SNMP Based Network Optimization Technique Using Genetic Algorithms

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Abstract

Genetic Algorithms (GAs) has innumerable applications through the optimization techniques and network optimization is one of them. SNMP (Simple Network Management Protocol) is used as the basic network protocol for monitoring the network activities & health of the systems. This paper deals with adding "Intelligence" to the various aspects of SNMP by adding optimization techniques derived out of genetic algorithms, which enhances the performance of SNMP processes like routing.

Keywords: *Network Optimization, Evolutionary Computing, Genetic Algorithms and Network Management*

1. Introduction

The past years had witnessed an increasing interest in the application of genetic algorithms on optimization techniques to the problems derived from various fields of Engineering and Science. In Computers, Optimization techniques are applied predominantly on network connectivity enhancement and management.

The contribution of this paper includes application of Genetic Algorithm in SNMP. Section 1.1 gives the detailed information about SNMP. Section 1.2 gives the information about Genetic Algorithm. Section 1.2.1 provides information about Genetic Operators. Section 2 gives the proposed Genetic Algorithm, which can be implemented by NMS tools.

1.1 SNMP (Simple Network Management Protocol) Scheme

SNMP scheme provides access to variables of the managed systems which describe system configuration that can be queried by managed applications that implement SNMP. SNMP scheme has got three major modules viz., Managers, Agents & MIB (Management Information Base). SNMP Managers are designated administrative computers, which monitors and manages a group of hosts or devices on computer network and run as NMS (Network Management System) software. SNMP Agents are software components which reports requested information to the manager using SNMP stack. It exposes management data derived out of the managed systems as variables that can be accessed by the underlying network processes.

It does active management tasks that include modifying and applying a new configuration through remote modification of these variables; these variables are accessed in hierarchies. MIB manages the virtual tree-structured hierarchical database to hold the entities in a communications network that can be addressed through object identifiers. MIB stores the data and metadata in hierarchies [1].

1.2 Genetic Algorithms

Over the last decade, genetic algorithms (GAs) have been successfully applied to problems in business, engineering, and science. This is a consequence of a noteworthy progress in their theory, design and development. Genetic algorithms (GAs) are stochastic, population-based search and optimization algorithms inspired by the process of natural selection and genetics. A major characteristic of GAs is that they work with a population, unlike other classical approaches that operate on a single solution at a time. Hence, they can explore different regions of the solution space (i.e., search space) concurrently; thereby exhibiting enhanced performance [2, 3, & 4].

1.2.1 Genetic Operators

Majorly there are three operators that dominate the functions of the genetic algorithms, which are selection, Crossover and Mutation. Selection operator grabs an individual from the present generation's population for inclusion in the next generation's population. Crossover works on Crossover Probability to create an offspring by exchanging and combing partial solutions from two or more individuals. Crossover operator can be subdivided into *one-point* and *uniform* crossovers.

One-point crossover randomly chooses one crossover point and exchanges all the genes from that crossover point. Uniform crossover achieves alternative form of genes(allele-wise) by mixing and exchanging the genes with probability of 0.5. Mutation works by slightly disturbing the recombination solutions with the alteration of small percentage of genes in the given list of individuals [4].

2. The Proposed Method

The proposed method focuses on the five different QoS (SNMP variables) parameters viz., Bandwidth, Latency, Delay, Throughput, Dropped Packets Measure and Transmission Time to gauge the performance of a network and with the Genetic Algorithm methods,enhancements are observed in terms of functionality. This method can be implemented through any standard NMS tools available in the market.

3. The proposed Algorithm

Step 1: Initialization

Initialize the required SNMP variables.
Generate initial network connectivity P at random or with prior knowledge

Step 2: Network Connectivity Fitness Evaluation

Evaluate the connectivity fitness for all the member in the given network P

Step 3: Selection
Select a set of promising network connectivity S from P

Step 4: Crossover

Apply crossover to the connectivity (routing) pool S for generating a set of routings set O

Step 5: Mutation

Apply mutation to the routings set O for obtaining its perturbed set OΔ

Step 6: Replacement

Replace the current network connectivity P with the set of offspring OΔ

Step 7: Termination

If the termination criteria are not met, go to Step 2

4. Conclusion

With the enablement of Genetic Algorithms the performance of the network has been enhanced by the observation of SNMP variables. With the emerging new techniques of GAs, further functionality improvements can be achieved and the application of GAs can be extended to other advanced protocols of the systems network stack.

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