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Optimization Algorithm for Online Link Power Management

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ABSTRACT: Demand for high precision, unattended, real-time data collection and observation over a wide area has increased the technological advancement towards distributed wireless networks. Inter dependent technologies which compose the complete system consisting of processor, battery and other hardware and software's. Developments can be made for some improvements as in case of processing, but all together doesn't make much of a divergence. To conquer these issues there is needs of overall technological advancement.
Current restrictions of wireless networks such as life of network, capacity and performance, are becoming part of high research effort. In this paper we try to attain the objective of high performance in wireless network, this work focuses on developing new algorithms for wireless network management for nodes in a distributed network to achieve higher data rates and network throughput performance.

Keywords: Power Management, communication channel capacity, capacity expansion

I. INTRODUCTION

In wireless networking, the communication between the nodes occurs over a wireless radio channels. In this work a conventional modeling of wireless channel based communication scheme is considered where, each communication channel consists of a channel pair, one for communication from source node (SN) to destination node (DN), which is known as down channel, and another for communication from DN to SN, which is known as up channel. The mode of communication considered is presented as;

For every communication session, a channel pair is allocated. This pair is used while the session continues within the same cell. There is also an additional pair of channels tapped by all DNs, which are utilized for signaling function. When a call for a DN arrives to the SN, the individuality of the DN is broadcast via the down signaling channel. When the target DN identifies itself, it replies with a affirmative response via the up signaling channel. Then, the SN specifies the channel pair that will be used for the communication. Afterwards, the data transfer and signaling continues on relevant channels. When a DN initiates a call, the SN is informed with a message sent via the up signaling channel. The call request is passed to DN by SN, and the node handles the rest of the connection request. When the link with the other party is established, the SN denotes the up and down communication channels to the initiator DN [1].

When the node initiates a call, the DN is informed with a message sent via the up signaling channel. The call request is passed to the node by SN, and node handles the connection request. When the connection is established, the SN specifies the up and down communication channels to the initiator. Since the node nodes are liberated to move, it is not guaranteed that any node involved in a communication session will remain in the location it once was during the lifetime of the session. When a node goes over to another location while a link proceeds, the call is passed to the new link hop. This procedure is called link-hop. The average number of link-hops during a session depends in the network area, mobility pattern of the mobile nodes and call duration. Two thresholds are set for the link-hop procedure. When the power level drops below the first threshold, the link-hop process is triggered. As long as the power level remains over the second threshold, which is lesser than the first one, the perception of the signal is sufficient for proper communication. To offer flawless communication, the received signal powers are monitored. The link-hop must be completed before the signal level drops below the second threshold. It is possible that new resources are not available on the way to the new links. Particularly when the carried data rate cannot be determined beforehand, it may be complicated to assign necessary resources on time. Therefore, the gap between two threshold values should be chosen very carefully to allow the procedure enough time to be completed. [2].

When the scopes of the wireless networks are extended to include also multicasting, different considerations are essential. Buffering is also deployed in cases of multicasting data to many mobile nodes over assorted data rates. The synchronization of data during link-hops is an exigent setback. If a large area is to be included in the wireless communication system, then there are a few potential to handle this.

The first prospect is to have a single big transceiver antenna. This case is analogous to the radio transmitters that service a large area. This antenna with its proper equipment is called link Station (LS). On the other hand, if multiple users of the system want to use it, there should be sufficient channels available for each connection. If not, the users should wait until the channels become vacant. If few links are present in a certain area, then there should be sufficient number of channels accessible in order to keep the refusal probability at a rational level, which is infeasible most of the time.

II. LITERATURE REVIEW

Junfeng Xiao *et al.* [3] discuss the technical solutions to expand LTE spectrum with CR technology, and survey the progress in LTE-CR from both research and implementation aspects. They present detailed key technologies that enable LTE-CR in the TV white space (TVWS), and related standards and regulation progresses. To show the possibility of deploying LTE spectrum with CR technology in TVWS, they conducted extensive system-level simulations and also developed a LTE spectrum with CR technology prototype.

Richard N. Clarke [4] described the capabilities of 4G LTE wireless technologies, and further improvement of it, to boost network capacity. The capacity expansion capability of LTE-Advanced along with traditional spectrum reuse are quantified, and are contrasted to forecasts of future requirements to evaluate the capability of U.S. networks to match this future demand. They find that without significantly increased allocations of spectrum, wireless capacity extension will be entirely insufficient to accommodate expected demand growth.

Linhan Feng *et. al.* [5] researched on the performance of channel allocation method in IEEE 802.11s WMN. The property of the traditional fixed assignment algorithm and the mesh interference model are discussed. Then an enhanced channel allocation method based on these will be introduced and implemented.

Henna [6] proposed two cross layer broadcasting protocols called CASBA and CMAB which dynamically adapt to network conditions of congestion and mobility. She also proposed a broadcasting protocol called DASBA which dynamically adapts to local node density. CASBA, CMAB, and DASBA improve the reachability while minimizing the broadcast cost.

III. INTERVENTION SYSTEM MODEL

In a wireless network profound data transfer results in interference obtained due to co-channel link communication.

Due to multiple requesting at one time there is a heavy packet collision and channel blockage, this effect results in reduction in throughput for the communication system. The upshot of MAI (multiple access interference) in wireless network could be observed as;

For a packet at node i received with the average received power of the needed signal $P^{(i)}$,at the i^{th} node. Presume that there are K interfering transmissions with received powers P_j, j = 1, . . . , K. The worth of the anticipated reception is effectively measured by the effective bit energy-to- noise spectral density ratio at the detector, denoted by μ(i). For an asynchronous direct sequence BPSK(binary phase shift keying) system, μ(i) is given by:

$$\mu^{(T)} \triangleq \left(\frac{2\sum_{j=1}^{k} P_J}{3wp_0^{(I)}} + \frac{1}{\mu_0} \right)^{-1}$$

Where W is the processing gain and μ_0 is the Eb/N0 eff detector in the absence of interference. As the interfering power increases, $\mu^{(i)}$ decreases, and the bit error probability increases. For example, in a multi-access system that uses BPSK modulation and a convolutional code with rate 1/2, constraint length 7, and soft decision Viterbi decoding. Let W = 100. To achieve a bit error probability of 10^{-6}, the required Eb/N0eff is 5.0 dB. Ignoring the thermal noise and using above equation, the whole intervention power must satisfy:

$$\frac{\sum_{j=1}^{K} P_j}{p_0^{(i)}} \leq 47.43$$

Transmitters are, in general, situated at diverse distances from the receiver. Suppose that the transmission powers are fixed and equal. Consider the case of one interferer (K = 1) at distance d1 from the receiver. Let XC d_0 be the distance between the receiver and the anticipated transmitter. Using the two-ray promulgation model for terrestrial communications (power loss ≈ 1/d4), it is easy to demonstrate that to convince the required bit error rate, we must have $d_1 \approx 0.38 d_0$. So if there is only one interferer that is at distance less than 0.38 d_0 from the receiver, trustworthy communication will not be possible (i.e., a secondary collision will occur). The above illustration shows that the near-far problem can severely affect packet reception, and subsequently, network throughput. A better-quality measure of network throughput is given by the expected forward progress (EFP) per transmission, named as the product of the local throughput of a node and the distance between the transmitter and the receiver.

In an interference-limited wireless system, the uplink cell capacity is basically limited by the total received uplink power at the node due to the transmit power limitation of user nodes.

In decentralized scheduling, each node assigns radio resources to its users on a priority basis until the estimated power level reaches a pre-defined target.

In decentralized networks, the scheduling algorithms have an intrinsic deficiency, due to their weakness to interlink interference, which has not been addressed yet. In other words, considerable proportion of power at the node is made up from multiple accesses interlink interference which the source node has little knowledge about or control upon. This in turn may direct the system to interference outage and reduced resource utilization.

Particularly when interfering cells have similar traffic load variations, inadequate (interlink) interference management strategy in highly loaded systems is an inherent problem of decentralized scheduling, regardless of the algorithm being used. Several interference mitigation techniques such as Multi User Discovery (MUD), Intervention cancellation (IC), antenna beam forming, and their combinations have been presented and proved to be effective in mitigating interference to some extent and thereby increase system capacity. However, in a highly burdened system, the difficulty of interlink interference remains an significant issue. From the scheduling viewpoint, although interlink interference problem is more severe in decentralized scheduling, it is also present in centralized scheduling due to the fact that the interlink interference impact of a scheduled user is not known and therefore has not been considered by the central scheduler. Since the number of channels are scarce most of the time and the number of users willing to use the system cannot be predetermined simply, it is necessary to reuse the limited number of channels in the system. If the nodes are placed far enough from each other such that the interference level is below a definite level, both communication sessions can carry on over the same channel concurrently. In wireless network, the power level of the received signal can be expressed as [8]:

$$P_r = P_0 \left(\frac{d}{d_0} \right)^{-n}$$

The term P_r is the power level received at a distance of d from the antenna, P_0 is the measured power level at a distance of d_0 and the n is the path loss exponent, which is in the order of two to four in the urban environments. If the complete set of obtainable channels will be used in each cell, then the received power level at an equal distance from both nodes will be equal if they work at the same power level. In any other location, one of the stations will be governing. So in the near vicinity of the cell boundaries, there exist locations where none of the nodes will be dominant. Hence, communication will not be achievable. In order suitable communication to persist, the signal level from the node serving the calls in the cell should be so large that another node using the same channels should be almost imperceptible.

It is enough to consider only the nearest neighbouring nodes that use the same channels because the signal power level received from other nodes will be at most 4^{-n} times that of the next such node according.

For a clustered nodes communicating simultaneously, the cluster size can be calculated as follows:

$N=i^2+ij+j^2$ $\quad$ $i.j \in Z^+$

The co-channel reuse factor Qf is the ratio of the distance D between the node centres that use the same frequency set to the larger radius R of the communication range. Qf and N are related to each other with the following formula.

$$Qf = \frac{D}{R} = \sqrt{3N} \qquad -$$

The signal to interference ratio S/I is the measure of requested signal to co-channel interference ratio. Furthermore, if there are i_0 immediate neighbours using the same co-channel set, S/I can be estimated as:

$$\frac{S}{I} = \frac{\left(D/R\right)^n}{I_0} = \frac{\left(\sqrt{3N}\right)^n}{I_0}$$

If the value of Qf is small, the system capacity increases since the value of N is also small and the channels can more frequently be used over a given area. On the other hand, if the value of Qf is large, this leads to better transmission quality since the S/I ratio increases. At the same time system capacity decreases. The choice of N depends on the quality of the transceivers used and the terrestrial factors. During communication each packet is processed with the power limit and the total offered link power is recorded in each node. For establishing a link the created link monitoring table is used and its value is used for comparison with a referenced “Lpth” threshold used for communication.

IV. ONLINE LINKAGE POWER MANAGEMENT ALGORITHM

This algorithm moves each node to keep a trace of the bond and power currents compared with the limit of threshold to create a signal or a statute before the storage block to avoid the connection of dead end. The algorithm is described as follows,

- For a network of the data disseminated by chance,
- Straight links of lucky find under the connection of range of constriction.
- Making a monitoring of table of connection (LMT) for the statute of power of node declared through bonds, launching of all the bonds with energy as zero.

At the source,

- Compare the current with Lpth LP, if <Lpth of LP, allow the process of transmission.
- Construct of a packet before the request is subjected; update the appropriate power of bond by LP.

-Where LP is about the cost determined close (K * central processing unit * D), where K is the number of simultaneous connections, central processing unit is the unit of power of uplink and D is the binary debit required.
- Revise the LP entry subsequent in the connection of access of LMT.
- Transmit the packets with the channel of emission with the fuel rating.

At the sink,
- If the power is taken to limit the significance of the transmission.
- Take the packet and revise the bond in the expenses of entry of sink based on the flow and the connection of essential power.
- If Lpth of LP the node of recipient, to recognize the source.
- Other, waiting a connection with the communication and LP once realized passes to 0 that Lpth recognize the similar thing.

This algorithm is located at each node and is based on the operating process that carries out the operation. By the inclusion of this algorithm excessive data blockage is avoided. This drives the channel with the reduction of the congestion and the collision of the packets. Because each node keeps the non-desired transmission or power of reception of distribution LMT can be avoided, because the motive fluid remotely is supervised and allowed for the transmission. This algorithm thus reduces the loss of non-desired power, which was observed in the conventional system due to require repeated.

The flow chart of method is organized in three modules. They are:
- Pre-processing module
- Initialize and update module
- Receive and block module
- Final module (combination of three modules)

V. EXPERIMENTAL EVALUATION

Network simulation is designed to create the nodes randomly distributed in the network. Two standard arrangements of routing explicitly DSR and AODV are employed for the construction and the communication of routes. Two arrangements to detect the communication of routing leads the transmissions network created based above protocol of the routing source.

For the developed demand routing protocol and source routing, the gap shrinks as the transmit power increases. However, this gap is much wider for source routing at low transmit power. Thus, most important observation is that the performance of source routing can depend strongly on the physical layer model.

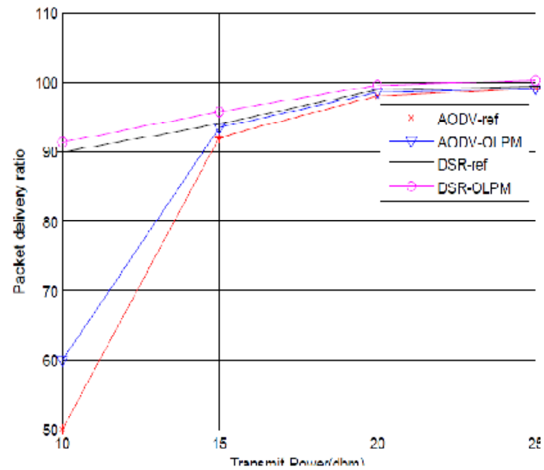

Fig. 1. Transmitted power over packet delivery ratio for the routing schemes developed.

VI. CONCLUSION

Wireless data traffic is growing extraordinarily, with new wireless devices such as smart phones and bandwidth-demanding wireless applications such as video streaming becoming increasingly popular and widely adopted. Correspondingly, we have also witnessed the phenomenal wireless technology evolutions to support higher system capacities from generation to generation.

In this work, the effect of various modeling for the physical layer performance for a distributed wireless network is developed. The proposed algorithms were evaluated with conventional approaches using analytical tool for model simulations. Differences between the scenarios suggested by the conventional pattern and metrics used to evaluate the performance of wireless network routing protocols is evaluated. Figure 7.4, illustrate that for CST= -84 dBm, the packet delivery ratios for reference and proposed are very similar with transmit power Pt higher than 16 dBm. When the transmit power is lower than 16 dBm, the proposed method outperforms the conventional method in terms of packet delivery ratio. Nevertheless at any transmit power, the usual system shows appreciably lower routing load than the proposed method. This is due to the conventional method aggressive use of route caching. The conventional method is likely to find a route in the cache and avoid using route discovery every time a link is broken. In previous approaches, it was found that 55 percent of the route replies were from the route caches and even though 41 percent of the route replies were based on cached data contained broken routes, the the conventional method route maintenance was able to deliver good performance.

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