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SEMI PERSISTENT SCHEDULING RESOURCE ALLOCATION FOR DEVICE TO DEVICE COMMUNICATION

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ABSTRACT:

Device to device communication is defined as devices communicate with each other over a direct link using the cellular resources instead of base station. It can be used in 3GPP Long Term Evolution (LTE) system and future 5G networks. It is also one of the starting points for developing Internet of Things (IOT). There are some issues occurred in D2D communication like authorization, authentication, interference, power consumption, multicasting and relay selection. In this paper we propose technique for interference mitigation, for that we propose a reuse resource allocation algorithm using Semi Persistent Scheduling (SPS) method to minimize the interference induced during the data transmission. This result also improves the throughput and spectral efficiency.

1.INTRODUCTION:

Device to device communication in cellular network is defined as direct communication between two devices without intermediate nodes and base station. It generally uses the cellular spectrum or licenced band. It provides the high bit rates / low delays and low energy consumption. Direct communication between nearby mobile devices will improve spectrum utilization, overall throughput, and energy efficiency while enabling location based applications and services [1-2].In d2d communication spectrum sharing can be done by two ways. They are In-band and Out-band. D2D communication utilizes the cellular or licensed spectrum is known as In-band. Its signalling is the sending of control information with in the same band or channel used for voice or video and it may be often by telephony participants [3]. In-band can be further classified into two types. They are overlay and underlay. In overlay the cellular and d2d communications use orthogonal spectrum resources while spectrum sharing. In underlay d2d users share the same resources occupied by the cellular users [4-5]. Underlay in-band device to device communication can greatly improves the spectral efficiency of cellular networks. The second way of spectrum sharing is out-band which utilize the unlicensed spectrum and its signalling is sent over a different channel or even over separate network. Out-band signals are in accessible to the user. It is classified into two types, they are controlled and autonomous [5]. The control of the second interface is under the cellular networks is known as controlled. In autonomous d2d controlled by the users, second interface is not under the cellular networks. Radio resources may be simultaneously used by cellular and device to device links so that the same spectral resource can be used more than once with in the same cell. D2D users communicates directly while remaining controlled under the base station. Therefore the potential of improving spectral utilization has promoted much works in recent years, which shows that D2D can improve system performances by reusing cellular resources [6]. D2D communication is mainly enhanced to support future wireless communication, public safety services, machine type communication (MTC) and national safety etc. During the spectrum sharing between cellular and d2d links the severe interference is induced. To reduce this interference there are many schemes are proposed such as network coding, resource allocation and mode selection techniques.

2. RELATED WORK:

To reduce the interference occurred in d2d communication there are many algorithm has been proposed. The first algorithm is interference aware resource allocation, which exploits multiuser diversity of cellular network such that the performance of the d2d underlay is optimized. While maintaining a target performance level of the cellular network. System simulations indicate large performance gains in cellular and d2d performance [7]. The next is channel aware resource allocation, which focus on the spare frequency resource in a cellular network are exploited by D2D users to provide local services. Channel quality experienced by an end user varies from user to user due to channel fading and individual user location, resource allocation in cellular networks can make use of this channel quality information to improve throughput. For that it use the Rayleigh distribution to describe the channel quality, and formulate the resource allocation problem as an linear optimization problem, optimal resource allocation is obtained by solving the problem. Simulation results show that the overall throughput achieved by the proposed allocation schemes is significantly higher than random channel allocation and much better than a static priority scheme that allocates the best available channel to users sequentially[8]. The last algorithm is auction based resource allocation, which improve the performance of d2d communication as an underlay downlink networks. Sum rate over the resource sharing of both cellular and d2d modes optimize the system. In the auction, all the spectrum resources are considered as a set of resource units, which compete to obtain business as bidders while packages of D2D pairs are auctioned off as goods in each auction round. The simulation results demonstrate that the algorithm efficiently leads to a good performance on the system sum rate [9].

3.SYSTEM MODEL:

In this paper, we concern both inter cell interference and intra cell interference between D2D and cellular link in D2D reuse mode. A new D2D receiver may suffer from interference by attached cellular users, neighbour D2D users and neighbour cellular users. Because the uplink is given in **Figure 1**. CUE denotes cellular users and DUE denotes D2D users. D2D users are in anchored eNB (A-eNB) and its neighbour eNB is N-eNB. Communication links are indicated by the solid line while interference links are indicated by the dotted line. DUE2 may suffer from interference by CUE_1^1, CUE_1^2, CUE_1^3, CUE_2^1, CUE_2^2, CUE_2^3 and DUE3. And when CUE_1^1 transmit to A-eNB, A-eNB may suffer from interference by DUE1,CUE_2^1 and DUE3. As in **Figure 1** the interference of CUE_2^1 in N-eNB to D2D link is strong, so we should avoid choosing the same resource of CUE_2^1 for D2D link.

P_d, P_c The transmission power of D2D user and cellular user

G_{dd} A channel gain of D2D link

y_i^j A binary variable which satisfies Y=1 if user I and user j use the same resource

N_0 Noise power at the receiver

i User device index in attached cell

j User device index in neighbour cell

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To support more allocations, without increasing the size of the PDCCH (physical downlink control channel), we can use semi persistent scheduling. Because SPS resource has its own regularity, we choose it to reuse. The control channel overhead (PDCCH) is too much for the E-UTRAN (Evolved universal Terrestrial Radio Access Network) in order to support a large number of VOIP users. PDCCH carries all allocation information for both the downlink and uplink shared channels. The size of packets and the inter arriving time intervals are constant over a period of time and users are allocated with resource periodically. One allocation would repeat according to the preconfigured periodicity. The voice over internet protocol is a technology that allows you to make voice calls using a broadband internet connection of a regular phone line. Usually, the algorithm of resource selection might take some time. Taking VOIP as an example the packets arriving time interval in 20ms. e NB gives SPS scheduling representation to users through PDCCH. The users can transmit or receive data in this schedule on the same resource after every 20ms.In this paper, we considering e NBs can exchange SPS resource allocation information through X2 interface. D2D pairs reuse SPS resource and this can be controlled by A-e NB. A –e NB compares with N-e NBs and measures correlates, then determines the most suitable SPS resource to reuse.

4. PROPOSED WORK:

Step 1: Every cellular and D2D users should link with its anchored eNB (ie A-eNB) A-eNB intimates its sps resource to its neighbour eNB(N-eNBs)with the help of information by interface X2.
Step 2: As stated by the information gathered from interface X2, N-eNBs conclude which resource can be used as sps resource with this decision A-eNB and N-eNB would use the same sps resource.
Step 3: D2D users (DUE1 and DUE2) intimate their position information to A-eNB, this position information obtained from GPS (or) A-GPS (assisted GPS), For example, the coordinates of DUE1 and DUE2 are $(x_1,y_1),(x_2,y_2)$. If the distance between DUE1 and DUE2 is less than d_0 and the channel condition is good ,they can form a D2D pair. Where d_0=threshold

$$d_{1,2} = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

Step 4: A-eNB calculates the distance between cellular users and D2D users, and then choose n maximum distance and takes their appropriate sps resource as members. The distance between cellular users and D2D pairs are,

$$d_{c,d}=\sqrt{(x_c-x_1+x_2/2)^2+(y_c-y_1+y_2/2)^2}$$

Step 5: A-eNB intimates there n sps resource groups and D2D positions to N-eNB.
Step 6: N-eNB finds its cell for users who the same resource ,and then tells the corresponding were calculate the interference to neighbour D2D users on the sps resource.
Step 7: N-eNB gets the interference information from the selected users in step 6 and gives feedback to A-eNB.
Step 8: A-eNB looking the smaller interference and select its appropriate resource as the sps resource to reuse.
Step 9: A-eNB allocates the sps resource group to D2D users.
Step 10: D2D signalling and data can be transmitted between DUE1 and DUE2.

5.SIMULATION RESULTS:

We consider a 7 hexagonal wrap-around-cell layout Cellular users are randomly located in cells and D2D users are located in cells' edge. When computing the inter-cell interference to D2D link, the 6 cells around should be considered. The distance between D2D users is less than 50m and the distance between two eNBs is 500m. There are 30 cellular users and 6 D2D pairs in each cell. In this simulation, the 3-sector antenna is used for each eNB. LTE power control scheme is utilized by controlling the power of cellular users and a

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constant is used to express the power of D2D users. Modulation and coding scheme (MCS) is used in this system, they are QPSK,

Parameter	Value
Noise Power Density	-174 dBm/Hz
RB bandwidth	180 kHz
Carrier frequency	2 GHz
RB number	100
Max UE Power	200 mW
Min UE Power	3.2 Mw
D2D UE Power	2 mW
Max BS antenna gain	14 dbi
UE antenna gain	0
Shadowing standard deviations	8dB

16QAM, 64 QAM.
System parameters:

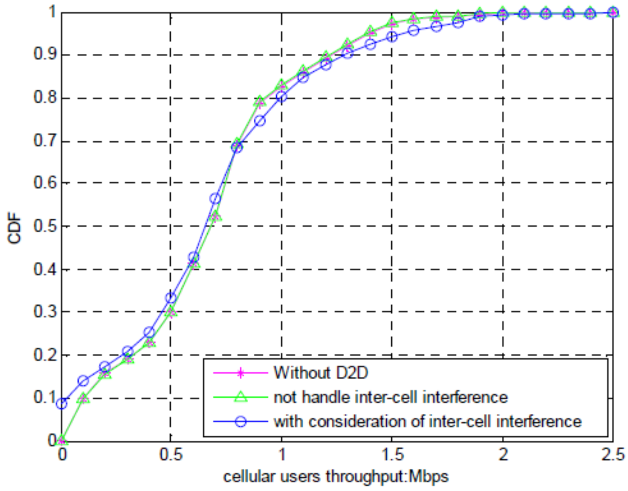
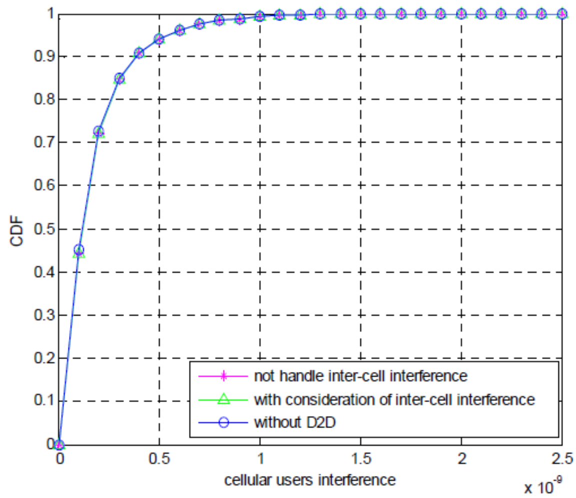


Figure 1: The throughput per cellular user.



We observe that the system throughput can be significantly improved by using d2d communication. When using our resource reuse algorithm considering neighbour cell interference, the throughput is higher than traditional algorithm. The focus of our study is that the interference to d2d users can be reduced and the throughput of cellular do not be significantly reduced. This can be validated in **Figure 1** and **Figure 2**. Because D2D users are distributed in each cell edge and they share the same reuse with cellular users which are far from them, the interference to from D2D users to cellular users is small. **Figure 3** shows the interference received by cellular users in the three cases above. The cellular users' interference stays the same. So we can conclude that our algorithm has little effect on cellular users.

Figure 2: The interference of cellular users.

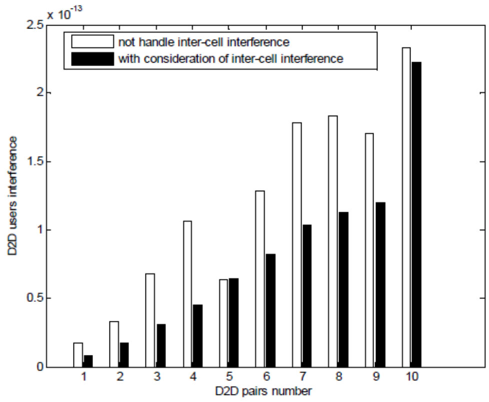


Figure 3: The interference of D2D users with D2D number changed

6.CONCLUSION:

In this paper, we proposed a new resource reuse algorithm that D2D users reuse the user link SPS resource. We consider both intra-cell interference and inter-cell interference between D2D and cellular links. By choosing reasonable resource to reuse, the system throughput grows higher. Simulation results show that the proposed algorithm significantly improves system throughput but causes little effect to the cellular users' throughput. When we use the proposed algorithm, the D2D throughput can be increased and the interference to D2D link is reduced.

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