Genetic Algorithm for Least Cost Routing in the Network

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INTRODUCTION

Routing is one of the most prime issues in network which has a notable impact on network performance and utilisation [1]. This has made the shortest or least cost path routing an important field of research. Although there is a considerable increase in the capacity of the Internet, regional congestion is still an issue at certain times of day. Dimensioning the system to provide minimal delay under these transient conditions would be uneconomical, particularly as various forms of application data are more or less sensitive to these delays, as are different end-users. This research work therefore investigates a scheme that uses Genetic Algorithm (GA) to find the least cost path as well as a set of best suitable paths for sending a data packet from source Autonomous System (AS) to destination Autonomous System (AS).

In this paper, I have used Genetic Algorithm to calculate a number of best possible paths based on the delay and cost associated with each link in the network assuming that this information will be accessible. This can provide the end-user to select the path the want their data to traverse through and it thus takes the form of Loose-Source Routing. Furthermore, the approach avoids the need for inter-operator cooperation.

KEYWORDS

Internet, Autonomous System, loose source routing, Genetic Algorithm.

DESIGN AND IMPLEMENTATION

A framework is built implementing to find the least cost path for sending data from one AS to another where the source and the destination ASes are taken as user input. The topology generator tool PFP (Positive Feedback Preference) developed by Mondragon and Zhou in 2004 [2] has been used to generate regional Internet topologies which are then fed into the bespoke tool I have developed. Then Genetic Algorithm calculates the least cost path and the best suitable paths for the end-user to send its data through.

RESULT AND EVALUATION

A small topology of 30 ASes, as shown in Figure 1, has been used to run the simulation to find the least cost paths from source AS12 to destination AS16.

The amount of delay experienced for inter-AS paths and intra-AS paths have been chosen as a ratio of 1:4, after doing some research on Internet delay measurements [3, 4]. The weights associated with the inter-AS links is 1 and with the intra-AS links is 4.

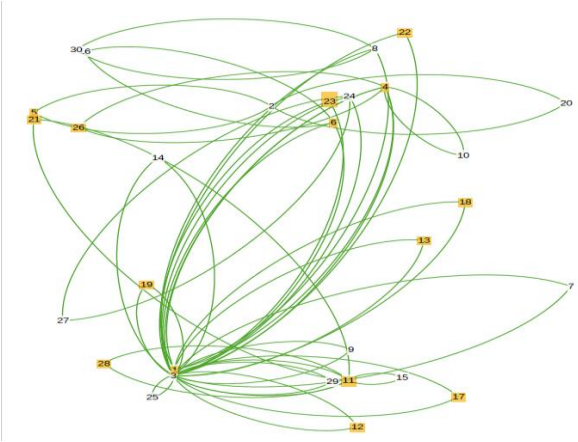

Figure 1: A sample topology graph

The Genetic Algorithm is run for 50 iterations to find the least cost path which is, ***12—2 – 5—16***

It also generates a set of best possibe paths for the end-user to select from:

12—2—22—3—17—4—27—5—16
12—3—26—4—7—2—5—16
12—18—3—30—7—2—5—16
12—2—22—3—10—4—27—5—16

The paths are selected based on a fitness function that gives equal weight to the delay and cost associated to the links. Unlike the common traditional routing algorithms, Genetic Algorithm calculates the best path considering more than one constraints. Moreover, it offers a set of best possible paths which gives the end-users the opportunity to use Loose-Source Routing. This way, they can avoid any congested AS if they wish to do so.

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