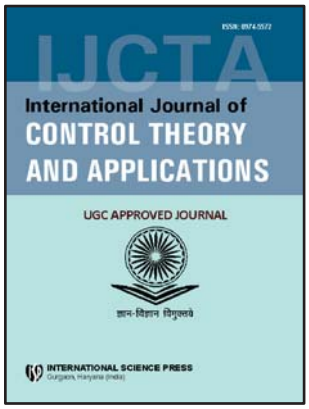

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An Efficient Energy and Bandwidth Allocation for D2D Communications in LTE Networks

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Abstract : In this paper we propose a novel algorithm for efficient energy and bandwidth allocation for each device to device communications under LTE network. In the network users (D2D) shares the spectrum and interference in communication is neglected. In existing they have used orthogonal and non-orthogonal strategy for energy resource algorithm. In this algorithm, it only concentrate on power control with or without interference to overcome the fluctuations in existing system. We have proposed a novel method for energy efficient resource allocation algorithm. The cellular spectrum energy allocation algorithm is allocated to improve speed as well as energy consumption in D2D communication, energy consumption is reduced and analyzed in user equipment. Spectrum consider as a special & bandwidth allocation, proposed method implemented and analyzed in network simulator 2.35.

Keywords: *Energy efficiency, D2D communication, LTE (Long term Evolution), Network, Resource allocation, Network traffic.*

1. INTRODUCTION

Nowadays, high data rate communication has been implemented in long term evolution networks (LTE), demand and traffic also increased due to more user equipment in device to device communication[1-3]. In normal device to device communication transmitter User Equipment node will transmit the data to its neighbor node directly while using cellular mode it uses relay node. Through this implementation it improves the spectral efficiency and energy. [3]

The interference between device to device communication in LTE networks has been faced in [4,5]. In [6-8] it considered underlay and overlay mode, where it uses non orthogonal and orthogonal strategy. The different resource allocation algorithm has been used in D2D communications for optimum energy optimum energy allocation [6]. Uplink resource sharing has been considered in a non-co-operative communication it considered spectral and energy sufficiency in D2D communications [9]. The joint radio resource allocation has seen formulated with reverse iterative game, where the cellular network user radio resource [10]. An energy efficient uplink resource allocated has been implemented in multimedia communications in [11].

The challenging issue in D2D communication used underlay and overlay node to solve the above problem [7,8]. In [11] underlay and overlay node has been considered to improve interference in D2D communication in the orthogonal and non-orthogonal resource allocation they have been formulated fraction programming problem and mixed integer nonlinear fractional programming.

The remaining paper follows below formulation. Section II included with aims and considerations. Proposed algorithm has been described in section III. Experimental results analyzed in section IV. Our proposed methodology concluded in section V.

2. AIMS AND CONSIDERATIONS

Our proposed system consider downlink & uplink communication for all users. Our proposed method implemented to achieve goals listed below.

1. It considers network traffic load
2. Improved network capacity
3. Less interface

Aim 1: The cellular spectrum efficiency has to be utilized and that have to be split into primary resource and secondary resource.

Aim 2: The cellular spectrum and energy resource allocation to be implemented, which improves spectrum and energy efficiency.

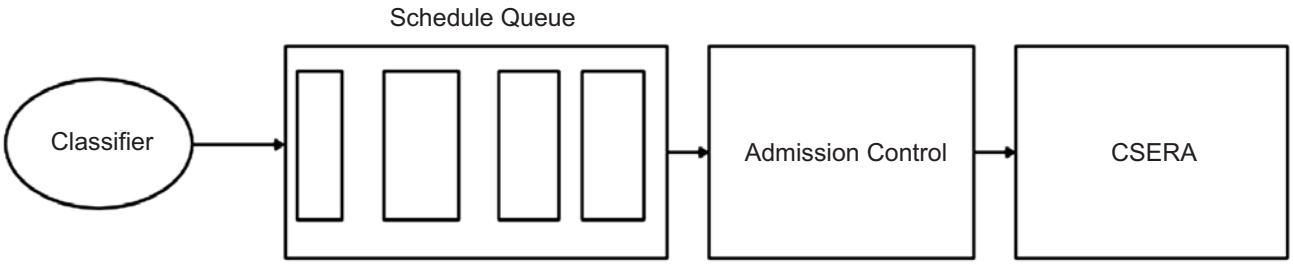

Figure 1: Proposed system model

Our proposed concept has been shown in below diagram fig(1). In first block, it consider user equipment type whether it uses real time or non-real time users. Based on that users type it schedule the type of spectrum utilization. Second block utilizes the queuing theory with the concept of FIFO. Type of the user equipment has been considered to assign the priority in queue. Admission control block has the following considerations in this method. The below equation gives the energy efficiency

$$Ee = \frac{St}{2} \sum_{R(n,i) \in Rb} E(n,i)K$$

The energy efficiency is denoted as E_e and S_t is the time required for each sub frame R_b is the resource in the user equipment and spectrum blocks. K value denotes the traffic load in the D2D communication and R (n, i) is the resource block assignment to the nth time slot and ith sub channel. E(n,i) is the energy consumption at the nth time slot in the ith sub channel.

The CSERA cellular spectrum energy resource algorithm has been explained in below section. It has been implemented to achieved interference free network, where using device to device communication in LTE network, it also reduces the traffic load in network.

3. CELLULAR SPECTRUM ENERGY RESOURCE ALLOCATION (CSERA)

The Cellular Spectrum Energy Resource Allocation (CSERA) considers two type of allocation, (i.e) bandwidth and energy. It works for each and every data frames in every D2D communication. Based on the demand of each user equipment, it allocates remaining node resources with respect to the traffic in network.

Energy consumption is changed based on the spectrum utilization. So, we split the spectrum resource into two types, they are primary resource and secondary resource allocation. Primary resource has been allocated for high and low priority of user. If there is no traffic or less traffic in the network.

If there is high traffic in the network, then it will allocates primary resource for high priority user equipment and secondary resource allocated for low priority user equipment. We have proposed this algorithm to improve Quality of Service (QOS).

Nomenclature:

E – Energy consumption for current user session.
E_{max} – Maximum remaining node energy.
N_{max} – Number of maximum users.
N_x – More number of users.
N_n – Minimum number of users.
Pof – Pre on flag it enables the resource allocation.

The algorithm and steps used in CSERA is described and explained below.

CSERA-Step1:

```
if (Es < Emax)
{
Allow the user session
}
else
{
The user is queued
}
```

CSERA-Step 2:

```
if( (Nx + Nn < Nmax) &&(POF = 0)
{
Allocate primary resource
}
elseif( (Nx + Nn > Nmax) &&(POF = 1)
{
Allocate secondary resource
}
else
{
User are queued
}
```

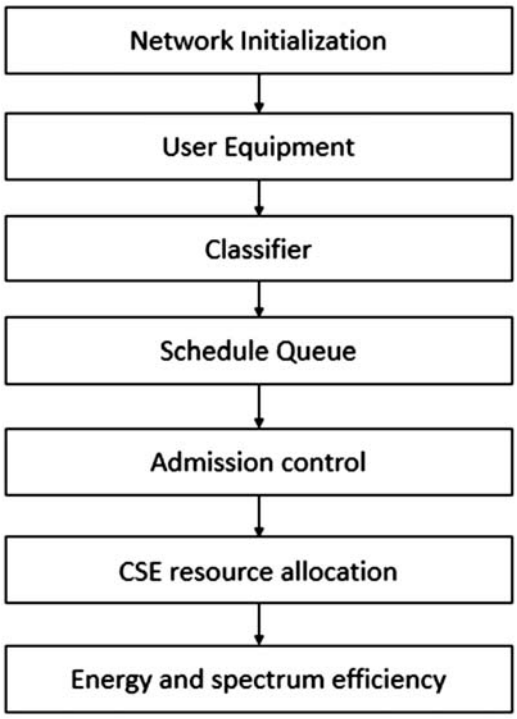

Figure 2: Flow chart of proposed model

The above flow chart shows the flow of work for our proposed system.

4. EXPERIMENTAL RESULTS

The Network simulator 2.35 has been used to simulate our proposed model CSERA algorithm and following parameters are analyzed. Ubuntu OS is used. Below figures are showing the simulation of LTE networks for D2D communication under high and low network traffic.

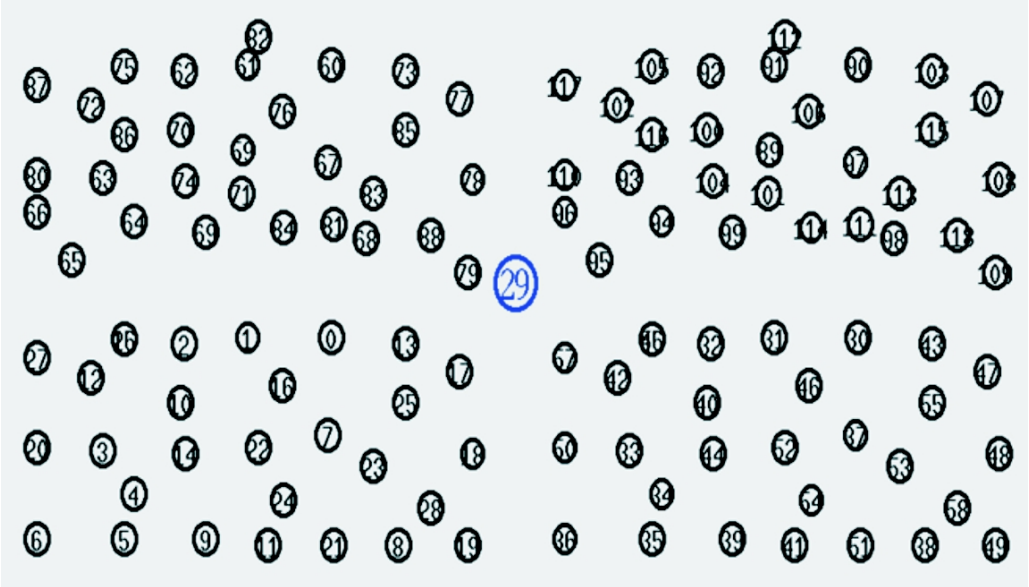

Figure 3: Network Implementation

The above fig.3 shows LTE network with different region for D2D communications.

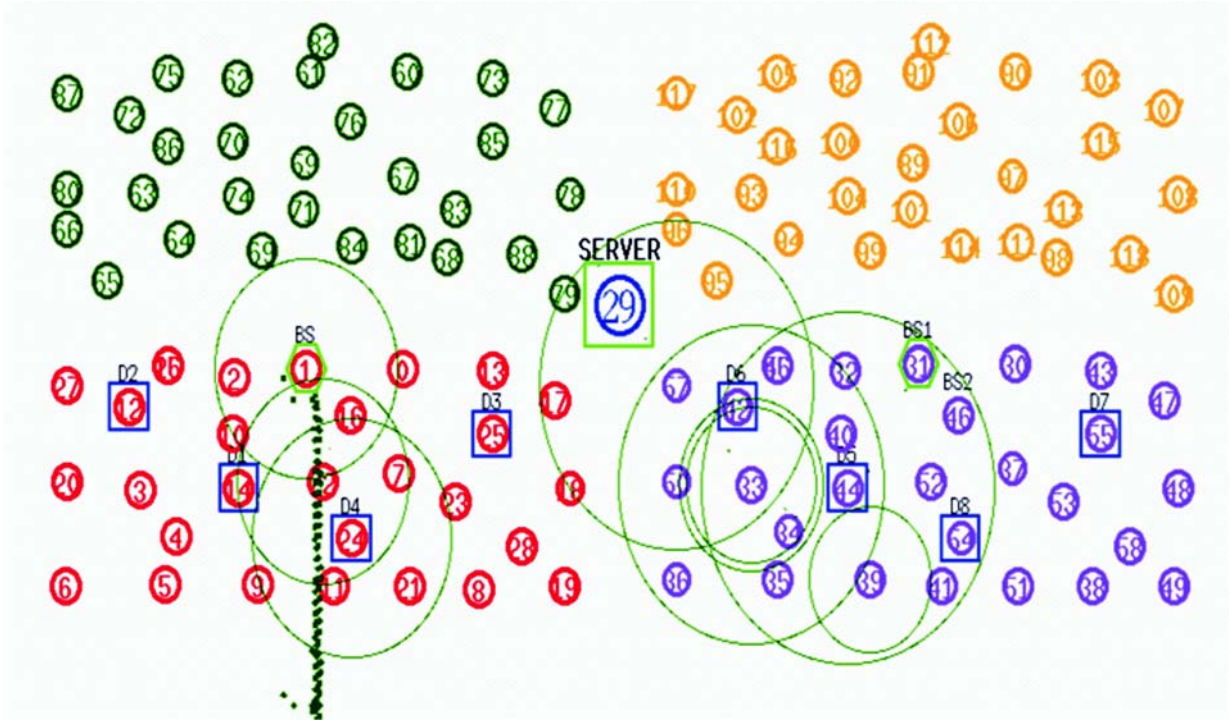

Figure 4: Existing system with high traffic

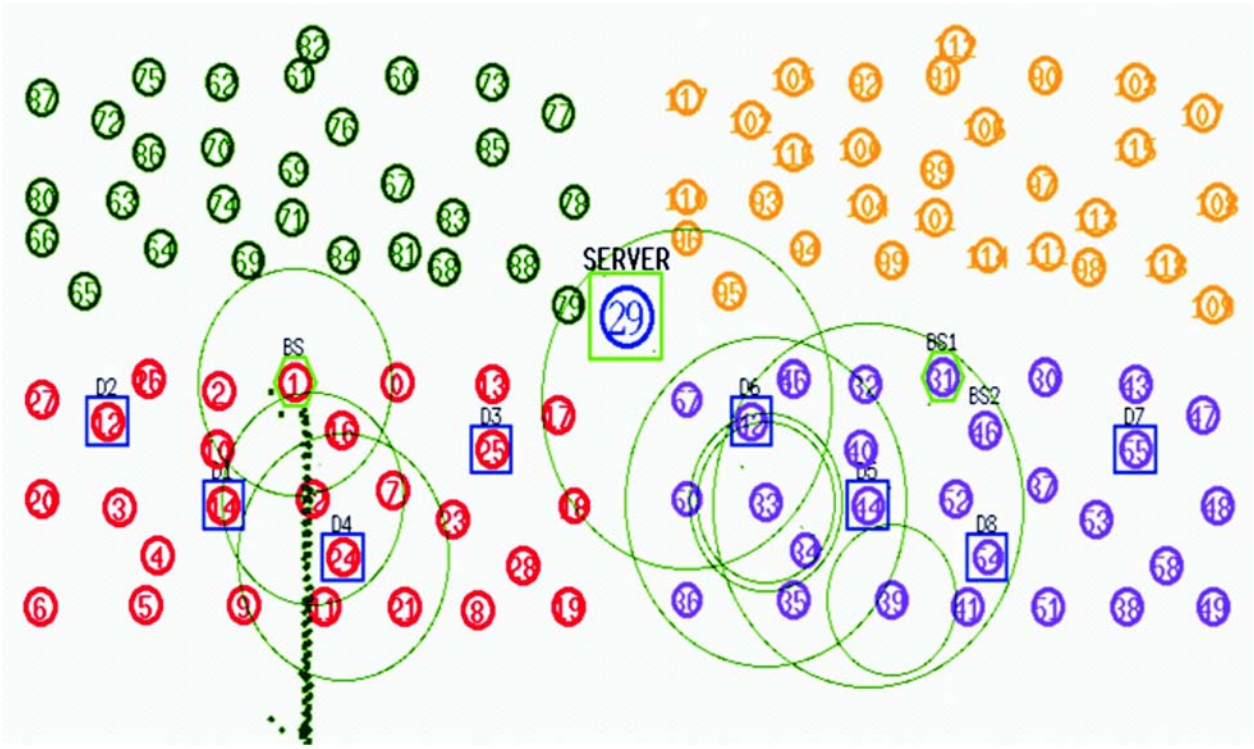

Figure 4: Shows that the existing system with traffic, where the packets are dropped due to buffer overflow

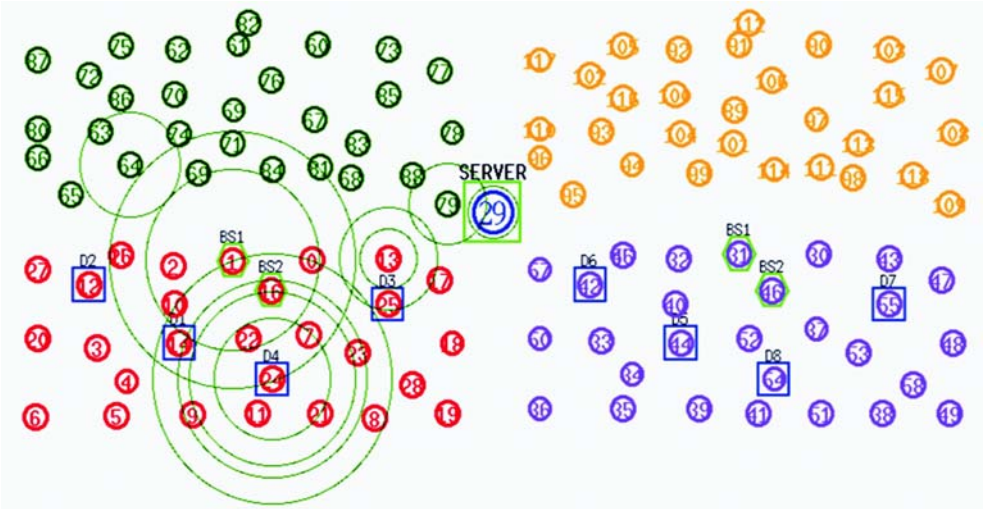

Figure 5: CSERA with D2D communication

The above fig.5 shows the efficient resource allocation in LTE D2D communication with high QOS. The communication parameters are measured and analyzed as follows, where we achieve high goodput and packet delivery ratio. Less energy and time consumption than existing models.

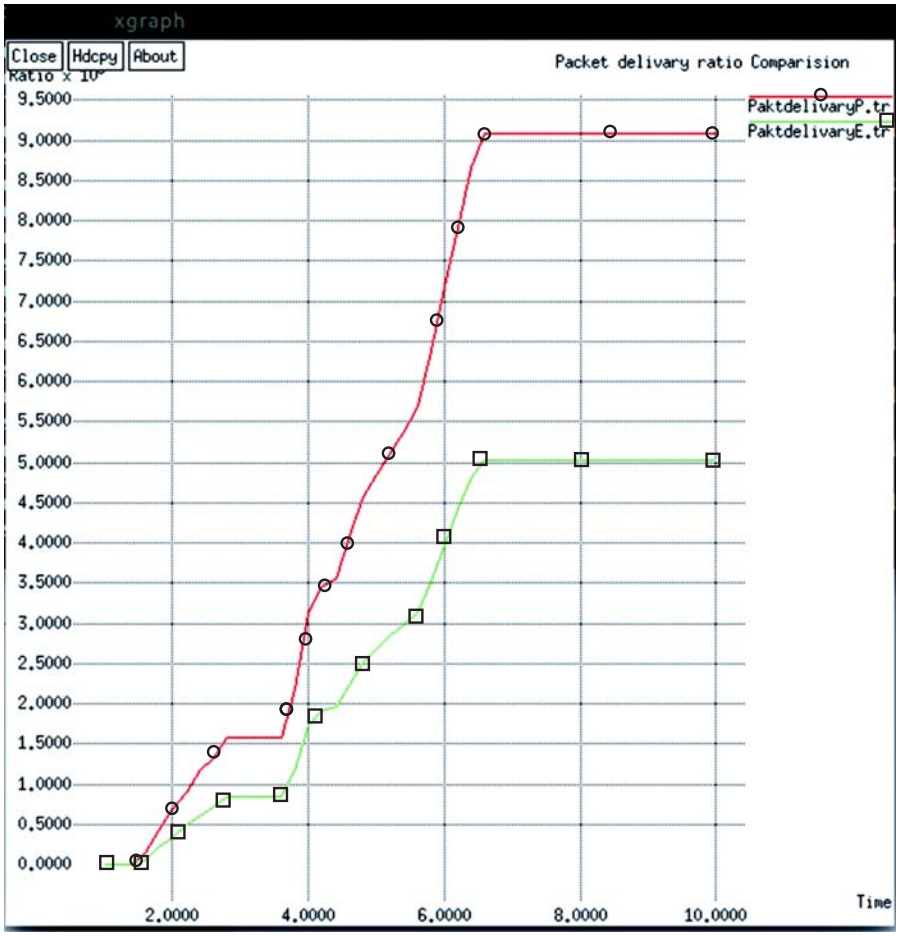

Figure 6: Packet delivery ratio

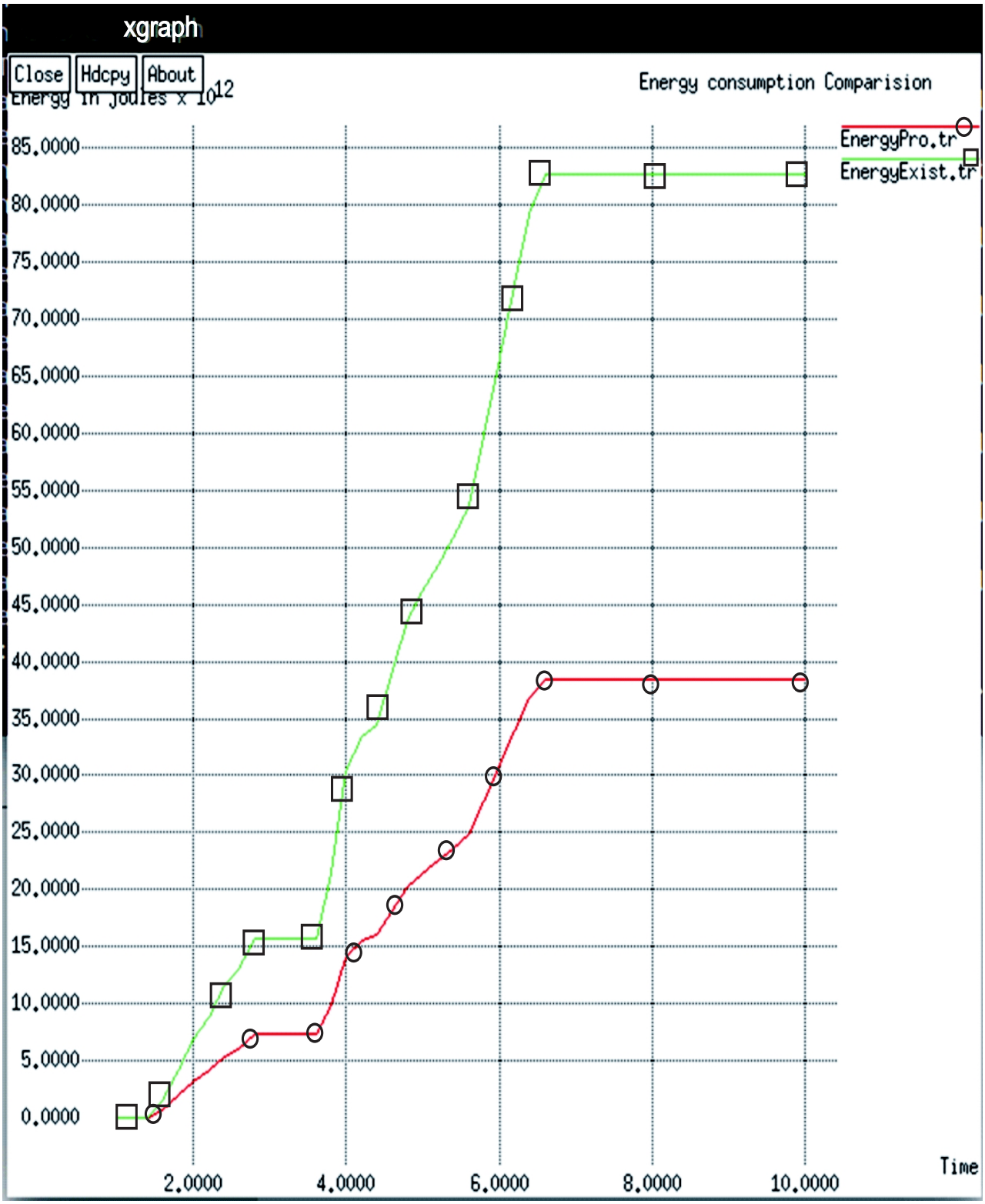

Figure 7: Energy Consumption

5. CONCLUSION

In our proposed system, we have successfully implemented a novel algorithm for efficient energy and spectrum allocation for D2D communication. The Cellular Spectrum Energy Resource Allocation CSERA has been simulated and analyzed under high traffic and less traffic with highly satisfaction of each user equipment. Our proposed algorithm simulated in LTE networks. In future work, We can efficiently allocate the resource in 5G networks.

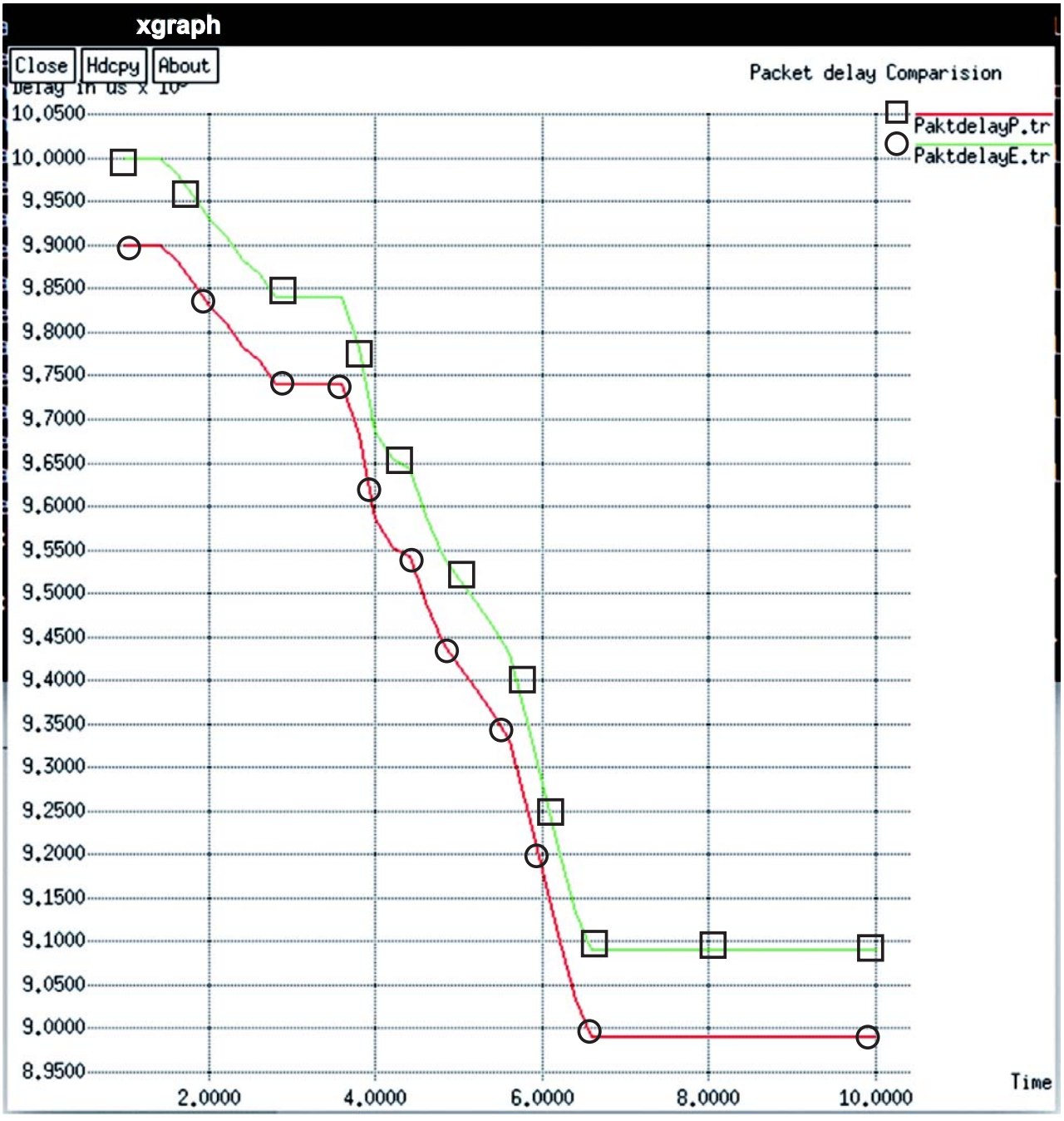

Figure 8: Packet Delay

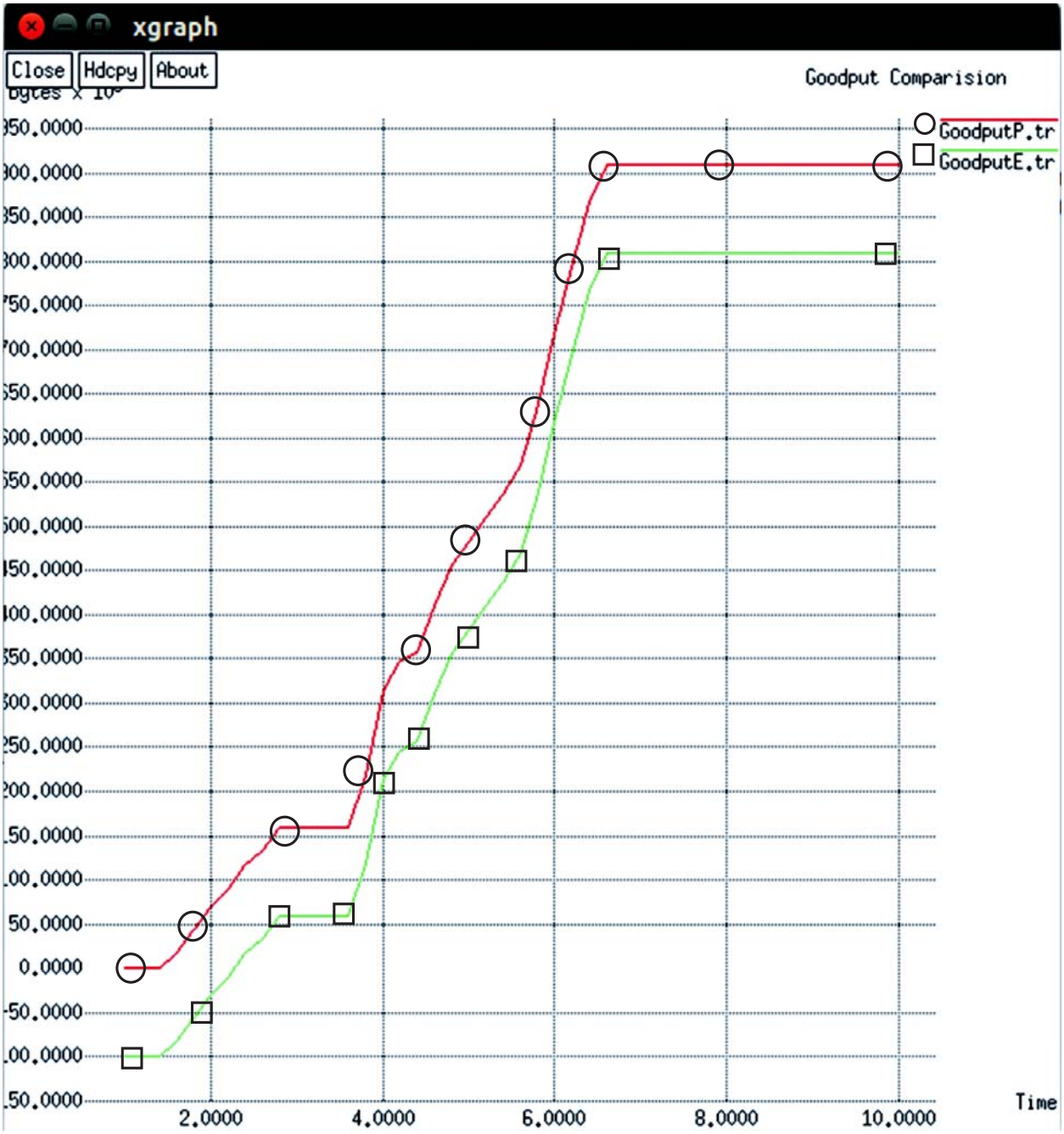

Figure 9: Goodput

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