MAINTAINING SPECTRUM SHARING IN CELLULAR NETWORK AND IN AD-HOC DEVICE TO DEVICE USERS

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ABSTRACT

According to conventional wisdom, we currently suffer from a storage of spectrum. This supposedly limits our ability to introduce new wireless products and services. In actually, if one measures spectrum utilization at a given time, much of spectrum will not be used because we want to prevent interference which causes the loss of packets. In our approach we seek new techniques to share spectrum without causing interference. Interference management is a major component in designing these spectrum sharing schemes and it is critical that the licensed users maintain their QoS. A distributed dynamic spectrum protocol is proposed in which device to device users can communicate directly with each other and access the spectrum more efficiently. Network information is distributed by route discovery packet in a random access manner to establish the single hop or multihop link between D2D users. The discovery packet which contains network information will decrease the failure rate of the route discovery and also reduces the number of transmissions to find the route. Network information is distributed by route discovery packet in a random access manner to establish the single hop or multihop link between D2D users. The discovery packet which contains network information will decrease the failure rate of the route discovery and also reduces the number of transmissions to find the route.

Keywords: Device-To-Device, Interference Management, Power Control, Route Discovery, Spectrum Sharing

I. INTRODUCTION

As we know, today people are using wireless network abundantly therefore satisfying their expectations has become a challenging task. As spectrum is expensive we cannot purchase it often. For this purpose spectrum sharing has become very important. To improve the overall performance service providers co-operated together And different methods are investigated like IMT Technologies and 3GPP LTE but there results were not up to the mark. Therefore Dynamic spectrum access are investigated and also they have become popular. Another one protocol is developed, in this base stations take advantage of users' topologies and provides resources to the cellular users'.A different approach is to dynamically share licensed spectrum with unlicensed spectrum.

Different methods are found to reusethe frequency resources with the neighbouring base stations. By increasing the total number of transmission we can reduce the interference for this different methods are used to allocate to set the frequency. Pricing schemes are developed where users choose frequency channels and transmit powers to maximize their gains while reducing the interference.We study this problem from the perspective that ad-hoc

Device-to-Device (D2D) users can simultaneously operate in the same frequency spectrum as a licensed cellular radio network. The biggest challenge in such a scheme is the interference management, specifically how to keep the level of interference. Much of the existing literature approaches this problem with numerous assumptions to reduce the complexity.

We develop a distributed dynamic spectrum Protocol to enable device-to-device communication. To solve the problem we are using coarse time scale as it is very large scale and suits to wireless communication. We focus on the power levels of signals allowing us to abstract away the specific modulation and coding schemes used. We intend for D2D users to utilize statistical estimates of the channel gains to set a transmit power level that will be with the allowed interference temperature of the cellular network. Then using the calculated transmit power, two D2D users will attempt to discover either a single-hop or multi-hop route connecting each other. We utilize network information in the discovery packet to improve both the success and efficiency of the route discovery.

II. NETWORK ARCHITECTURE

The network considered consists of seven circular cells of radius *R* with a base station (BS) equipped with an omnidirectional antenna located at the centre of each cell. We focus on the uplink frame of the system and assume it to be divided into *NC* orthogonal channels.1 we consider the same *NC* channels are available for use in each cell. For a cellular link to be established with the base station, a minimum SINR of βB is required. We assume that there exists a margin κ in the required SINR at each base station.

In this we are considering two types of users Macro users (MU) and Device to Device users(D2D) . In MU the source establishes the link with the nearest base station and having its information relayed to their 20 intended destinations. There is *NM* Active macro users uniformly distributed in each cell and we assume that there is only one active macro user per channel. In D2D users communicates directly with each other in a distributed ad-hoc fashion over one or more hops without any assistance by the base station. All D2D users are uniformly distributed within a single randomly located circular cluster of radius *r* where we assume $r \leq R$. This user cluster is distributed such that the entire area of the cluster is within the boundary of the macro cell.

Channel model:

In this we consider three arbitrary users: a transmitter *i*, a receiver *j*, and an interferer *k*. We assume a path loss dominated channel with multiplicative fading and additive white Gaussian noise. The large-scale fading is determined by the Euclidian distance dij between two users i and j And the path loss exponent α. A Rayleigh random variable fij determines the small-scale fading between the same two users.

III. DEVICE TO DEVICE COMMUNICATION USING MULTI HOP ROUTE

In wireless network data packets find their paths through routers. Each time a packet is passed to the next router a hop occurs, if only one hop occurs between source and destination then its single hop.

In multi-hop wireless networks there are one or more intermediate hops along the path that receive and forward packets via wireless links.

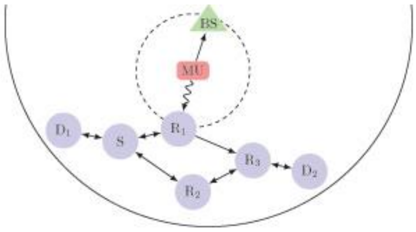

Fig. 1. An example realization of what a cellular network with an under laid D2D network may look like. The source (S) communicates over a single-hop if possible, as to D1, or uses idle D2D users R*I*as relays over a multi-hop route, as to D2. The interference from the macro user (MU) causes too much Interference for a two-way route to be used with relay R1.

In our work, we use the Dynamic Source Routing (DSR) protocol to discover D2D links in the network. DSR is a source initiated packet based discovery protocol. The DSR protocol floods the network with discovery packets and in doing so, exchanges the address of relay nodes in the network so the destination will have a virtual map of how to reach the source.

If node *j* is the D2D destination, then a single-hop route exists with the D2D source. If a single-hop route does not exist, then node *j* can continue the discovery process and serve as a relay. However, it will only continue the discovery if it knows that a two-way link exists with the D2D source. It rebroadcasts the discovery packet adding its own transmission power and interference power. Once the D2D destination receives the packet, it will have a list of relay nodes that form a multi-hop route with the D2D source. We now outline how a multi-hop route connecting two random D2Ds can be discovered and refer to Fig. 1 as reference. Assume that the source S wants to communicate with the destination D1 by using the same channel as the active macro user MU. The source transmits a discovery packet intended for D1 at a power level ofP^{*}_{TS}. D1 is sufficiently far away from the interfering macro user to receive the packet and uses the values of P^{*}_{TS} and *IS* containedin the packet to determine that a two-way single-hop link exists with S. Now assume that S wants to communicate with D2. Each relay R*i*would forward the discovery packet intended for D2 after adding their own transmit and interference power to the packet. A two-way route between R1 and R3 could not be used due to strong interference from the macrouser. Using the powers in the discovery packet from R1, R3 would be able to determine that a two-way link does not existwith R1 and wouldnot forward the discovery packet. This reduces the number of transmissions necessary for discovery and increases the chances of discovery packets along twoway routes reaching the destination. A two-way route could be established using R2 instead. Thiscan be shown by using the following simulation results using NS2

A] Simulation Results of nodes

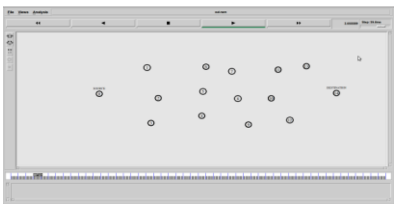

Fig 2 Nodes

B] Simulation Result of dropping packets.

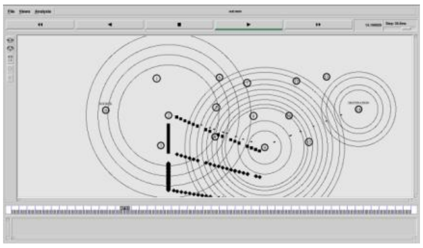

Fig.3 Dropping of packets.

C] Throughput result for the dropping packets.

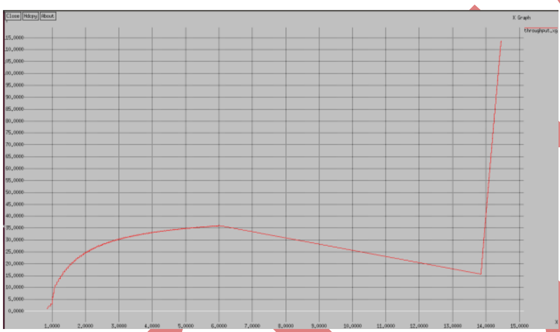

Fig: Through put.

D] Simulation Result for the recovery packets

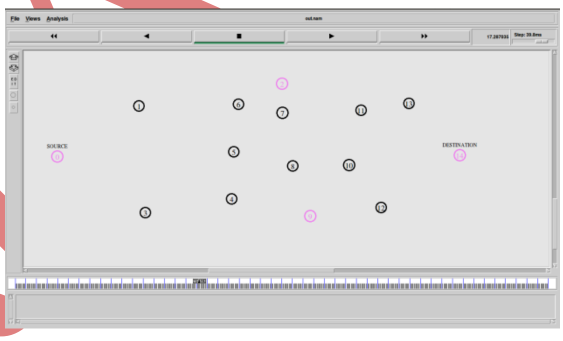

Fig.4:Recovery by making node 2 out of range.

E] Through put result for the recovery packets.

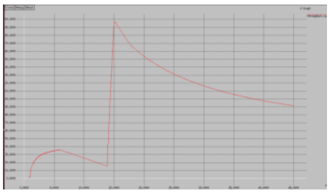

Fig: Through put of the recovery module.

IV. CONCLUSION

In this we have presented an opportunistic communication scheme in which an ad-hoc Device-to-Device network can simultaneously communicate on the same set of frequency resources as a fully loaded cellular radio network. We develop a practical protocol for D2Ds to use this scheme in a distributed manner and with no coordination from the base station. The D2D users first step is to control their powers to a level which causes minimal interference to the base station. Then using the calculated power, the second step is to employ a discovery protocol to establish a route connecting them to their intended destination. Results show that including network information in the discovery packet significantly lowers the route discovery's failure probability and reduces the number of transmissions necessary to discover a route to the destination. Given that a route is found, the probability of outage for a D2D link is derived and lower bounded using perfect channel inversion in the power control. Using a practical statistical estimate in the power control, our protocol shows performance near to the lower bound. The spectrum is fully utilized by the macro user network so there is a clear tradeoff in the performance of the two classes of users. However, large improvements in the D2D performance come at a cost of only a small loss in macro user performance. Furthermore, simulation results show that significant power savings can be gained using D2D routes rather than connecting to the cellular base station.

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