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RESEARCH ARTICLE

AN EFFICIENT SEARCH METHODS FOR MULTI RELAY BASED COOPERATIVE COMMUNICATIONS WITH MINIMAL PRICING AND LOAD SHARING

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ABSTRACT

The co-operative communication is a cellular network and it is used to reduce the energy consumption in Mobile Terminals. But it is difficult to implement, because it has some problem for paying incentives to the mobile terminals in co-operative communication. Here pricing mechanism is introduced to pay the credits for the helping mobile terminals to upload the data to the source mobile terminal with the help of co-operative communication. Source mobile terminals knows all the information of the helping mobile terminals like channel condition, battery condition this is consider as the full cooperation under complete information. Selecting the relay is major problem. In practical co-operative mobile terminals used to co-operative in uncertainty of helping mobile terminals conditions. In this case a partial co-operative with pricing mechanism is proposed. It is allowed to select and pay another mobile terminal in promising to help the forward the data to base station even though poor battery condition or bad channel condition. In proposed system, a Fibonacci search procedure used to reduce the searching time and get a better output. The relay selection problem and multi relay can be used to avoid the data traffic and supporting the data communication

INTRODUCTION

With the latest technology in the smart phones and the multimedia application in cellular network and is also increases exponentially in wireless data traffic in a mobile terminals. Limited battery is used in the smart phones this is the major compliant from customer side. As minimizing the consumption of the energy and energy shortage of MTs has been improved by the connectivity of wireless network. When compared to 4G smart phones the energy loss will be increased in 2G and 3G mobiles. Cellular network and sensor network, the co-operative communication is a better way for energy saving. The poor battery condition and the quality or content cannot be considered before. But in the cellular network, some mobile terminals are low battery level, and others high. The mobile terminals may lack in proper incentives to co-operative. This is the major unsolved issues in co-operative communication. In existing dichotomous algorithm having some disadvantages like complex scheduling, increased interference and extra data traffic. So we are using Fibonacci search procedure to overcome the extra data traffic in cellular network.

Primilinaries

Mechanism used for incentivizing co-operation

We consider that mobile terminals in the network are selfish. It is only co-operative when they can benefit from the communication. To exploit the heterogeneities of the channel conditions we are using battery level of the mobile terminals. For this uncertainties using the new mechanism to incentivize the co-operative communication.

Full co-operation with exhaustive information

This is the ideal case. In this method a problem is that when the case of dividing and non dividing data at the source mobile terminals. Splittable data follows a simple threshold structure.

Partial co-operation with non exhaustive information: In this practical case, mobile terminal belongs to individual interest entities and it does not share private information to other mobile terminals. Uncertainties in the battery condition and channel we formulate pricing and load sharing problem. In order to avoid this problem we use the dichotomous search and alternative optimization method.

The channel coefficient *hk* is expressed as,

$$h_k = \begin{cases} \bar{h}_k \sqrt{G_0 \left(\frac{r_k}{r_0}\right)^{-\alpha}}, & r_k > r_0 \\ \bar{h}_k \sqrt{G_0}, & \text{otherwise} \end{cases}, k \in \mathcal{K},$$

1) Direct transmission mode:

In DT mode data is directly send by the source mobile terminal to the base station with normalized data rate Di,

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$$E_i^{(D,S)} = \frac{\sigma^2}{g_i}\left(2^{D_i} - 1\right), i \in \mathcal{K}_S.$$

2) Co-operation transmission mode:

In this mode an idle mobile terminal with distance d as it relay mobile terminal to relay data to the base station. Where d is the short range communication (SRC). Example is WI-FI and Bluetooth. PMF is expressed as

$$\Pr(N_i = n) = \frac{\mu_{N_i}^n}{n!} e^{-\mu_{N_i}}, n = 0, 1, \ldots, i \in \mathcal{K}_S.$$

for the CT mode the source splits the data into two parts. i.e.,

$$D_i = D_i^{(S)} + D_i^{(R)}: D_i^{(S)}$$

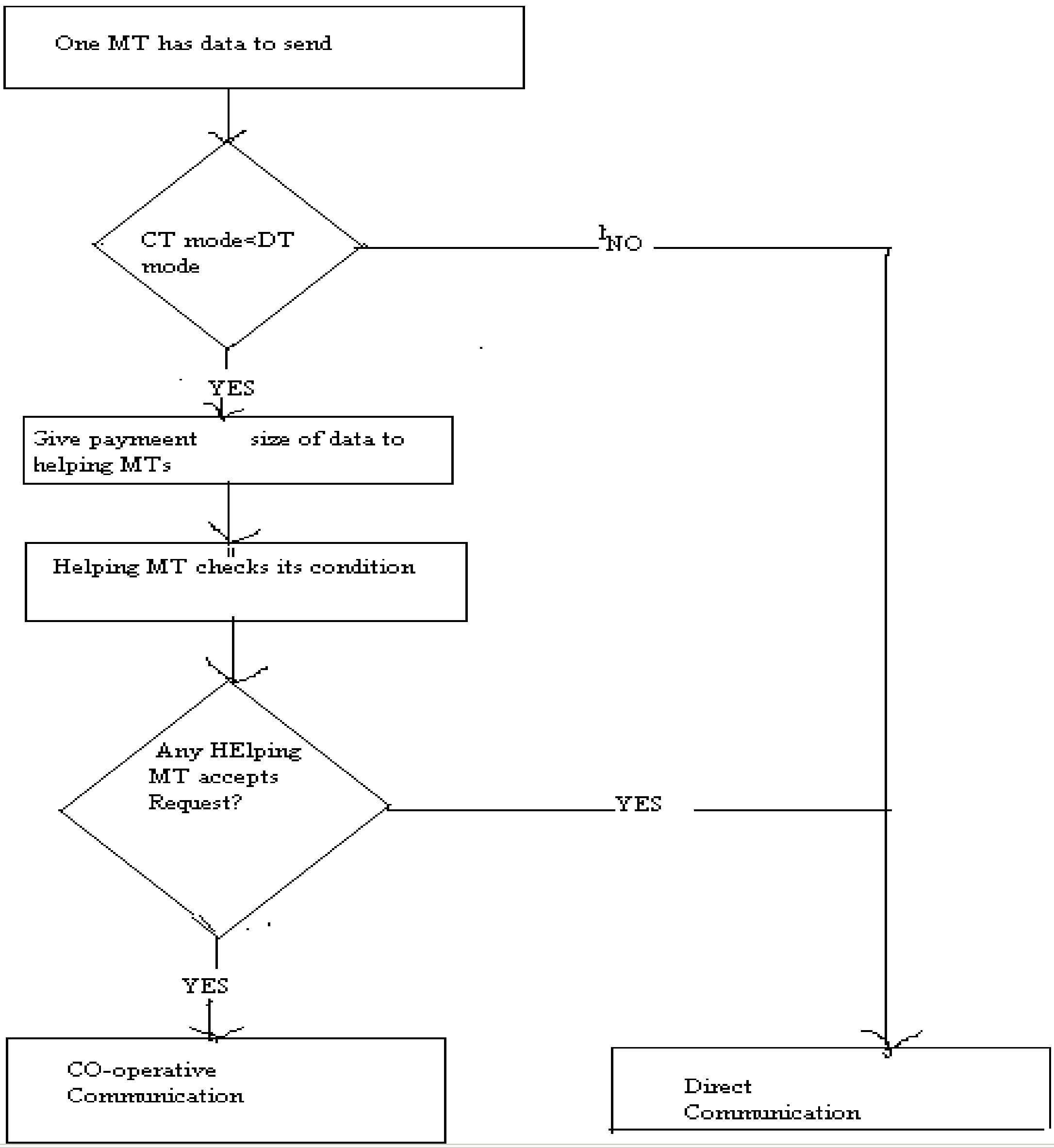
The source mobile terminal transmit the data first to the selected relay mobile terminal after that relay mobile terminal decodes and forwards the signals to the base station. SRC technologies are used to provide high communication data rate with low transmit power and energy consumption also decreased. Channel power gain between helping mobile terminal and the common base station. Energy consumption to transmitting the data is,

$$E_j^{(C,R)} = \frac{\sigma^2}{g_j}\left(2^{D_i^{(R)}} - 1\right), j \in \mathcal{H}_i, i \in \mathcal{K}_S.$$

Mobile terminal has to send the data it chooses between the CT mode and DT mode according to the case of completely known information and incomplete information. When one mobile terminal weight is greater than the other mobile terminal it causes the problem of low energy in the mobile terminals.

Co-operation with Non Splittable data

The data are not divided at the source mobile terminal.



Source mobile terminal choose the best helping terminal the better relay

Fig. 2. Co-operative communication protocol

All the data of the co-opearative communication is transmitted by the relay mobile terminal. Here, selection of the relay is the major problem. Two step procedure: First step the source Mobile terminal computes and finds the helping mobile terminal with the least energy cost.

Co-opearation with splittable data

In proposed sytem the data is splitted at the transmitter side in cellular network. From this paper has a problem, it is a convex optimisation problem and the solution for this problem is given by,

$$\hat{D}_i^{(R)} = \begin{cases} 0, & \text{if } \log_2 \frac{\theta_i}{\theta_j} < -D_i \\ \frac{1}{2}\left(D_i + \log_2 \frac{\theta_i}{\theta_j}\right), & \text{if } -D_i \le \log_2 \frac{\theta_i}{\theta_j} < D_i \\ D_i, & \text{if } \log_2 \frac{\theta_i}{\theta_j} \ge D_i \end{cases},$$

Proposed Algorithm

In existing method they are used the Dichotomous algorithm is a searching algorithm that is used selecting the two distinct near possible mobile terminals. This search method is similar to the binary search method. In proposed system Fibonacci search procedure is introduced to minimize the search in the cellular networks. A multi relay is used for the simultaneous data transmission but selecting the relay is the problem which is generated as optimization problem. In this scheme, the control of power and the MT selection are unified into the signaling procedure in a disburse manner. A controlling the power problem has a two alternative solutions. Those two solutions are relay-selection policies. One of the policies is decreases the overall price per unit data and the other one is to increases the network lifetime. Compared with single relay transmission with power control at the source, our scheme can optimize the transmitting power distribution among the transmitter and the relays. So when the channel condition between the source and Base station is not good, we can utilize the channels from the source to the relay and also we can utilize channel between the relay and the Base station, when compared to direct transmission of the data between the source and the Base station is more energy efficient. This will bring significant energy benefits to our scheme in fading environments. Another comparable alternative of our scheme is conventional two hop routing scheme with power control at both the transmitter as well as the relay. In this scheme, based on the available channel conditions the better relay is taken for the data transmission. The transmission process is from the source to the best relay and then from this best relay to the access point. If the arrival time difference between the direct path from source to destination and the paths source-relay-destination is constrained then relays must locate inside the coverage area.

Simulation Result

In this section we compared the features of single source mobile terminal and multi source mobile terminal.

Single source mobile terminal

The single source mobile terminals for the partial co-operations with splittable data rate (Algorithm-II) and compared with non-splittable data rate (Algorithm-I). Then we show the simulation result for the expected cost of single mobile terminal versus battery level conditions.

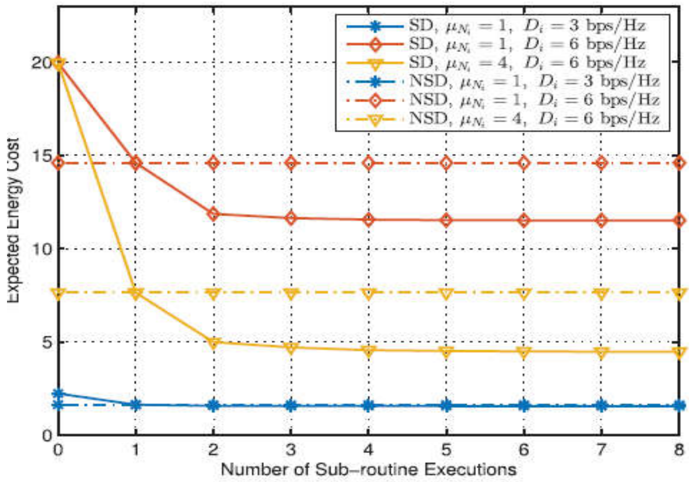


Fig. 3. Expected energy cost of data.

The partial co-operation with the splittable data compared to the non splittable data for data transmission on a source terminal with different rate of data and average number of helping terminals. Global optimal solution is obtained and the expected cost reduction from direct transmission. A transmission mode selected by the transmitter CT and DT mode. A higher density of helping mobile terminal is reduces the expected energy cost. By comparing dividing and non dividing case in addition to optimal pricing load sharing algorithm also be used to reduce cost and energy. If the size of the data is large the mean value of helping mobile terminal is small. From the above results we can say that splittable data leads to lowest energy compared to non splittable data. Expected energy cost under different battery conditions and transmission schemes:

There are 5 schemes,

- Direct Transmission
- Full Cooperation under exhaustive Information with non dividing data
- Full Cooperation under exhaustive Information with dividing data
- Fractional Cooperation under Incomplete Information with non dividing data
- Fractional Cooperation under Incomplete Information with dividing data

Partial co-operation under incomplete information with dividing and non dividing data the minimum expected cost is obtained. The single source mobile terminals transmits the data rate of *Di* = 4 bps/Hz. From the simulation result, it is observed that our proposed performance of co-operative communication scheme shows the result better than the direct transmission. Co-operative communication is more effective when the battery level of the source mobile terminal is low. It is very difficult to get help from other mobile terminal if the battery level source mobile terminal is high and direct transmission cost is low. In the case of complete information with non splittable data the source mobile the source mobile terminal knows the helping mobile terminal conditions such as battery level, channel condition and cost-efficient relay.

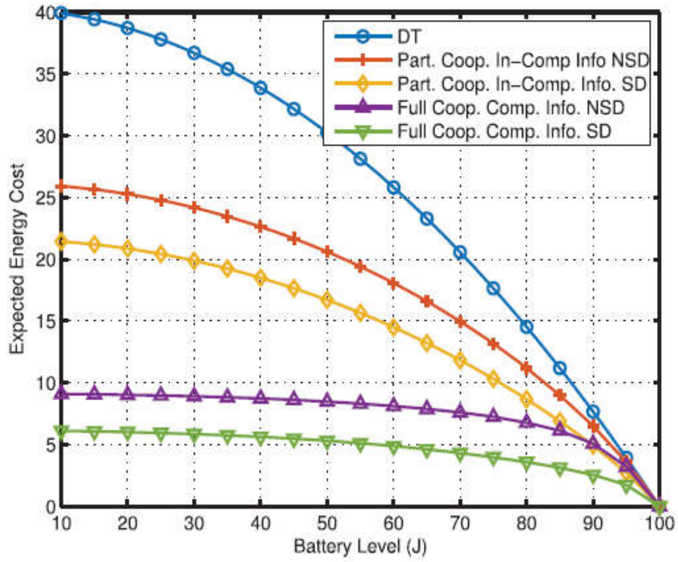


Fig. 4. Expected cost of the single source MT versus its battery level under different schemes

In non exhaustive information, the source mobile terminals randomly choose helping mobile terminal. In the case of complete information with splittable data, relay data rate and payment are jointly optimized by the source mobile terminal. In both the cases with and without splittable data under complete information the reservation utility of the helping mobile terminal is zero. This further reduces the cost of source mobile terminal.

Multiple Source mobile terminals:

Source terminals examine the five schemes considered in the base paper and show the performance improvement like, battery and communications outage, battery level and average battery level, distribution under a single-cell setup.

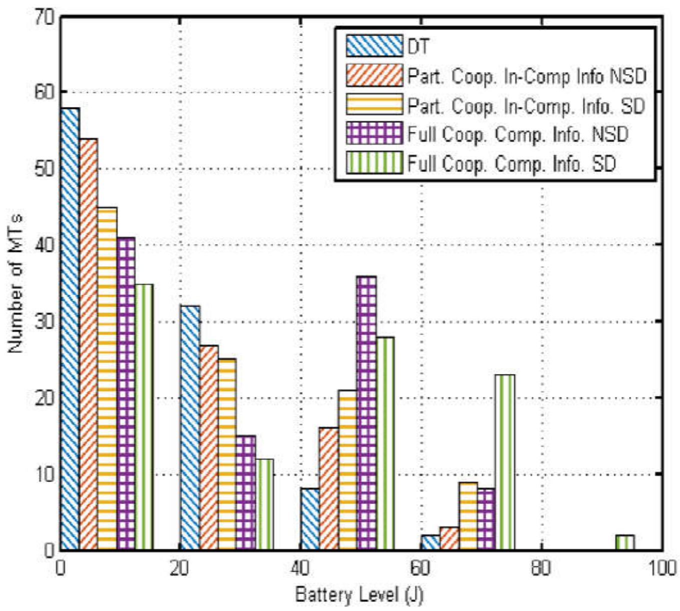


Fig. 5. Distribution of the battery levels of 100 MTs after 300 time slots

The specific simulation parameters for multiple source MTs are given table

Simulation setup for multiple source mts

Simulation Parameters	Values
Total number of MTs	$\lvert\mathcal{K}\rvert = 100$
Probability at which MTs initiate data transmission	$\rho = 0.2$
Normalized data rate[13]	$D_i = 6$ bps/Hz
Range of the SRC for a source MT	$d = 7$ m

Here we are considering our simulation within a range of 100 × 100 m2 square area. The uplink spectrum efficiency of the LTE system is 3.75 ~ 15 bps/Hz. Finally, we show the distribution of the battery levels of the 100 MTs at the end of the 300 time slots. MTs under cooperative communications employs the low battery region (i.e. 0 − 20 J), their battery level doesn't gets empty because when their battery levels are lower, then these MTs can possibly receive help from the other MTs such that their battery levels can be sustained. While for the direct transmission case, the battery usages of the MTs in this region are empty and there is a problem to help the other Mobile terminals.

Conclusion

This paper says about the efficient search methods for multi relay based on cooperative communications with cellular networks in mobile terminals with wireless cooperative communication. By using the cellular network, expected energy cost for each source terminals get reduced. Energy efficiency is used for the single routing alternatives and also used to reduce the collision probability via optimization strategies handle the asymmetric channels. In future Fibonacci series and multi relay techniques are improve the helping Mobile terminals and also coverage area, at the same time efficiency is increased.

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