

CHAPTER 1

INTRODUCTION

1.1 Background

Communication plays an important role in our day to day life and it is the live wire of almost all human activities including health, business, education and development. There is definite need for effective communication between two parties located in any part of the world. International communication is therefore very vital in the modern world and certainly there is much tendency for increased usage of international communication in the future. Among the available international communication methods today, international telecommunication has become very popular and is an emerging sector.

International telecommunication traffic is one of the main sources of revenue for national telecommunication service providers (Telcos) and it is still growing. It has to be managed properly and driven effectively to obtain the fullest benefits to the Telcos and their consumers.

1.1.1 International Settlements

It is not possible for a Telco in one country to route IDD traffic directly to a destination country. For example, if the IDD call is from Sri Lanka to The United Kingdom (UK), the Sri Lankan Telco company (who ever) it might be, cannot route the IDD call directly to a specific Telco company in the UK. The call should be routed through one or many (depending on the geographical locations of the originating country and the destination country of the call) international operators (international carriers) whose business is to route IDD calls in various parts of the world. Telcos usually deal with multiple international carriers (for example, SingTel, Telco, Vectone, BTCOM, BVSNL, Telstra) in order to use the latter's networks for international traffic (both terminations and originations). These international carriers offer different charging structures which vary with the time, volume and the destination of the call. At the end of a pre-agreed period of time, usually one month,

international carriers will exchange with Telcos the details of terminated and originated traffic in summary (traffic in terms of minutes) to each destination with the related charge.

Hence it is very important for the Telcos to be properly organised and plan their IDD traffic in order do business well.

1.1.2 Planning IDD Routes

Telcos use various methods to configure the IDD routes for originating (outgoing) traffic; some of them are:

- Manually configuring the routes by inspecting the minute rates of available international carriers.
- Using tools that only consider the minute rate and propose the routing plan for the next month or week. These tools do not have adequate analytical capability and are not sensitive for dynamic changes of key parameters of international carriers.

Such a routing plan is generally static throughout the traffic period. Because of the dynamic nature of the IDD carriers and the complexity in agreements between Telcos and IDD carriers, it is not manually possible to determine a cost-effective routing plan. Also, a static routing plan, that would result from a manual process, for the entire traffic period would certainly not be cost-effective for the IDD traffic for Telcos. That is, there is potential for Telcos to save significant cost if routing plan is more dynamic.

Most Telcos incur huge costs due to lack of a proper methodology to analyse and propose a good routing plan for the IDD traffic. It is not feasible to manually validate a particular routing plan since there are a large amount of IDD destinations (8000 to 10000) and international carriers with different routing destinations. Various international carrier conditions such as commitments, discounts will increase the complexity in planning the cost effective routes.

1.1.3 The Need for a Proper Methodology

Because of the complexity in finding the best routing plan for the IDD traffic, Telcos will benefit a lot from a methodology or a tool which can be utilised for this purpose.

A good system should consider the following factors when determining a cost effective routing plan for IDD calls originating from a Telco:

- International carrier rate plan
- Destinations supported by international carriers
- International carrier commitments
- Volume of estimated traffic to each destination in the near future from the Telco
- New international carriers coming in and discontinuing of the existing international carriers
- Dynamic behaviour of any of the above parameters.

Therefore, a methodology capable of analysing the usage patterns of the subscribers of the Telco and other international-traffic-cost-dependant parameters and then forecasting a cost-effective traffic routes, ideally in real-time would be of immense benefit to many Telcos and in-turn their customers today.

1.2 Description of the Research

The objective of this research work is to obtain a suitable methodology to generate a cost-effective IDD traffic routing plan for the next 24 hours in near-real-time for a Telco.

The following are the two main tasks involved:

- **Traffic pattern forecast**
 - Based on the past traffic and the current trend of international traffic, forecast the traffic pattern in the near future
- **Cost-effective routing plan**
 - Determine the optimum routing plan (international carrier – destination combination).

1.2.1 Traffic Pattern Forecast

A heuristic process for forecasting the future traffic based on historical information, current traffic trend and the subscriber growth rate of the Telco have been used in this project. This task is divided into the following sub areas/tasks

- Extract the history of data in a meaningful manner. Usually there are millions of Call Detail Records (CDRs) for a period of one month.
- Store them suitably for the purpose of analysing
- Consider the current trends of calling patterns
- Consider any sudden change of calling pattern (unexpected changes)
- Analysis of the growth rate of the subscriber base of the Telco.

1.2.2 Cost-effective Routing Plan

The Genetic Algorithm (GA) technique is used to solve this optimisation problem because of its unique feature of quick convergence with natural genetic operations when the search space is considerably large. The power of GA is used to obtain a cost-effective routing plan within the short time available.

The dynamic behaviour of the parameters (international carrier's information and other) is the main reason for the use of GA in the process of finding an optimised routing plan

Basic elements of the GA, *genes* and *chromosomes* were defined appropriately in accordance with the problem domain.

gene - an international carrier for a destination

chromosome - set of all such operators for each destination

Reproduction, mutation, and crossover, (basic operations in a GA) were used in producing (generating) populations in the GA process. The optimum set of approximate ratios for the GA operations were determined during the research based on experimental results as 5%, 10%, and 85% respectively for reproduction, mutation, and crossover. The fitness function is defined appropriately to calculate the total route charge for the set of destinations which were selected through GA process.

Experimental results show that the total cost of IDD routing can be reduced to 30% - 50% compared to the current manual method used by Telcos.