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Analysis of Broadcast protocol in Random channel usability in multi hop CR Ad hoc network

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ABSTRACT: Broadcast is an important operation in wireless ad hoc networks where control information is usually propagated as broadcasts for the realization of most networking protocols. In traditional ad hoc networks, since the spectrum availability is uniform, broadcasts are delivered via a common channel which can be heard by all users in a network. However, in cognitive radio (CR) ad hoc networks, different unlicensed users may acquire different available channels depending on the locations and traffic of licensed users. This non-uniform channel availability leads to several significant differences and causes unique challenges when analyzing the performance of broadcast protocols in CR ad hoc networks. In this paper, a novel unified analytical model is proposed to address these challenges. Our proposed analytical model can be applied to any broadcast protocol with any CR network topology. We propose to decompose an intricate network into several simple networks which are tractable for analysis. We also propose systematic methodologies for such decomposition. Results from both the hardware implementation and software simulation validate the analysis well. To the best of our knowledge, this is the first analytical work on the performance analysis of broadcast protocols for multi-hop CR ad hoc networks. To achieve high success rate with minimum delay using QoS based Scheme. Success rate is defined as the probability that all the nodes receive message successfully.

KEYWORDS:Cognitive radio, Broadcast protocols, random channel usability, mobile adhoc network.

I. INTRODUCTION

Mobile computing is human–computer interaction by which a computer is expected to be transported during normal usage. Mobile computing involves mobile communication, mobile hardware, and mobile software. Communication issues include ad hoc and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. Hardware includes mobile devices or device components. Mobile software deals with the characteristics and requirements of mobile applications.

Mobile Computing is "taking a computer and all necessary files and software out into the field. Mobile computing is any type of computing which use Internet or intranet and respective communications links, as WAN, LAN, WLAN etc. Mobile computers may form wireless or a pioneer.

Wireless data connections used in mobile computing take three general forms so. Cellular data service uses technologies such as GSM, CDMA or GPRS, 3G networks such saw, EDGE or CDMA2000. And more recently 4G networks such as LTE, LTE-Advanced. These networks are usually available within range of commercial towers. Wi-Fi connections offer higher performance, may be either on a private business network or accessed through public hotspots, and have a typical range of 100 feet indoors and up to 1000 feet outdoors. Satellite Internet access covers areas where cellular and Wi-Fi are not available and may be set up anywhere the user has a line of sight to the satellite's location, which for satellites in geostationary orbit means having an unobstructed view of the southern sky. Some enterprise deployments combine networks from multiple cellular networks or use a mix of cellular, Wi-Fi and satellite. When using a mix of networks, a mobile virtual private network (mobile VPN) not only handles the security concerns, but also performs the multiple network logins automatically and keeps the application connections alive to prevent crashes or data loss during network transitions or coverage loss.

A wireless ad hoc network (WANET) is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes forward data is made dynamically on the basis of network connectivity. In addition to the classic routing, ad hoc networks can use flooding for forwarding data.

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An ad hoc network typically refers to any set of networks where all devices have equal status on a network and are free to associate with any other ad hoc network device in link range. Ad hoc network often refers to a mode of operation of IEEE 802.11 wireless networks.

Mobile Ad-hoc Networks (MANET) are created of composite distributed systems which connect wireless nodes. These nodes can generously and dynamically self in mobile network topologies. Since the nodes are mobile, the network topology may change rapidly and unpredictably over time. The network is decentralized, where all network activity including discovering the topology and delivering messages must be executed by the nodes , i.e., routing functionality will be incorporated into mobile nodes. Factors such as variable wireless link quality, propagation path loss, fading, multiuser interference, power expended, and topological changes, become relevant issues. The network should be able to adaptively alter the routing paths to alleviate any of these effects.

II. RELATED WORK

Even though the broadcasting issue has been studied extensively in traditional mobile ad hoc networks mobile ad hoc network (MANETs), research on broadcasting in multi-hop CR ad hoc networks is still in its infant stage. The existing works mainly focus on broadcast protocol designs. The performance analysis of these proposed protocols is simulation-based. Thus, the analytical relationship between these proposals and their performance is not known. More importantly, without analytical analysis, the system parameters in the protocols are not designed to achieve the optimal performance. In fact, analytical analysis is beneficial not only for better understanding the nature of a proposed protocol, but also for better designing the system parameters of a protocol to achieve the optimal performance. It can also provide useful insights to guide the future broadcast protocol designs in CR ad hoc networks.

Due to this problem by considering this problem, make an efficient methodology to analyzing the several protocols. A novel unified analytical model is proposed to analyze the broadcast protocols in CR ad hoc networks with any topology. Specifically, in this work propose to decompose an intricate network into several simple networks which are tractable for analysis. Also propose systematic methodologies for such decomposition.

Current research into cognitive radios hopes to improve spectral utilization by allowing users from crowded bands to bleed off into nearby empty bands. In an ideal scenario a spectrum aware cognitive radio is able to sense the local spectrum usage and adapt its own radio parameters accordingly. As an example, consider a personal Wi-Fi network in a crowded New York apartment complex. The number of co-located networks present can easily fill the 2.4 GHz band, in which personal Wi-Fi devices are designed to operate. Instead of adding an additional device to an over-used band, a cognitive radio would be able to sense the over-use of the allocated Wi-Fi spectrum and the underutilization of other nearby spectrum blocks. Once so determined the cognitive radio would operate in the free spectrum, thus more efficiently utilizing the total available spectrum. Examples of spectrum blocks that may be underutilized may include empty broadcast television/radio stations, radio- astronomy blocks, radio-navigation blocks, and others. The advance of cognitive radio and spectrum sensing radios is a high priority for the FCC. The 802.22 draft standard, which is still under review, is the FCC's first foray into cognitive radio and demonstrates their commitment and active interest in this emerging technology.

Cognitive radio network advantages are the use of a cognitive radio network provides a number of advantages when compared to cognitive radios operating purely autonomously:

- **Improved spectrum sensing:** By using cognitive radio networks, it is possible to gain significant advantages in terms of spectrum sensing. [see later pages in this tutorial].
- **Improved coverage:** By setting up cognitive radio network, it is possible to relay data from one node to the next. In this way power levels can be reduced and performance maintained.

Hence this novel technique based on the CR ad hoc networks. By estimating the protocol efficiency without considering the specific protocol design helps to carried out effectively. The main works on this methodology are as follows.

First an algorithm for calculating the successful broadcast ratio (i.e., the probability that all nodes in a network successfully receive a broadcast message) is proposed for CR ad hoc networks. The proposed algorithm is a general methodology that can be applied to any broadcast protocol proposed for multi-hop CR ad hoc networks with any topology. Second an algorithm for calculating the average broadcast delay (i.e., the average duration from the moment a broadcast starts to the moment the last node in the network receives the broadcast message) is proposed for CR ad hoc networks under grid topology. Finally the derivation methods of the single-hop performance metrics that means

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successful broadcast ratio, average broadcast delay, and broadcast collision rate (i.e., the probability that a single-hop broadcast fails due to broadcast collisions), for three different broadcast protocols in CR ad hoc networks under practical scenarios (e.g., no dedicated common control channel exists and the channel information of any other SUs is not known) are proposed.

III.SYSTEM DESIGN

In Existing System the Federal Communications Commission (FCC), almost all the radio spectrum for wireless communications has already been allocated. In traditional ad hoc networks, since the spectrum availability is uniform, broadcasts are delivered via a common channel which can be heard by all users in a network. In traditional MANETs exist; there is no analytical work on broadcast protocols in multi hop CR ad hoc networks. The MANET Network, the channel availability is uniform for all nodes. In addition, some exigent data packets such as emergency messages and alarm signals are also delivered as network wide broadcasts. In traditional MANETs, it is always one time slot (i.e.) Sender only needs one time slot to let all its neighboring nodes receive the broadcast message in an error-free environment.

Even though the broadcasting issue has been studied extensively in traditional mobile ad hoc networks (MANETs) research on broadcasting in multi-hop CR ad hoc networks is still in its infant stage. There are a few papers addressing the broadcasting issue in multi-hop CR ad hoc networks. However, these proposals mainly focus on broadcast protocol designs. The performance analysis of these proposed protocols is simulation-based. Thus, the analytical relationship between these proposals and their performance is not known. More importantly, without analytical analysis, the system parameters in these protocols are not designed to achieve the optimal performance. In fact, analytical analysis is beneficial not only for better understanding the nature of a proposed protocol, but also for better designing the system parameters of a protocol to achieve the optimal performance.

It can also provide useful insights to guide the future broadcast protocol designs in CR ad hoc networks. Hence, in this project, to focus on the analytical analysis of broadcast protocols for multi-hop CR ad hoc networks. Although a vast amount of analytical works on broadcast protocols in traditional MANETs exist, currently, there is no analytical work on broadcast protocols in multi-hop CR ad hoc networks. More importantly, all the methods proposed for traditional MANETs cannot be simply applied to multi-hop CR ad hoc networks. This is because that in traditional MANETs, the channel availability is uniform for all nodes. However, in CR ad hoc networks, different secondary users (SUs) may acquire different available channel sets, depending on the locations and traffic of primary users (PUs), as shown in Figure 1. This non-uniform channel availability leads to several significant differences and causes unique challenges when analyzing the performance of broadcast protocols in CR ad hoc networks.

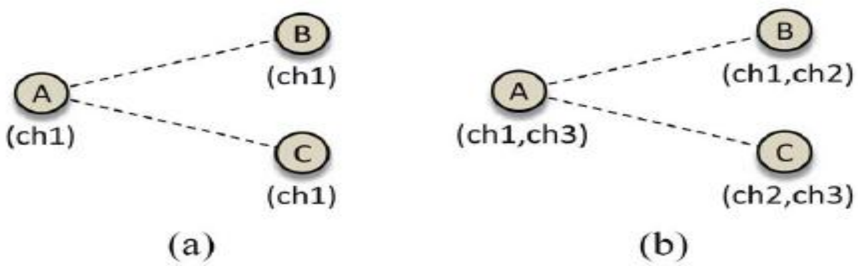

Figure 1: Single-hop broadcast scenario. (a) Traditional ad hoc networks. (b) CR ad hoc networks.

First of all, unlike in traditional MANETs, in CR ad hoc networks, the single-hop broadcast is not always successful in an error-free environment. If node A is the source node, in traditional MANETs, all its neighbouring nodes can tune to the same channel to receive the broadcast message. However, in CR ad hoc networks, such a common available channel for all neighbouring nodes may not exist. As a result, the broadcast may fail. More severely, even if a common available channel exists between the source node and its neighbouring nodes, they may not be able to tune to that channel at the same time, which will also result in a failed broadcast. In fact, whether the single-hop broadcast is successful depends on the channel availability of each SU which is time-varying and location-varying. Due to the uncertainty of the single-hop broadcast success, the successful broadcast ratio of a network is usually random. Secondly, different from traditional MANETs where the relative locations of the communication pair do not impact the successful receipt of the message as long as they are within the transmission range of each other, in CR ad hoc networks, the probability that a node successfully receives a broadcast message is affected by the relative locations between the

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sender and the receiver. This is because that the available channels of a SU are obtained based on the sensing outcome from the proximity of the node. Thus, SU nodes that are close to each other have similar available channels and they may have higher successful broadcast ratio, as compared with the SU nodes far away from each other whose available channels are often less similar.

Existing System using common available channel for all neighbouring nodes may not exist as a result, the broadcast may fail. Source node and its neighbouring nodes, they may not be able to tune to that channel at the same time, which will also result in a failed broadcast. Due to the uncertainty of the single-hop broadcast success, the successful broadcast ratio of a network is usually random broadcast collisions are complicated in CR ad hoc networks. In CR ad hoc networks, nodes may use multiple channels for broadcasting. Without the information about the channel used for broadcasting and the exact delay for a single-hop broadcast, to predict when and on which channel a broadcast collision occurs is extremely difficult.

The Unified Analytical Model for Broadcast Protocols are using in the proposed system. There are three main contributions in this model. The initial step is converting the network nodes into simpler forms by using standard model.

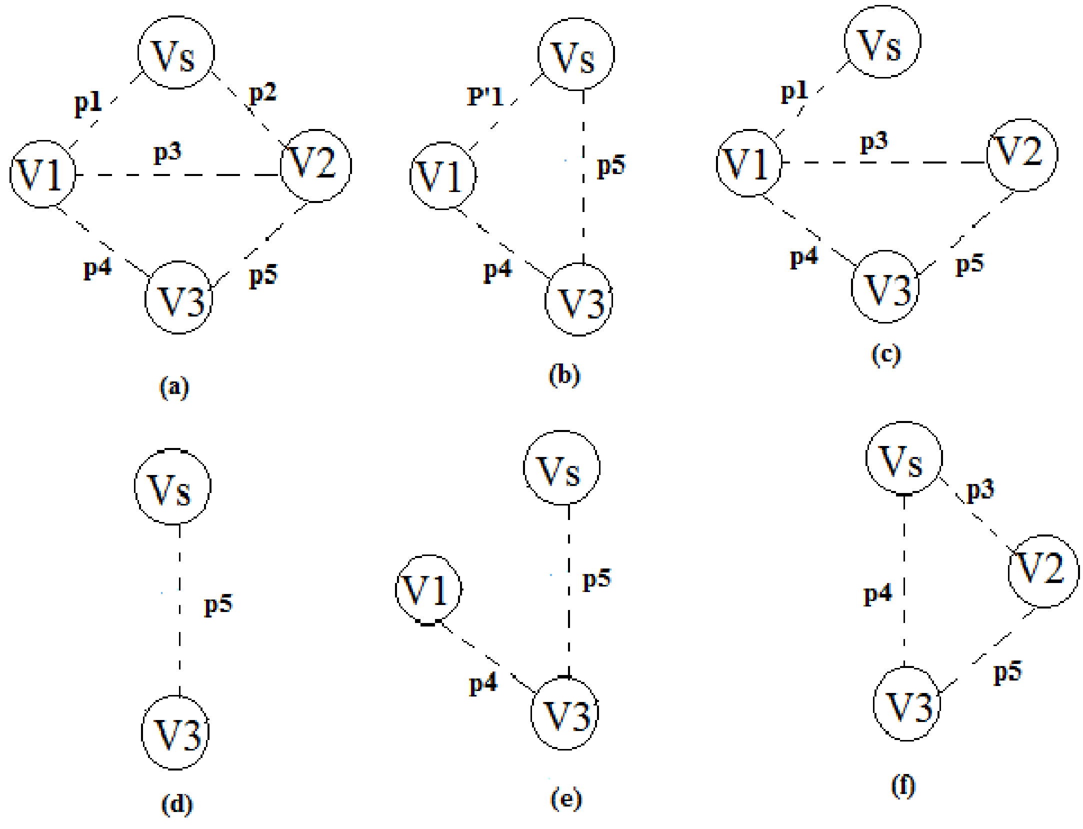

Figure 2 Process of the proposed Algorithm 1 for a 4-node CR ad hoc network. (a) The original network. (b) Link e(vs, v2) is successful. (c) Link e(vs, v2) is failed. (d) Link e(vs, v1) is successful after (b). (e) Link e(vs, v1) is failed after (b). (f) Link e(vs, v1) is successful after (c).

Second one is an algorithm for calculating the successful broadcast ratio (i.e., the probability that all nodes in a network successfully receive a broadcast message) is proposed for CR ad hoc networks. The proposed algorithm is a general methodology that can be applied to any broadcast protocol proposed for multi-hop CR ad hoc networks with any topology. Finally using an algorithm for calculating the average broadcast delay (i.e., the average duration from the moment a broadcast starts to the moment the last node in the network receives the broadcast message) is proposed for CR ad hoc networks under grid topology

The grid topology is the proposed methodology can be applied to any network topology. To define the level of SUs as h if they are h hops to the source node (denoted as L = h). An example of an 8-node CR ad hoc network with the levels

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of SUs where A is the source node. Then, the original network is decomposed into Hm levels, where Hm is the distance from the source node to the furthest node in the network. To make the derivation process tractable, we first make two assumptions. First of all, to assume that the broadcast message is propagated from the source node to the furthest node sequentially based on the relative distance to the source node. This means that, To assume that the nodes who are closer to the source node receive the message sooner than the nodes who are farther away from the source node. Based on this assumption, categorize the SUs based on their relative distances to the source node. The further justify this assumption using simulation.

The broadcast protocol is applied to the network in the proposed method. The simulation results of the average delay for different nodes to receive the broadcast message in the network shown in Figure 3. It is shown that nodes at a higher level (e.g., nodes D and E at the second level) receive the broadcast message later than the nodes at a lower level on average (e.g., nodes B and C at the first level), which justifies our first assumption. The second assumption is that only the nodes that are at the highest level or have a path leading to the furthest node (excluding the source node) contribute to the overall average broadcast delay. Other nodes will be removed from the network for calculating the average broadcast delay

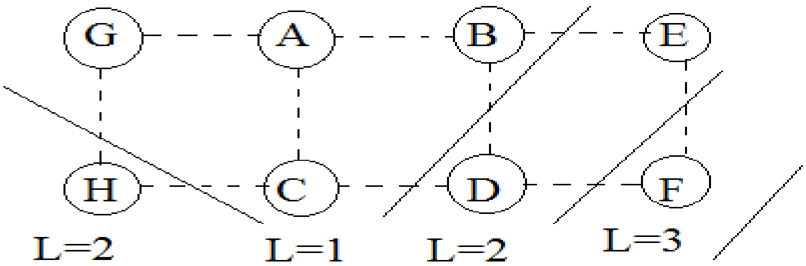

Figure 3: Example of an 8-node CR ad hoc network with the levels of SUs.

IV. SYSTEM IMPLEMENTATION

In this chapter describe about system implementation. Here proposed method using 4 phases for implementation. Those are Intrinsic Network and Initial BR Value Setting Phase, Updating BR Value for Simple Network, Level Classification in Grid Topology, Estimate the Performance of Protocols.

A) Intrinsic Network and Initial BR Value Setting Phase

For Network formation, each node needs to register their details such as IP address, Location and Available number of channels. After authenticating these details then network is constructed with Specific number of nodes and links and also setting the initial value of Broadcast Ratio for each link.

B) Updating BR Value for Simple Network

Initially select a link which is one hop distance to server and perform the broadcasting through that link only. Based on the broadcasting result new BR value is calculated. If successful broadcasting occurs then, update BR value otherwise dynamically remove the link.

C) Level Classification In Grid Topology

After finding the successful Broadcasting Ratio, then simple Gird network is formed. At this stage, Grid networks are separated in various levels based on hop distance from the server. This helps to find the Broadcast Delay at each level of network.

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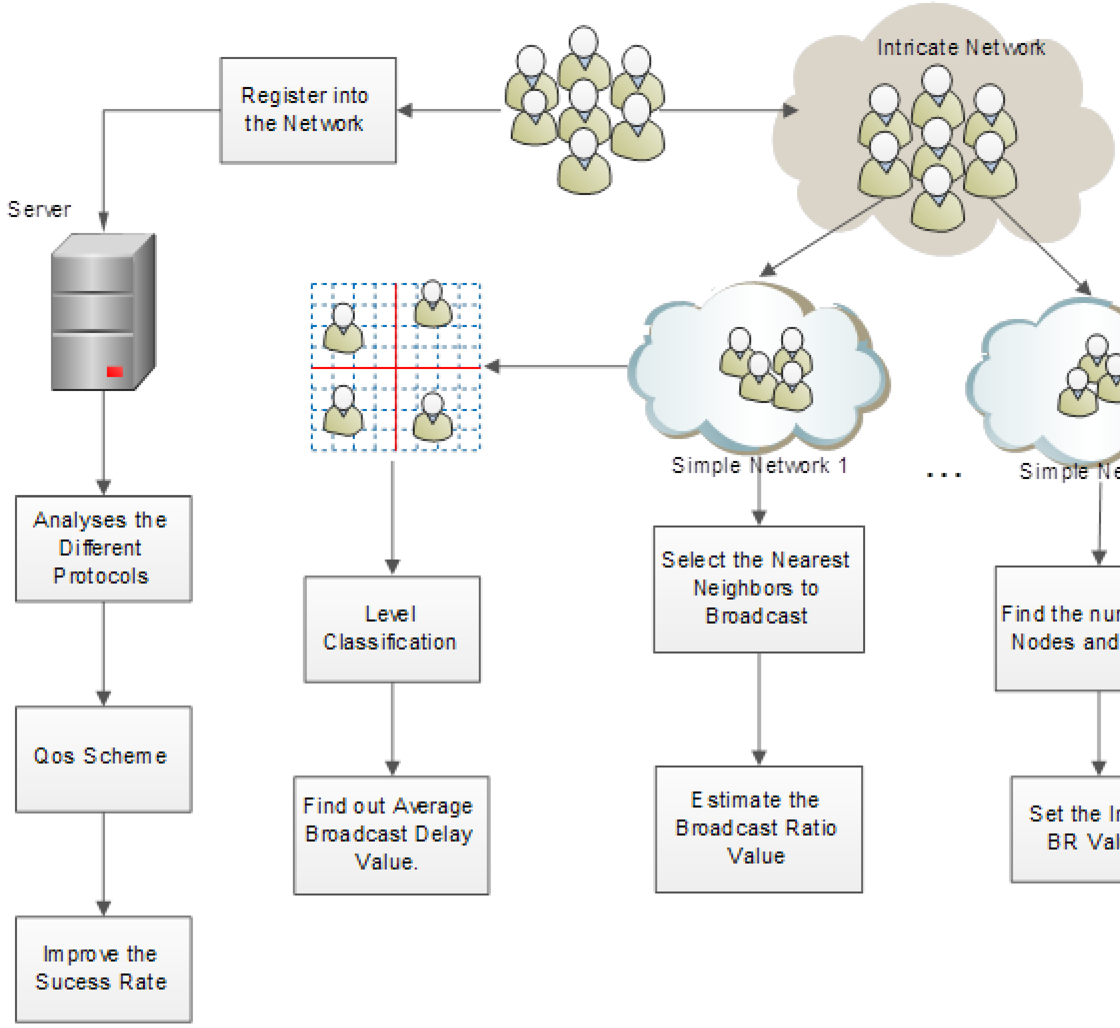

Figure 4: Architecture diagram

D) Estimate the Performance of Protocols

By collecting all broadcast delay value at each level, finding the Average Broadcast Delay for the broadcasting protocol. With the help of Broadcast Ratio and Average Broadcast Delay value, evaluate the performance of broadcast protocol.

V. CONCLUSION

A novel unified analytical model is proposed to address the challenges in traditional MANET and analyze the broadcast protocols in CR ad hoc networks with any topology. Specifically, two algorithms are proposed to calculate the successful broadcast ratio and the average broadcast delay of a broadcast protocol. In our future work analyzing the various broadcast protocol, we provide more approximate value in performance statics. In this broadcast delay is calculating based on distance from the source and not estimating the delay for the node which is not having path leading. So in future consider that issue, make average delay estimation 99% successful.

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