks. In the case of excess demand,part of the network load can be offloaded to other networks using heterogenous gateway nodes.Although dynamic channel allocation and channel handoff are studied extensively within the context of cellular networks, they have not been studied much in the context of MANETs, where the bandwidth efficiency and load balancing are mostly studied at the network layer . The AODV protocol to include a distributed system to infer the network status and to optimize routes considering bandwidth efficiency and stability. A centralized load aware joint channel assignment and routing algorithm is proposed.At the MAC layer, propose a location aware dynamic channel allocation scheme for MANETs.However, their protocol mandates that location information be provided to each node.

A light weight dynamic channel allocation scheme for cluster-based mobile ad hoc networks, a cooperative load balancing algorithm, incorporate these two algorithms into our earlier TRACE framework leading to DCA-TRACE and CMH-TRACE; and iv) we combine both algorithms to provide support for non-uniform load distributions and propose CDCA-TRACE. We compare the performance of these algorithms for varying network loads.In MH-TRACE, the channel access is regulated by dynamically selected cluster heads (CHs). MH-TRACE has been shown to have higher throughput and to be more energy efficient compared to CSMA type protocols. Although MH-TRACE incorporates spatial reuse, it does not provide any channel borrowing or load balancing mechanisms and thus

The proposed system includes the existing system approach as well. In addition, heterogeneous network environment is taken in to account in which more number of local channel node network present. In addition, the CH nodes are also taken into consideration such that the local channel nodes server the MANET nodes with insufficient bandwidth availability. For that, the proposed system presents a distributed clustering protocol, Cooperative Networking protocol.

Namboothiri and Sivalingam study the capacity of the IEEE 802.15.4 protocol for linear and grid topologies and calculate the optimal channel assignment yielding the maximum possible channel reuse.

3.EXISTING SYSTEM

does not provide optimal support to non-uniform loads. Hence, we apply the dynamic channel allocation and cooperative load balancing algorithms to MH-TRACE, creating the new protocols of DCA-TRACE, CMH-TRACE and the combined CDCA-TRACE.

- Decoupling carrier signaling in the coexistence of other heterogeneous wireless networks is not considered.
- It cannot prevent the harmful interference caused by unmanaged wireless devices.
- The current deployment of CCS is restricted to a single WPAN with star-topology.

4. PROPOSED SYSTEM

- Heterogeneous network environment is taken in to account in which WLAN, Zigbee and Bluetooth nodes are in use.
- The proposed system 'HETERONET' dynamically clusters the network according to each node's bandwidth, energy, and application type.
- It implements the HETERONET prototype to evaluate its performance on real hardware systems.

- It also simulates HETERONET for large networks of more than 100 mobile nodes and evaluate the performance.
- Both results demonstrate that HETERONET is effective in reducing the power consumption of WLAN-based communications.

- **Add Signaler**

The zigbee node (signaler node) id with an optional name is added or selected from available zigbee nodes. The transmission range is keyed in (‘N’ units for e.g., ‘N’ MHz). All the nodes list are viewed using data grid view control.

- **Modify Cluster (Signaler/Transmitter Range)**

The transmission range is calculated randomly for all the transmitter nodes and updated such that the interference range of any signaler node.

Temporary Channel Hopper

When running the temporary channel-hopper, a ZigBee signaler switches to a nearby channel before its scheduled signaling, and returns to the original channel immediately after the busy-tone is sent. However, the busy-tone still overlaps with the WiFi frequency and can inform WiFi of a ZigBee transmission, as long as its power exceeds the WiFi’s carrier sensing threshold.

Signaling Scheduler

CCS maintains the legacy scheduling protocol in ZigBee, but requires the signaler to dispatch the busy tone at an appropriate time, such that

(i) It reduces the WiFi preemption over ongoing or forthcoming ZigBee transmissions.

(ii) It minimizes the potential influence on WiFi performance. The signaling scheduler is designed to address this tradeoff. It allows both the CSMA and TDMA modes of ZigBee to coexist with WiFi.

- **CSMA Scheduler:**

Specifically, a sender polls the receiver before delivering data, and the receiver returns a 5-byte confirmation packet when it is ready to receive (we refer to the polling and confirmation packet as RTS, CTS, respectively). Upon overhearing the CTS confirmation, the signaler starts the temporary channel-hopper and emits the busy-tone immediately.The busy-tone duration equals the data packet length plus the ACK wait duration and a guard period. The data packet length is a one-byte field piggy-backed in the CTS.

- **TDMA Scheduler:**

CCS exploits ZigBee to allocate fixed slots to clients. The slot allocation information is carried in the coordinator’s beacon message. The beacon is retransmitted if the confirmatin is missing. Following a successful slot allocation, the signaler will send the busy-tone whenever a scheduled TDMA slot fires. To reduce unnecessary interference to an ongoing WiFi transmission, the signaler starts CCA δ units of time earlier than the scheduled ZigBee transmission (δ is called pre-signaling time). It starts signaling on the first idle CCA, and cancels the signaling if the channel remains busy before the TDMA transmission.

Heteronet

This module is proposed which is a bandwidth-aware and energy-efficient clustering protocol for multi-radio mobile networks. It uses Bluetooth to reduce the power consumption of WLAN in mobile devices. It dynamically reconfigures the clusters based on the bandwidth requirements of applications to avoid the performance degradation. The applications are classified into two cases: group networking and individual networking.

- **Add Node**

The node id and details are keyed in. The current status of the node (Cluster Head or Regular Node) will be updated during the protocol operation. The current parent is also updated during the cluster head election. The values are stored in the 'Nodes' table.

- **Protocol Operation**

The number of nodes below the nodes counts in the 'Nodes' table is keyed in. The nodes are created as label control and added in a panel control with id as label text. When cluster head button is clicked all nodes are assigned with Cluster Head Role. Then a timer is invoked which carries out the normal protocol operation; in which all the nodes execute the operations and change to regular node or cluster head as per the instructions.

6. CONCLUSION

The project focused on bandwidth utilization and leave full adaptation of the system for delay sensitive communications as future work. Systems incorporating channel handover provide uninterrupted channel access for source nodes that travel away from one channel coordinator towards another one by transferring their load. The cooperative load balancing algorithm can be extended to provide such channel handover capability. In this provisioned system, moving active nodes are required to change their channel coordinator not only based on the load on the channel coordinators but also based on the RSSI measurements of Beacon packets from each channel coordinator. Although the system describes HeteroNET based on WLAN/Bluetooth, it is believed that it can be easily extended to other interface combinations, such as WiMAX/Bluetooth. In the future, node failure scenario can be studied.The new system becomes useful if the above enhancements are made in future. The new system is designed such that those enhancements can be integrated with current modules easily with less integration work. The following enhancements are should be in future.

- The application if developed as web services, then many applications can make use of the records.
- The data integrity in cloud environment is not considered. The error situation can be recovered if there is any mismatch.
- The website and database can be hosted in real cloud place during the implementation.

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