Virtual Topology Design using Genetic algorithm

[1]Hardik Parmar, [2]P.Selvaraj

[1]M.Tech IT Student, [2]Assistant Professor

Department of Information Technology, Faculty of Engineering and Technology, SRM University, Chennai, India

[1]Er.Hardik.H.Parmar@gmail.com, [2]selvaraj.p@ktr.srmuniv.ac.in

***Abstract*— Virtual topology design issue is based in Cognitive Networking. Cognitive networking is one Advance type of Networking; Virtual design Problems are more in virtual topology so to cure those problems Genetic Algorithm can use. It is an Advance Networking because in this; networking and its framework structure it is having Genetic algorithms that has sense of thinking like human brain. As human brain can take smart decisions having n-number of path and having many ways to deal with work the same time taking only one best way or procedure to deal with it. In this networking at the end simulation will going to be implemented. If algorithm is having two or more than two paths at that time it will choose one of them which is best among all or it will generate new path if best path is not available. Fitness function can perform the optimization. Also it will always fix and tuned some number of results. Genetic algorithm will reduce congestion and Bit Error Rate with less number of transmitters. Results show that the new method enhanced obtains more and better results than the other method.**

***Index Terms*— Genetic Algorithm, fitness function, mutation, crossover, selection.**

I. INTRODUCTION

A Genetic algorithm is using natural selection process. That is also known as natural genetics, in set of parameters strongest individual will be selected for the best optimum solutions. Each parameters will be defining each solution of the given Virtual topology design issue. GA (Genetic algorithm) will be having a string of strong parameters that will give an accurate and optimum solution of VTD (Virtual Topology Design) that is called as chromosomes.

In terms of virtual topology design process, the cognitive network can be defined as "a network that can dynamically alter its topology and operational parameters to reply to the needs of the particular request while optimizing the overall usage of the network resources and its performance attributes". The cognitive system will keep on learning from optimizing sets. GA will select one fittest parameter among all strong individual and that fittest parameter's fitness will be calculated by Fitness function. A Fitness Function will find fitness mainly by reducing congestion and Bit Error Rate, also Fitness function will select best fit individual that leads increase in Throughput.

II. GENETIC ALGORITHM

The proposed genetic algorithm can search the solution space in a very efficient manner, and the algorithm converges faster than the normally used Dijkstra's algorithm. GA is considering on natural selection process. If any virtual topology has been given then GA will deal with the problem differently and first it will find the strong Genomes that is also called as chromosomes and when GA will get a string of strong parameter, Fitness evaluation process will happen. First according Fitness evaluation best fit will be selected that means Mutation Crossover and Selection process will happen. In that Variable-length chromosomes have been employed for routing by GA. According to Figure GA will find initial strong chromosomes.

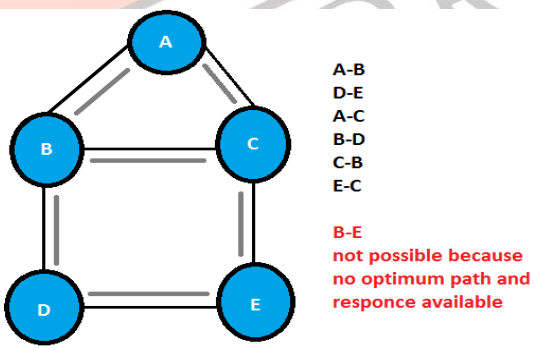

Fig. 1.1 Topology

Here as shown in to figure VT nodes are optimize and all possible paths like A-B, D-E, A-C, B-D, C-B, E-C and not possible path is B-E due to lake of resource and path availability. Each edge in chromosomes simply represented a source destination. It takes each gene and tries to establish light path between two respective nodes. After establishing light path logical topology will be considered and at list one optimum light path will be considered if it fails to find then again physical topology will be considered. The gene of first locus is always reserved for the source node. The length of the chromosome is variable. Here Optimum path will be having less Bit Error Rate having less congestion and best throughput.

III. NATURAL SELECTION PROCESS

Natural selection process contains main three stages mutation, Crossover, Selection.

1. Selection:

   Selection stage will give priority to the high quality chromosomes priority so that it can be used for next same issue cure.

2. Mutation:

Mutation will generate one partial alternative route for the same design issue. It will raise another optimum path with new route and with more throughput.

3. Crossover:

Crossover will select one intermediate node to eliminate less fit node from the optimum path. For this it will select one node and change the route and crossover the less fit node to the fittest node.

The algorithm can cure all the infeasible chromosomes with simple repair function. Cross over and mutation together can provide a search capability that results in improved quality of solution and enhanced rate of convergence.

IV. FITNESS FUNCTION

A Fitness function will test the fitness of the gene and it will find optimum path by linking all fit node with each other. Fitness function will measure quality of chromosomes and find minimal cost path. Fitness function will consider Throughput, congestion and Bit Error rate. Among all Throughput is directly proportional where Congestion and Bit Error Rate are inversely proportional.

Throughput is describing direct relation with accuracy of optimum path and least cost so with increase of Throughput fitness will increase while Bit Error Rate and congestion should reduce to get fit accurate result. So formula for Fitness Function will be like,

$$f(x) = \frac{1}{\sum_1^n f(x), f(x+1)} \qquad (1)$$

Here f(x) is fitness function while limit is given like 1 to Nth chromosomes and at i^{th} position congestion and Bit Error rate will be as f(x) and f(x+1) that will be in denominator. In this fitness function congestion will be calculated by formula given below,

$$F(x) = f_0, f_1, f_2, f_3 \ldots f_n. \qquad (2)$$

While $x \neq 0$;

In fitness function Bit Error Rate is also going to consider in denominator and hence formula for Bit Error Rate will be mention below,

$$F(x) = f_1, f_2, f_3 \ldots f_n. \qquad (3)$$

While $x \neq 0$

Here as given in to the formulas as mention this F(x) will calculate from x = o to x = n means number of possible fit genes this formula will be executed and among them it will find the strongest fit optimum result. Same as Bit Error Rate it will calculate with in limit has been specified. Here value of x and value of will be Nonzero because for each issue we will get at list one optimum solution and one light path to be follow.

V. SIMULATION

Simulation of this GA will be plotted and described in graph. A Graph plot defines how GA will behave while the time of implementation. The Random selection of population increases the chance of good solution, where as the best population selection has got a chance of giving sub optimal solution. Here we are going to consider main three graph.

Graph of Best fit is: This Graph will show Best Fit genes among all the possible strong optimum light path issue.

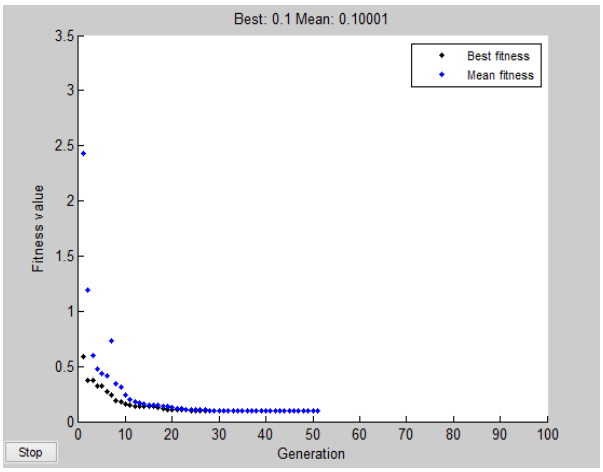

Fig: V.1 Best Fit Graph

Graph of Generology is: This graph will describe Generology of the GA fitness function.

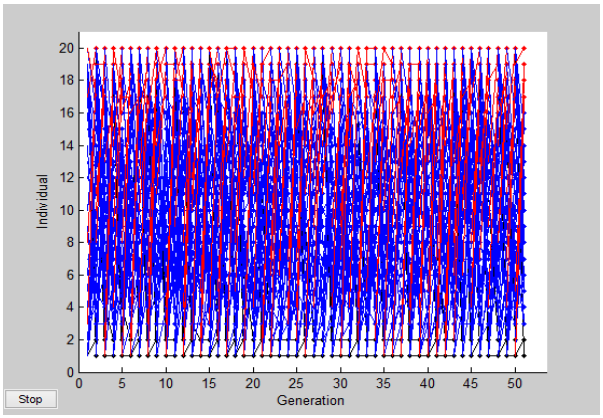

Fig V.2 Generology Graph

And Graph of Range is: Range Graph will show Overall Range of Fitness function to be getting Strong Fit Gene.

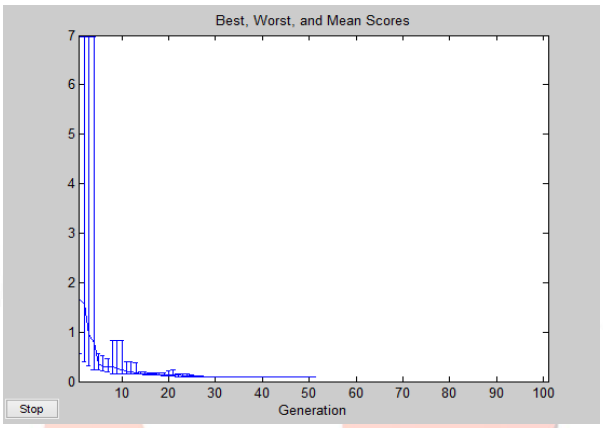

Fig V.3 Range Graph

The behavior of GA is like this and GA will optimize itself and by this way fitness function will optimize light path.

CONCLUSION

The GA deals with accuracy and optimal performance for the VTD problem of Optical Networks.For today's evolving traffic demands accurate and robust methods are required to provision the requested amount of bandwidth. If the new solution outperforms the older one, the older solution will be considered as a backup path and the topology will be migrated to the new VTD solution. For Dynamic VTD problem a tool can be implemented and simulated in MATLAB using Genetic Algorithm.

REFERENCES

[1] Jingjun Zang, Jitao Zhong, Ruizhen Gao, Lili He "A Joint Optimization Method of Genetic Algorithm and Numerical Algorithm Based on MATLAB," Handa China 2009.
[2] Guangya LIU, Jingli Chen, "The Application of Genetic Algorithm Based on Matlab in Function Optimization." China, 2006.
[3] Dr. Richard Frost, AKM, Aktar-uz-zaman, "Survey on Design/Reconfiguration of Logical Topology of WDM Networks using Tabu Search," July 13, 2008.
[4] DOCTORAL THESIS, "Heuristic Algorithms for Virtual Topology Design AND Routing AND Wavelength Assignment In WDM Networks"-2008.
[5] Rundra dutta, George K Rouskas, "A Servey of Virtual Topology Design Algorithms for Wavelength Routed Optical Networks".
[6] Joun Carlose, Rubben Lorenzo Cognitive Algorithm to Solve the Impairment-Aware Virtual Topology Design Problem in Reconfigurable Optical Network".
[7] Sujoy Ghose, Rajeev Kuma, Multihop Virtual Topology Design in WDM Optical Networks for Self-Similar Traffic.