International Journal of Engineering Technology and Applied Science
(ISSN: 2395 3853), Vol 1 Issue 4 August 2015

Genetic Based Approach for Resource Allocation in OFDMA Wireless Mesh Networks

Chandrashekhar Sahu[1], Prof. Nikhilesh Barve[2]
[1] M.Tech Scholar, [2]Asst. Prof. IFIT Bhopal
e-mail id – csahu22@yahoo.com, un.atminui09@live.com

ABSTRACT:- Resource allocation in wireless mesh network is very critical task. For the allocation of resource such as channel used various scheduling technique such as centralized and distributed. In centralized technique the allocation of channel resource shares in single window process. For the improvement of the performance various authors used various optimization techniques such as DCF game theory and other heuristic function. In this paper used genetic algorithm for the selection of resource such as cannel in wireless mesh network. By the genetic algorithm the selection of channel is very fair and improved the channel capacity and decreases the value of degree of interference. The proposed system of channel selection simulate in MATLAB 7.8.0 software. This software is well known simulation software for the analysis of communication network

Keywords: Mesh Network, OFDM, Resource Allocation.

INTRODUCTION

Wireless Mesh Networks (WMNs) have become the focus of much research since they allow for increased coverage while retaining the attractive features of low cost and easy deployment. WMNs have been identified as key technology to enhance and complement existing network installations as well as provide access where traditional technology is not available or too costly in install [1]. A WMN is made up of mesh routers (MRs), which have limited or no mobility, and mesh clients (MCs) which are often fully mobile[2,3]. The mesh routers form the backbone of the network allowing the clients to have access to the network through the backbone. The OFDM (orthogonal frequency division multiplexing) system is one of the MC (multi-carrier) systems which divides one high speed data stream into several low speed data stream in parallel and transmits them by many sub-carriers at the same time. So the symbol duration of each low speed data stream is lengthened[4,5]. Modulation and demodulation of OFDM system can be made in the FFT (fast Fourier transform) processor so that the transceiver of OFDM can be effectively implemented in the digital domain. It also has an advantage that can avoid the interference among subcarriers by inserting the guard interval longer than delay spread of channel. A heuristic is a technique that improves the efficiency of a search process, possibly by sacrificing claims of completeness. They are good to the extent that they point in generally interesting directions; they are bad to the extent that they miss point in generally interesting directions. Channel Assignment[6,7] (CA) in a multi-radio WMN environment consists of assigning channels to the radio interfaces in order to achieve efficient channel utilization and minimize interference. In this section, we describe different schemes that can be used to assign channels in a wireless mesh network. These schemes are generally classified as: Static, Dynamic and Hybrid Channel Assignment. Hybrid[8,9] channel assignment strategies combine both static and dynamic assignment properties, for example, by applying a fixed assignment for some interfaces and a dynamic assignment for other interfaces. Hybrid strategies can be further classified based on whether the fixed interfaces use a common channel or varying channel approach. Resource allocation and resource utilization is important factor in wireless mesh network. In wireless mesh network faced a problem of traffic congestion and delay rate. Such type of event generated due to sharing of channel and limited number of channel[10]. For the reduction of traffic congestion and delay various authors used optimization technique. II in this section discuss Genetic algorithm III. Section describes proposed work in section IV discuss experimental result and finally discuss conclusion and future work in section V.

II. GENETIC ALGORITHM

Genetic algorithms are search algorithms based on the mechanics of natural selection and natural genetics. They combine survival of the fittest among string structures with a structured yet randomized information exchange to form a search algorithm with some innovative flair of human search. These algorithms are started with a set of random solution called initial population[16]. Each

member of this population is called a chromosome. Each chromosome of this problem which consists of the string genes. The number of genes and their values in each chromosome depends on the population specification. In the algorithm, the number of genes of each chromosome is equal to the number of the nodes in the DGA and the gene values demonstrate the scheduling priority of the related task to the node, where the higher priority means that task must executed early. Set of chromosomes in each iteration of GA is called a generation, which are evaluated by their fitness functions. The new generation i.e., the offspring's are created by applying some operators on the current generation. These are called crossover which selects two chromosomes of the current population, combines them and generates a new child (offspring), and mutation which changes randomly some gene values of chromosomes and creates a new offspring. Then, the best offspring's are selected by evolutionary select operator according to their fitness values.

III. PROPOSED ALGORITHM

Using genetic selection approach, we can improve the efficiency of channel allocation in mesh network. In mesh network the total physical channel allocated as set of population for the processing of selection of resource.

Proposed Algorithm:

- Let n is the no. of MR (j1, j2, and j3… jn).
- Let M is the no. of resource (r1,r2,……., rm)
- Compute the selection parameter indicator value.
- For each resource obtain the information like channel, computing capacity and current load of mesh network.
- For each MR obtain the MR size and the time needed to complete to complete the MR.
- Create grid matrix for the process and apply selection process.
- Generate the initial population of MR and apply the genetic selection mechanism to select the optimal MR from population. The selection of MR is done using fitness function evaluation.

$$F(xi) = \frac{f(xi)}{\sum_{i=0}^{n} F(xi)}$$

Where f (xi) is the fitness of individual xi and F (xi) is the total pheromone of that individual MR selected. Here in the process of genetic algorithm crossover phase are not required. For the process of mutation we fixed the value of variable probability p=0.07. And finally gets the optimized set of MR for allocation.

- Calculate local pheromone and set process priority order for completion of MR. If selected MR priority is high, then execute the MR.
- Again select population and repeat the process until all MR are processed.

The key idea of selection operator is to give preference to better individuals by allowing them to the pass on their genes to the next generation and prohibited the entrance of worst fit individuals into next generation; here we are using genetic approach to only select the channel for solution of mesh network.

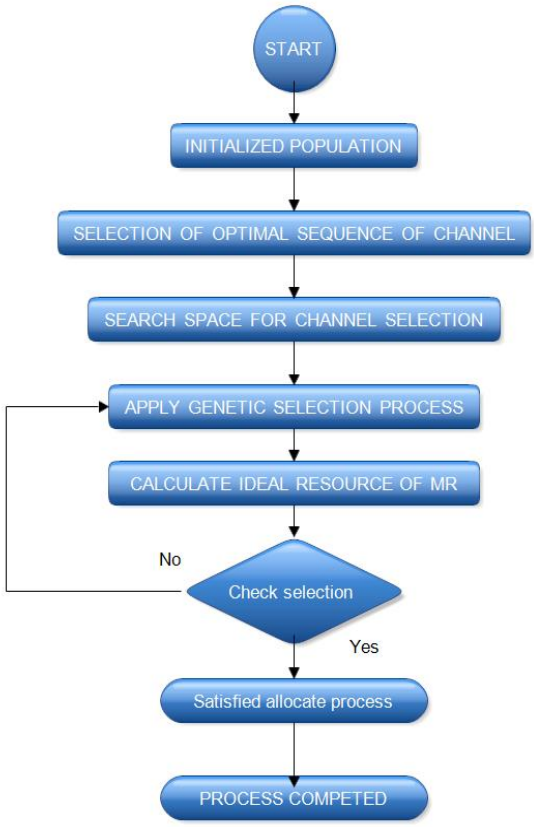

Figure 1 Proposed model.

IV. EXPERIMENTAL RESULTS

For an experimental process we used the value of number of node with using wireless mesh network resource allocation techniques for the group of nodes 10, 20,30 and 40 etc. all these nodes are apply to resource allocation techniques and the find elapsed time, degree of interference etc.

Table 1: Comparative result of some existing algorithm.

Method Name	Number of MR	Throughput	Elapsed Time
Game Theory	10	29.05	22.55
	20	35.05	32.06
	30	29.04	27.45
	40	38.07	31.76
Proposed algorithm	10	26.05	16.93
	20	36.05	34.04
	30	34.04	30.08
	40	35.06	32.26

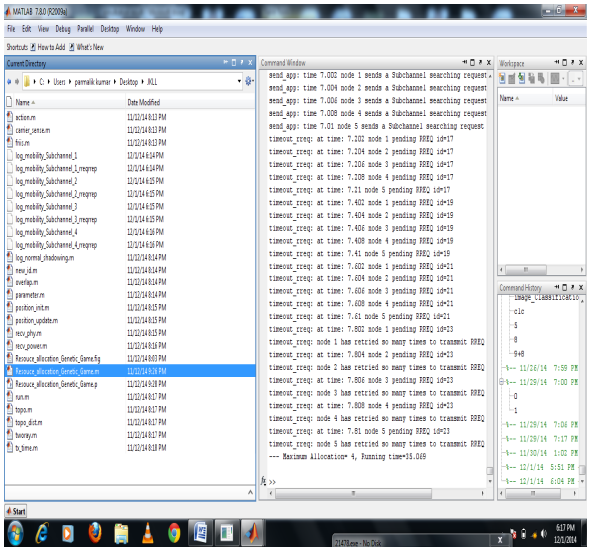

Figure 3: Shows that the window for Time request procedure and Running time value for Wireless Mesh Networks in OFDMA with maximum number of allocated node is 10 for Game theory.

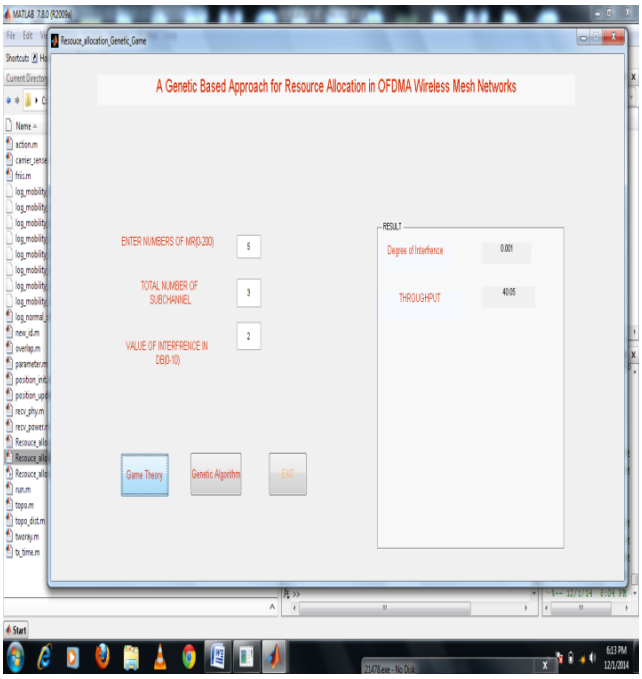

Figure 2: Shows that the window for Wireless Mesh Networks in OFDMA using GAME THEORY.

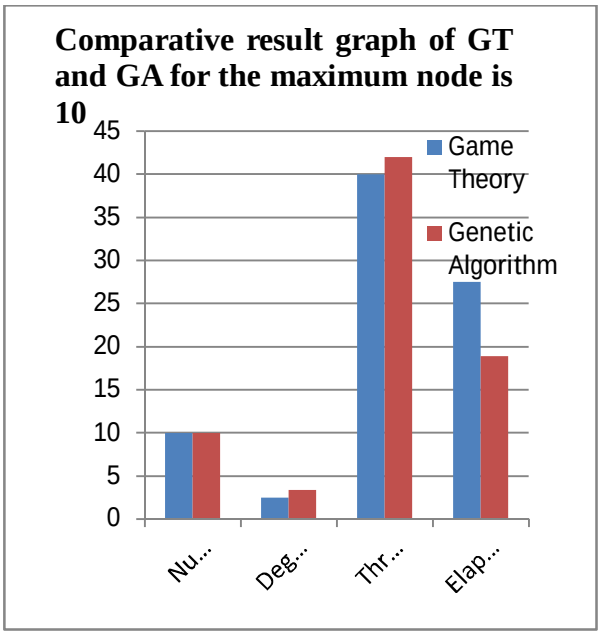

Figure 4: Shows that the comparative result graph for performance evaluation for the maximum number of node is 10 with using Game Theory and Genetic Algorithm, find the Degree of interference, Throughput and Elapsed Time.

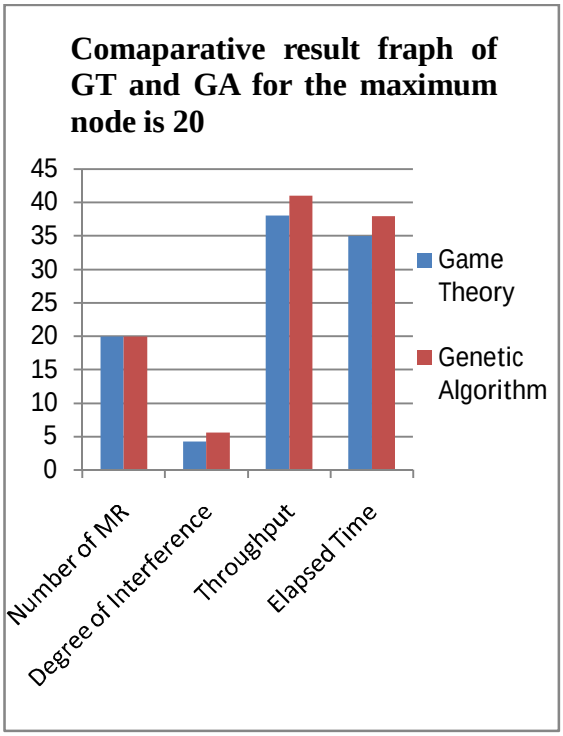

Figure 5: Shows that the comparative result graph for performance evaluation for the maximum number of node is 20 with using Game Theory and Genetic Algorithm, find the Degree of interference, Throughput and Elapsed Time.

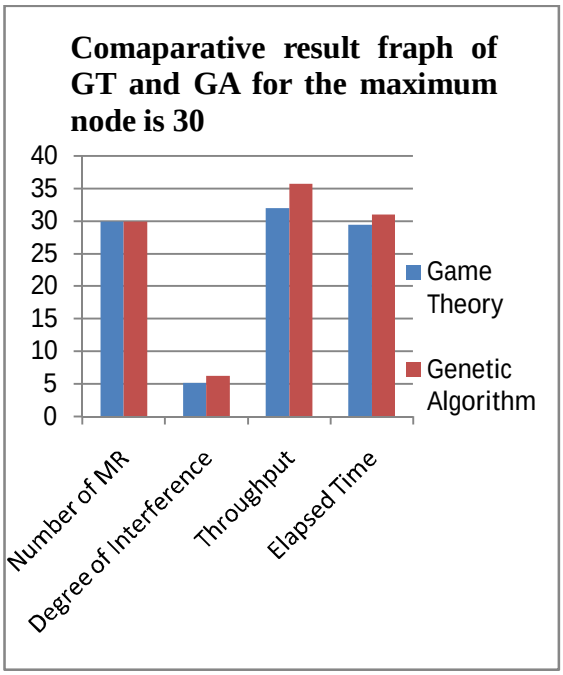

Figure 6: Shows that the comparative result graph for performance evaluation for the maximum number of node is 30 with using Game Theory and Genetic Algorithm, find the Degree of interference, Throughput and Elapsed Time.

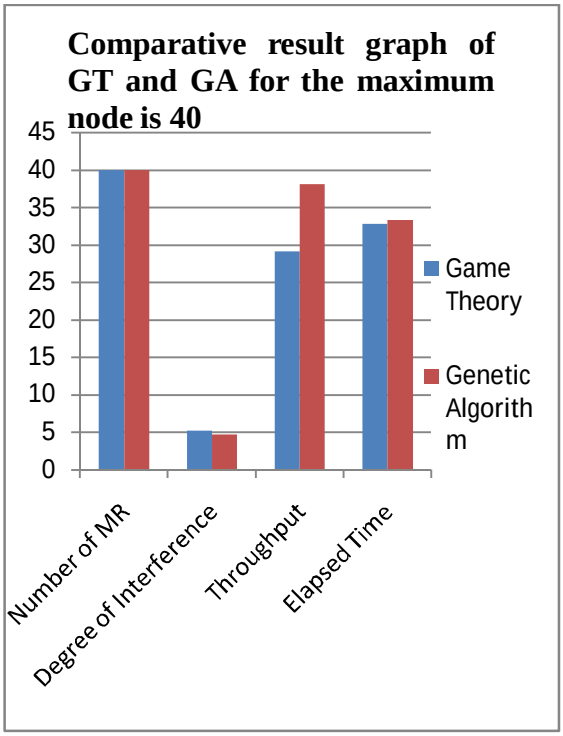

Figure 7: Shows that the comparative result graph for performance evaluation for the maximum number of node is 40 with using Game Theory and Genetic Algorithm, find the Degree of interference, Throughput and Elapsed Time.

V. CONCLUSION AND FUTURE WORK

In this paper we modified the process of channel selection in wireless mesh network. The process of channel selection in wireless mesh network is very difficult due to limited number of resource and maximum number of user traffic. For the improvement of channel selection used genetic algorithm. Genetic algorithm is dynamic population based searching technique. The dynamic population searching technique proposes a selection process of channel. The selection process of genetic algorithm used fitness function for the selection of channel. The modified channel selection process is very efficient in case of traffic congestion and delay rate of mesh network. The increasing the size of mesh network the process of genetic channel selection process faced a problem of normal selection of channel. In case of vast network used Meta heuristic function for selection of channel in mesh network.

REFERENCES

[1] SaharHoteit, Stefano Secci, Rami Langar, Guy Pujolle "A Nucleolus-Based Approach for ResourceAllocation in OFDMA Wireless Mesh Networks" TRANSACTIONS ON MOBILE COMPUTING, IEEE VOL. 12, 2013. pp 2145-2154.

[2] Yao-Win Hong, Wan-Jen Huang, Fu-Hsuan Chiu, and C.-C. Jay Kuo "CooperativeCommunications inResource-ConstrainedWireless Networks" SIGNAL PROCESSING MAGAZINE IEEE 2007. Pp 47-57.

[3] Mohamed Salem, AbdulkareemAdinoyi, Mahmudur Rahman, Halim Yanikomeroglu, David Falconer,Young-Doo Kim, Eungsun Kim, Yoon-ChaeCheong"An Overview of Radio Resource Management inRelay-Enhanced OFDMA-Based Networks" COMMUNICATIONS SURVEYS & TUTORIALS, IEEE VOL. 12, 2010. Pp 422-438.

[4] Ho Ting Cheng and Weihua Zhuang, University of Waterloo "Joint Power-Frequency-Time Resource Allocation inClustered Wireless Mesh Networks" IEEE 2008. Pp 45-52.

[5] Mohammad Fathi, Hassan Taheri, MehriMehrjoo "Cross-Layer Joint Rate Control and Scheduling forOFDMA Wireless Mesh Networks" IEEE 2009. Pp 1-9.

[6] Ho Ting Cheng, Weihua Zhuang "Novel Packet-Level Resource Allocation withEffective QoS Provisioning for Wireless Mesh Networks" IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS IEEE vol 8 2009. Pp 694-700.

[7] F. Kaabi, S. Ghannay, and F. Filali "Channel Allocation and Routing in Wireless Mesh Networks:A survey and qualitative comparison between schemes" International journal of wireless & mobile networks vol 2, 2009. Pp 132-150.

[8] Aria Nosratinia, Todd E. Hunter "Cooperative Communication inWireless Networks" IEEE Communications Magazine IEEE 2004. Pp 74-80.

[9] SaharHoteit, Stefano Secci, Rami Langar, Guy Pujolle "Strategic Subchannel Resource Allocationfor Cooperative OFDMA Wireless Mesh Networks" IEEE 2006. Pp 1-5.

[10] I. Ahmed, A. Mohamed, T. Fouly, and Y. Hu, "On the Fairness ofFrequency Domain Resource Allocation in Wireless Mesh Networks- A Survey," Proc. IEEE GCC Conf. and Exhibition, Feb. 2011.

[11] F. Brah, A. Zaidi, J. Louveaux, and L. Vandendorpe, "On theLambert-W Function for Constrained Resource Allocation inCooperative Networks," EURASIP J. Wireless Comm. and Networking, 2011, pp. 1-13.

[12] D. Saha, A. Dutta, D. Grunwald, and D. Sicker, "ChannelAssignment in Virtual Cut-Through Switching Based WirelessMesh Networks," Proc. 11th Int'l Conf. Distributed Computing andNetworking (ICDCN), Jan. 2010.

[13] F. Martignon, S. Paris, I. Filippini, and A. Capone, "EfficientBandwidth Allocation in Wireless Community Networks," Proc.Wireless Days Conf., Oct. 2011.

[14] Y. Park and E.-S. Jung, "Resource-aware routing algorithms for multihopcellular networks," International Conference on Multimedia andUbiquitous Engineering, 2007.,Pp. 1164-1167.

[15] S. Sadr, A. Anpalagan, and K. Raahemifar, "Radio resource allocationalgorithms for the downlink of multiuser OFDM communicationsystems," IEEE Commun. Surveys Tutorials,2009, pp. 92 – 106.

[16] Chun-Cheng Lin" Dynamic router node placement in wireless mesh networks: A PSO approach with constriction coefficient and its convergence analysis" in Information Sciences 2013 PP-294–308