

PRIVATE NETWORK TRAFFIC FORECASTING MODELS

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ABSTRACT

This paper describes two methods for forecasting the trunk traffic of user-owner facilities.

INTRODUCTION

The interconnection policy in Canada has a great impact to telecommunication industry. The advanced technologies in information sciences are also increasing the demand for telecommunications. A good private network could increase the effectiveness and image of a corporation. Therefore, private network planning is more important than ever. Forecasting of private networks has thus become more complex than it used to be. Inaccurate forecasting can result in misdirected capital investment, service degradation and the associated expense and lost revenue. Two methods which have been used in other applications are described here for traffic forecasting for the first time.

FORECASTING METHODS

1. THE PARTIAL ADJUSTMENT MODEL

This model is used to suit the volatile economic situation. It uses different set of exogenous variables for different companies depending on the industry they are in. The basic variables are GNP, industry index and consumer index etc.. The endogenous variables is traffic volume. The following equations have been used to derive a dynamic relationship:

$$Y^* = A + BX_t + E_t \quad (1)$$

$$Y_t - Y_{t-1} = K(Y^* - Y_{t-1}), \quad 0 < K < 1 \quad (2)$$

On combining (1) and (2), the equation can be written as,

$$Y_t = KA + KBX_t + K(1-K)Y_{t-1} + KE_t \quad (3)$$

The application of logarithmic adjustment to (3),

$$\log Y_t = K(A+B(\log X_t)) + (1-K)\log Y_{t-1} + KE_t \quad (4)$$

where,

- Y^* the desired traffic
- X_t the exogenous variables
- Y_t the endogenous variable, current traffic
- Y_{t-1} lagged traffic volume
- K the adjustment coefficient
- A, B coefficients
- E_t disturbances term

Three-stage least squares estimation method has been used to estimate parameters. The results show that independent variables are somewhat correlated with the exogenous variables. The predicting power is reasonably well.

2. THE BLACK BOX MODEL

The black box technique has been investigated. This technique is being used in other area of engineering practices, but it has not been used in forecasting. It assumes that the trend will continue in the future(short term). By using the known statistics such as GNP, consumers index and price index etc. and the traffic data, the value of an unknown black box can be determined. Once the black box is known, the estimated future traffic can be obtained. The results vary depending on data. Generally speaking, the results can be improved if the right statistic data being used.

The method is as following:

- A_{11} GNP
- A_{12} consumer index
- A_{13} price index
- A_{1j} other indices
- F_t traffic volume
- X_t element in black box

$$A = \begin{bmatrix} a_{11} & \dots & a_{1n} \\ \vdots & & \vdots \\ a_{n1} & \dots & a_{nn} \end{bmatrix}, \quad X = \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix}, \quad F = \begin{bmatrix} f_1 \\ \vdots \\ f_n \end{bmatrix}$$

$$A = X * F \quad (5)$$

Thus, from the known statistics, X can be obtained,

$$X = A^{-1} * F \quad (6)$$

If we know a_{1j} of the future, then we will know F

$$F = A * X \quad (7)$$

CONCLUSION

These two methods are very easy to use and have good predictive power. Due to the changing aspects of a company's business and global economic condition, both methods are for short term forecasting. These methods with limited historical data produce reasonably accurate results. If more historical data is available, these methods should give a much better traffic prediction.