IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 6, Issue 7, July 2017

Dynamic Channel Allocation for Cluster Based Mobile Ad Hoc Networks

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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.

Keywords: Band width, Dynamic Allocation, IPDB, Protocol, MANETs.

I. INTRODUCTION

Network security consists of the policies and practices adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Network security involves the authorization of access to data in a network, which is controlled by the network administrator. Users choose or are assigned an ID and password or other authenticating information that allows them access to information and programs within their authority. Network security covers a variety of computer networks, both public and private, that are used in everyday jobs; conducting transactions and communications among businesses, government agencies and individuals. Networks can be private, such as within a company, and others which might be open to public access. Network security is involved in organizations, enterprises, and other types of institutions. It does as its title explains: It secures the network, as well as protecting and overseeing operations being done. The most common and simple way of protecting a network resource is by assigning it a unique name and a corresponding password. Network Security concept, Network security starts with authenticating, commonly with a username and a password. Since this requires just one detail authenticating the user name, the password this is sometimes termed one-factor authentication. With two-factor authentication, something the user 'has' is also used (e.g., a security token or 'dongle', an ATM card, or a mobile phone); and with three-factor authentication, something the user 'is' is also used (e.g., a fingerprint or retinal scan). Once authenticated, a firewall enforces access policies such as what services are allowed to be accessed by the network users. Though effective to prevent unauthorized access, this component may fail to check potentially harmful content such as computer wormsor Trojans being transmitted over the network. Anti-virus software or an Intrusion Prevention System (IPS) help detect and inhibit the action of such malware. An anomaly-based intrusion detection system may also monitor the network like wireshark traffic and may be logged for audit purposes and for later high-level analysis. Newer systems combining unsupervised machine learning with full network traffic analysis can detect active network attackers from malicious insiders or targeted external attackers that have compromised a user machine or account. Communication between two hosts using a network may be encrypted to maintain privacy.

II. LITERATURE SURVEY

Jothilakshmi.M et al [1]. They described to Coordinate channel access protocols have been shown to be well suited for highly loaded MANETs under uniform load distributions. In this paper, they presented a lightweight dynamic channel allocation mechanism and a cooperative load balancing strategy that are applicable to cluster based MANETs to address this problem. They presented 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

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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. The cooperative load balancing algorithm has less impact on the performance compared to the dynamic channel allocation algorithm. We showed that these two algorithms can be used simultaneously, maximizing 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. Both of the algorithms as well as the combined system also have a fast response time, which is on the order of a super frame duration of 25 ms, allowing the system to adjust under changing system load. The carrier sensing mechanism enables CDCA-TRACE to select the channel coordinators more effectively compared to IEEE 802.15.4. CDCA-TRACE provides channel access to 20x more nodes and improves the number of receptions compared to IEEE 802.15.4.

Subhajit Sadhu et al [2]. They described the foundation of Optimal Routing Path (ORP) has been proposed with the introduction of cluster-based approach for mobile cellular networks in this paper. The computations of all possible candidate paths and thereby, selection of the least congested path is done by cluster-heads only. Significant reduction of backtracking has been achieved resulting in optimization of the incurred time delay. Clustering approach has been introduced to exempt the nodes other than cluster head from computation and to employ them only to call transmission. The efficiency of the model has been improved with the reduction of delay due to least probable backtracking. The experimental results show as improvement of the proposed model over previous approach with respect to the classified regions.

Deepa V. Guleria et al [3]. They described systems are inefficient and suffer from a large number of false alarms. Some of the common attacks such as DoS, R2L, Probe and U2R affect the network resources. Intrusion detection system has challenges to detect malicious activities reliably and should able to perform efficiently with large amount of network traffic. .It is demonstrated that using Conditional Random Fields high attack detection accuracy can be achieved and using the Sequential Layered Approach high efficiency. These methods cannot detect the Remote to Local and the User to Root attacks effectively, while the proposed integrated system can efficiently and effectively detect such attacks. They described system identify an attack once it is detected at a particular layer and gives a quick response to an attack, thus minimize the impact of an attack. The number of layers in the system can be increased or decreased which a major advantage of the system.

Sannasi Ganapathy et al [4]. They described developing efficient intrusion detecting systems that use efficient algorithms which can identify the abnormal activities in the network traffic and protect the network resources from illegal penetrations by intruders. Though many intrusion detection systems have been proposed in the past, the existing network intrusion detections have limitations in terms of detection time and accuracy. To overcome these drawbacks, we proposed a new intrusion detection system in this paper by developing a new intelligent Conditional Random Field (CRF) based feature selection algorithm to optimize the number of features. we proposed a LAICRF model which is developed by combining an ICRFFSA and LA based classification algorithm for effective intrusion detection. In this work, rule and LA based classification methods have been used that significantly reduce the detection time and hence it increases the detection accuracy.

Osamah Mohammed Fadhil et al [5]. They described Intrusion detection systems are used to detect and prevent the attacks in networks and databases. Rough Set Attribute Reduction Algorithm is one of the major theories used for successfully reducing the attributes by removing redundancies. They described algorithm is used for selecting the minimal number of attributes has been from KDD data set. Moreover, a new K-Nearest Neighborhood based algorithm is proposed for classifying data set. This proposed feature selection algorithm considerably reduces the unwanted attributes or features and the classification algorithm finds the type of intrusion effectively. The proposed work selects only the significant features that have the high probability of predictive measure. With the reduced set, we have reduced the computational time. Further, the Enhanced K-NN classifier helped in achieving the greater accuracy. Hence, we computed the result in an efficient manner to prevent the attacks that improves the security.

III. PROBLEM DESCRIPTION

Motivation

Balanced clustering is the key to increasing the network life time. Also the Cluster Head consumes the maximum of its battery as compared to the rest of the nodes. Hence, if the number of nodes under one Cluster Head is more as compared to the rest of the Cluster Heads, then this node will prematurely dropout of the network. This dropping out of the cluster head drastically reduces the network life time. Hence the energy consumed in communicating with the different nodes in the networks, formation of the cluster, checking for living nodes etc. must be kept at a minimum. One way of doing this is to optimize the number of communications made by the Cluster Head. This can be done by balancing the number of nodes under all the Cluster Head i.e. making each Cluster Head have almost the same number of nodes under every Cluster Head.

Wireless network is any type of computer network that is not connected by wires, and is generally associated with a telecommunications network where the connection between the nodes are made without the using any wires. Wireless telecommunications networks generally use some type of electromagnetic waves (such as radio waves or microwaves) for the transmission of data or communication.

Types of Wireless Networks:
Wireless PAN-Wireless Personal Area Networks (WPANs) interconnect devices within a small area (ranging in meters). For example, by using Bluetooth we create WPAN for interconnecting a head set to a cell phone.

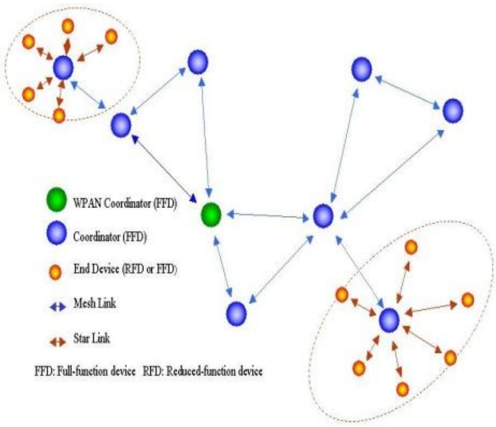

Fig 1: Typical WPAN

Wireless LAN–Wireless LAN is represented as a Wi-Fi network or a Fixed Wireless Data Communication. Fixed Wireless Data implements point to point links between computers(can be two independent networks also) at two different locations, by using dedicated microwave signals or laser beams over the line of sight paths .It is often used to connect two networks existing in two or more adjacent locations.

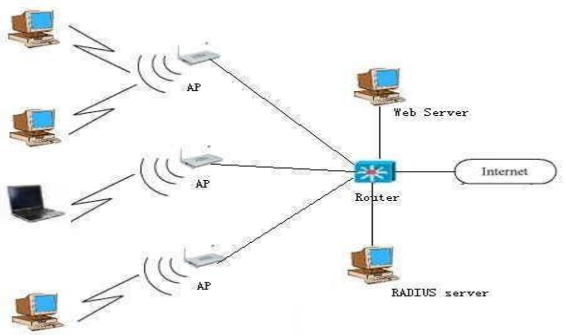

Fig 2: WLAN

Wireless MAN - Wireless Metropolitan Area Networks connects multiple Wireless LANs. WLAN is also known as WiMAX and is covered in IEEE

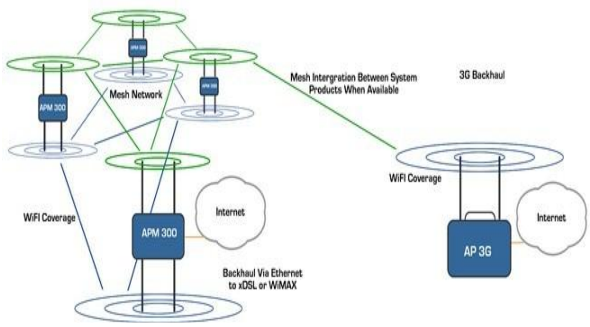

Fig 3: WMAN

Wireless WAN -Wireless Wide Area Networks are wireless networks that cover large outdoor areas. They are deployed at the frequency of 2.4 GHz.

MANET

MANET also known as mobile mesh network is a self configuring collection of mobile devices connects via wireless links. Each device in MANET is connected to the other via wireless links, but since the network is an Ad Hoc network, the node can move in any direction without any constraints. Hence the link between two or more devices changes dynamically. This is the primary challenge of every MANET i.e. to maintain proper communication links with other nodes.

IV. METHODOLOGY

A. APPLYING DISTRIBUTED CHANNEL ALLOCATION AND COOPERATIVE LOAD BALANCING TO TRACE

a. Protocol Overview:

MH-TRACE This section briefly describes the MH-TRACE protocol. The complete protocol description is available in [4]. Also various protocol parameters are optimized. 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 neighbourhood. 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. In MH-TRACE, time is divided into super frames of equal length, as shown in Fig. 1, where the super frame is repeated in time and further divided into frames. Each cluster head operates using one of the frames in the super frame structure and provides channel access for the nodes in its communication range. There are an equal number of IS slots and data slots in the remainder of the frame. During the IS slots, nodes send short packets summarizing the information that they are going to be sending in the corresponding data slot. By listening to the relatively shorter IS packets, receiver nodes become aware of the data that are going to be sent and may choose to sleep during the corresponding data slots. These slots contribute to the energy savings mechanism by letting nodes sleep during the relatively longer data slots whose corresponding IS packets cannot be decoded. IS packets can also carry routing information. However, for the purposes of this paper, we assume that all the nodes that can success-fully receive the IS packet listen to the corresponding data slot, since we are testing the performance of the MAC layer only. Routing considerations addressed in [45] are out of the scope of this paper.

B.Collaborative Load Balancing for TRACE

In this described DCA-TRACE which tackles non-uniform load distribution by allowing the CHs to access more than one frame in the super frame. The same problem can also be tackled from the member nodes’ perspective. In our previous work, we determined that the majority of the nodes in a TRACE network are in the vicinity of more than one CH (they are in the vicinity of two, three or four CHs with probabilities of 52, 19 and 1 percent). The nodes that are in the vicinity of more than one CH can ask for channel access from any of these CHs. Using a cooperative approach and a clever CH selection algorithm on the nodes, the load can be migrated from heavily loaded CHs to the CHs with more available resources. In the TRACE protocols, nodes contend for channel access from one of the CHs that have available data slots around themselves. After successful contention, they do not monitor the available data slots of the CHs around them. Due to the dynamic nature of the network load, a cluster with lots of available data slots may become heavily loaded during a data stream. In order to tackle this issue, nodes should consider the load of the CH not only when they are first contending for channel access but also after securing a reserved data slot during the entire duration of their data stream.

C. Collaborative Load Balancing for MANET

DCA-TRACE, which tackles non-uniform load distribution by allowing the CHs to access more than one frame in the super frame. The same problem can also be tackled from the member nodes’ perspective. The majority of the nodes in a TRACE network are in the neighborhood of more than one CH . The nodes that are in the vicinity of more than one CH can ask for channel access from any of these CHs. Using a cooperative approach and a clever CH selection algorithm on the nodes, the load can be migrated from heavily loaded CHs to the CHs with more available resources. In the TRACE protocols, nodes contend for channel access from one of the CHs that have available data slots around themselves. After successful contention, they do not monitor the available data slots of the CHs around them. Due to the dynamic nature of the network load, a cluster with lots of available data slots may become heavily loaded during a data stream. In order to tackle this issue, nodes should consider the load of the CH not only when they are first contending for channel access but also after securing a reserved data slot during the entire duration of their data stream.
Nodes A-G are source nodes and need to contend for data slots from one of the CHs. Each CH has 6 available data slots. In MH-TRACE, if their contentions go through in alphabetical order, node G would mark CH1 as full and would ask for channel access from CH2. However, if node G secures a data slot from CH1 before any of the nodes A-F, one

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

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Vol. 6, Issue 7, July 2017

of the source nodes would not be able to access to the channel. In DCA-TRACE, once CH1 allocates all of its available slots, it triggers the algorithm to select an additional frame.

V. EXPERIMENTAL RESULTS

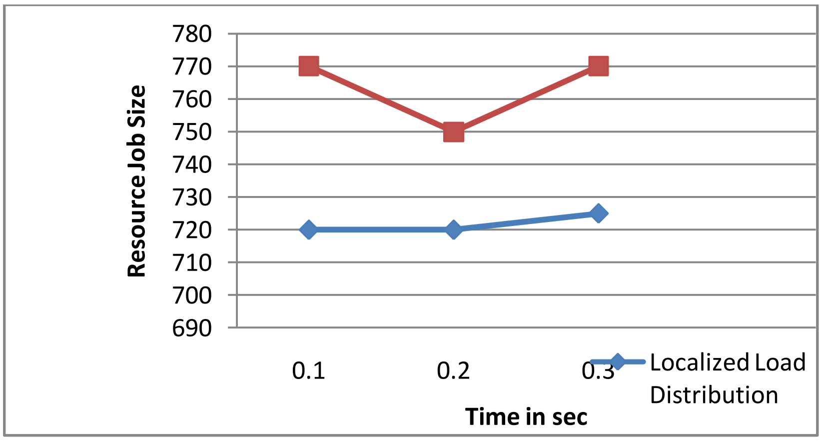
A. Setup

We evaluate our performance based on the priority by simulating load balancing algorithm. One by one Simulation of the working group completed in 10 jobs. In each execution Simulation, a group of 70 different analog service Applications (ie jobs), and each includes a service request up to 18 subtasks. We believe in Simulation of clouds. All 70 will be subject to random cloud service requests any time soon. In these requests services 70, 15 Application is in AR mode, while the rest is the best way to work with different SLA objectives. That Table 1 Parameter set randomly in simulation According to their maximum and minimum values. Since we only focus on the planning algorithms, we do simulations locally without implementing in any exiting cloud system or using VM interface API.

Table 1: Parameters and its Range

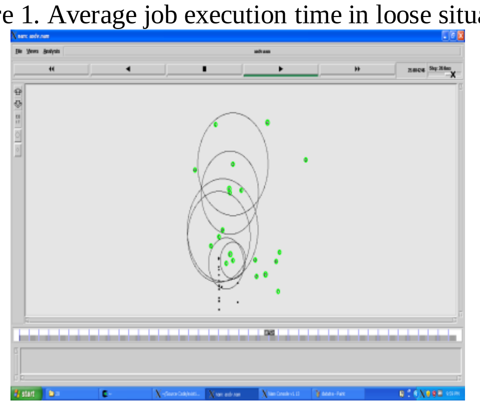
Parameter	Minimum	Maximum
No. of virtual machine in cloud	23	120
No. of CPU in a VM	1	7
Disk Space	8000	100000
Memory	16	2048
Speed	100	1000

B. Result



In Figure 1 shows the average execution job loose situation. We realized that the algorithm. The minimum average execution time. Resource Parameters when work occurs AR work best be replaced by. Such as Resource contention at least loosened, it is expected that Target part-time work is nearing completion of the actual time. Therefore Adaptation procedure does not affect the date of execution significant.

Figure 1. Average job execution time in loose situation



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Under prove difficult situation shown in Figure 2 Multi hob network localized load distribution behavior random load distribution better. In stressful situations the scramble for resources more so when the work actually completed it is often later than expected arrival. Because AR preemption works the best, the process of adaptation and upgrade Information more meaningful works in a difficult situation.

VI. CONCLUSION

In this work, the problem of non-uniform load distribution in mobile ad hoc networks. We 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. We showed that these two algorithms can be used simultaneously, maximizing 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. Both of the algorithms as well as the combined system also have a fast response time, which is on the order of a super frame duration of 25 ms, allowing the system to adjust under changing system load. We proposed a novel MAC protocol, CDCA-TRACE, that combines dynamic channel allocation and cooperative load balancing algorithms into the TRACE framework. CDCA-TRACE, which controls channel utilization through the dynamically selected distributed channel coordinators, is compared to beacon, which controls channel utilization in a fully distributed manner.

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 DOI10.17148/IJARCCE.2017.6752