Econometric models for decision making in IT services

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Abstract

This article offer an econometric model that is presented as a tool for controlling LAN congestion and take decision in service. To achieve this objective it should make the revision of the time series as a way to measurement, understand and analyze data networks, as well as the behavior of the shares in a stock exchange. So the concept of the time series of actions and data networks to engage with this model planet congestion control. In order to present a model for test the performance of the model is used to simulate a LAN trace.

Keywords
Time series, congestion control, decision making.

1. Introduction

In computer science, various mathematical tools are used for analysis and design of systems to improve performance. A particular example is the time series, which are used in various fields like research and industry. By making a review of the applications that it has for the time series it has been found that the analysis of the stock exchanges has a similarity to the field of telecommunications. After checking the traces that LAN network leaves, is observed that the behavior of traffic carried by the network is very similar to the graphs of the variation of the shares on the stock exchange. Taking as reference this observation, this research aims to reach a common ground between the two camps to have a tool in the analysis of traffic data networks and propose a model of congestion control based on an econometric model.

So that's why time series are suitable to assess the situation of a moving performance of the variable to be analyzed, in this case the data congestion in telecommunications network. This type of series is adequate for detecting the most immediate trend or error in terms of displacement and volume of participation, providing opportunities, corrective and trends of importance in the management of data channels and thus provide forecasts of occurrence for the decision making. The analysis regarding congestion in data networks, can be performed under different parameters and trends, obtaining estimates for the control and application of statistical measures in decision making, such as guiding forecasts of variables to look within a given model, with its historical, statistical characteristics and giving the opportunity to assess the level of occurrence in the future. It is in this way that past data can lead to predict the movements of future values, as data are established and evaluated using graphs and indicators inherently given by the positive or negative trend variables. For this research the variables that are taken are the delay and bandwidth in data networks.

So we estimate a model that can be contextualized within the technical analysis of stock trading firms, which provide the opportunity to evaluate trends, variables, relations of influence, historical within the supply and demand of the stock market. Usually the variable within the action more important is the price, which determines the movement of

stocks upward or downward along the opening or closing, the highs, the lows, the times, volatile, trading volume on the horizon of the average assessed at day, week, month, year in the period you want to apply. It is in this way that the information in the global market and its needs is reflected, setting trends trading patterns over time, allowing information to be cyclical and repeat for the characteristics of the market. Given the above concepts, will present the analysis of the shares of a company and this will give the steps to raise the congestion control model on data obtained from a simulation for a LAN network.

2. Time Series as an analysis tool

Reviewing the characteristics of the time series in the stock markets, we can say that by analyzing financial graphs based on the basics of the variable to be analyzed. As an example, we can take the share price; Figure 1 analyzing as follows:

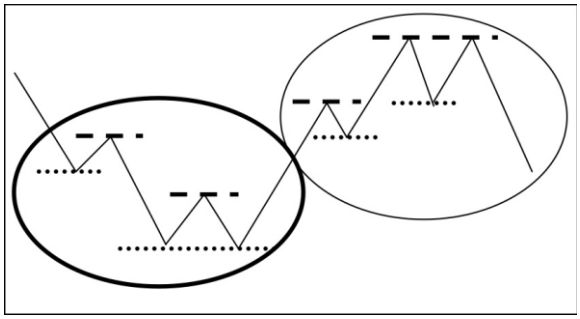

Figure 1. Concept of variation

According to Figure 1 lower market is enclosed with the contour redialing. The oper market is locked in the light contour. The supports are dotted lines with black circles; this give lineament to the trend in the downward movement, giving the ability to regrow up, so we can say that the demand for money is outstanding at the offer price. On the other hand the dotted lines striped reflects the rising market in which supply exceeds demand.

Price appreciations can be developed under a time t (n), which allows to have an appropriate measure, talk yourself a day forward. Explaining that a market is known as bullish or higher, or that the price tends to be higher than the value found is when the maximum referents (1,2,3,4) are shown in Fig. 2 are ever higher and the minimum reference (1.1, 2.2, 3.3, 4.4) in Figure. 2 which in turn are given increasingly higher than the previous. Thus generating a trend line which breaks, support the price trend, giving rise to a new trend, this rise in the stock market is called pull back.

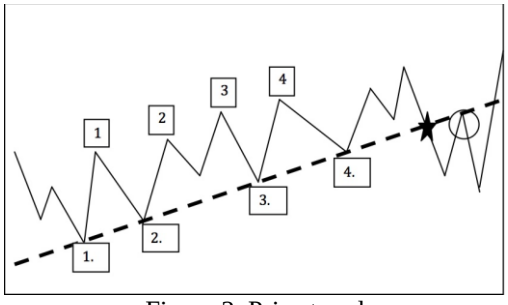

Figure 2. Price trend

2.1 Graphical Analysis

Given the behavior of the market, and based on time series obtained a Graphic as illustrated in Figure 3

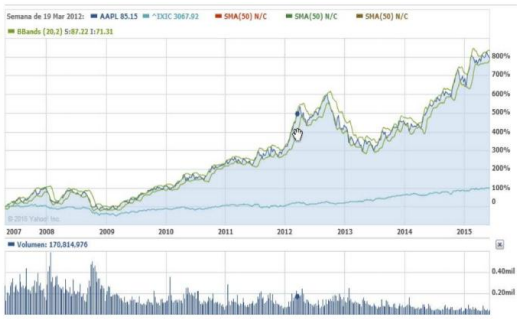

Figure 3. Graph behavior action

Given what you have in Figure 3, can be thought of a regression model, which gives the possibility that a variable (action # 1) Independent is in a relationship or compared to another (action # 2 Variable) independent, according to their behavior in the market (Stock Exchange). The variable action # 1, take into account the random error within the constant mean being this equal to zero. And his B will reflect where the level of risk is the tendency of volatility. Within the independent stock market, generating a unique variety. In the same way will be the behavior of the action # 2. By linking these two variables, generate covariance of behavior in the stock market, but the same does not affect the performance of the independent variable within the market.
It then has to:
Media independent variable.

$$x = \frac{\sum_{i-1}^{n} x_i}{N}$$

Variance of the independent variable.

$$\sigma^2 \frac{(x_1-x)^2+(x_2-x)^2+\cdots+(x_{n-x})^2}{N}$$

$$\sigma^2 = \frac{\sum_{i-1}^{n}(x_i-x)^2}{N}$$

Covariance of two independent variables in the market:

$$\sigma_{xy} \frac{\sum f_i x_i y_i}{N} - xy$$

Beta, level of risk.

$$\beta = \frac{COV\ AR(Mercado,Accion)}{VAR(Mercado)}$$

Taking the above equations, the stock market within the CAPM (Capital Asset Pricing Model) [8] used to calculate the price of an asset or liability is handled. This model supports set the required rate of return for an independent variable in this research is intended that the variable is the amount of congestion that may be experienced on a network. So it is a kind of analysis allows you to estimate the behavior of the variable given the historical data to be analyzed in the measurement periods.

It is considered that the CAPM is defined by:

$$E(r_i) = r_f + \beta_{im}\left(E\left(r_m - r_f\right)\right)$$

3. Congestion control data networks

Congestion in data networks is a phenomenon that has become inherent in this technology, and comes in several parts of the network architecture. Beginning in the sizes of buffers routers, which are responsible for making the routing of packets. These buffers are limited and can be modeled as a type of M/M/1/ N/∞ tail where the queue size is N, which is a limited resource, so when the queue is full, it begins to present a consequence known as packet loss, which can be measured as blocking probability.

$$P_B = P_N = \frac{(1-\rho)\rho^N}{1-\rho^{N+1}}$$

In this equation P_B it represents the probability of blocking phone calls in a switched network or packet drop probability. It is the intensity of traffic coursing over telephone lines or packet flow. N is the number of channels or size of the buffers in the switching systems.

3.1 TCP congestion control

Models congestion control have focused on the protocol of the transport layer TCP [9], [10], so that the most commonly used techniques are the flow control sliding window, technical AQM (management active queues) [11], admission control, management and delay times. All this is done through various changes or versions to TCP, TCP Tahoe and starting TCP Reno, which modify the retransmission of ACK packets or confirmations.

These modifications to TCP have been exploring new ways to control congestion, which have been concentrated in the states of the transmission, which define how the algorithm runs. This sequence can be modified according to the needs of the control you want to perform on the data flow. For example, in [9] states defined as the TCP congestion control algorithm changes, starting with the state slow start (slow start) and then move to the state prevention of congestion (congestion avoidance). During the transition of the window size of retransmissions it is affected by the link status.

The main idea of this article is to propose a control model, without making any changes in the protocol because it leads to make a change in the time of transmission, confirmations and retransmissions of network elements. These changes could worsen the behavior of the network. Therefore, a model that does not change the protocol in its structure, but helps to address the behavior of network elements, to fit to the data streams produced by the random user behavior arises.

4. Posing Model

Taking as a base the analysis of econometric model and operation of congestion control, the way which the CAPM and congestion control relates is:

- It must be a time series with data packets transiting in the network.
- You must calculate the beta for this time series.
- To estimate the rate of return E (r_i), R_M and R_f.
- Adjust transmission rates with the results and verify congestion control.

To achieve this objective of the research data that are taken when LAN network is running through traces obtained in the network interface port of a switch. The analogy between the collection of data on the LAN and the econometric model is the way in which the services have on the network is represented. Each service is taken as an action of a product, so you should analyze the behavior of this action or these actions to know how the market behavior is, in this case the market is all data traffic passing through the LAN network. Once the time of network congestion is known, the operation of congestion control is performed.

The variables that are taken in observing the behavior of the network are: EC (Number of connected equipment), PU (utilization rate), TR (response time). With these variables the following result:

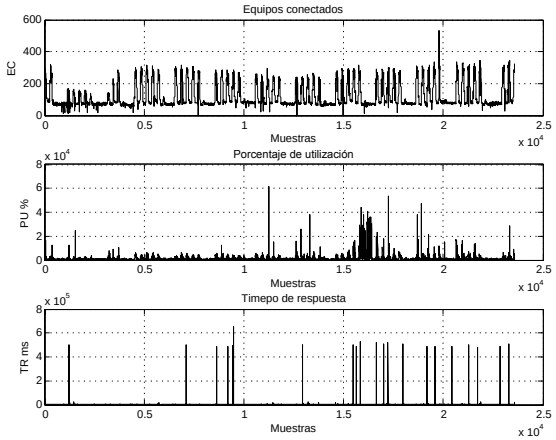

Figure 4. Behavior of the variables in a LAN.

In the figure 4 is shown as is the behavior of the LAN with the three variables separately. It is due to the entry of each variable is affected by the phenomenon of congestion, for example, if congestion occurs on the network, the response time starts to increase as the percentage of utilization and connected equipment may have complications with their different services or applications. So the model is applied to detect which is the measure of the response times are high to consider that there is congestion or when the utilization rate is. When the detected number is taken proceeds to vary the transmission rates to alleviate the problems of the LAN.

5. Model Results

To review how the proposed model behaves, it makes a series of data obtained from the LAN, for this data set calculating, by reference to the following values is:

- β_im amount of risk = limit response times or the utilization rate.
- R_M Market Performance = Performance LAN network under no congestion.
- R_f Performance of a risk-free asset = performance of channel capacity.

Considering these variables on TCP control system:

$$q_k = \left(\frac{E(r_i)r_k}{M} RTT - \frac{C}{M} R_0, B, 0\right)$$

The comparison between the behaviors of two types of data streams supported by the TCP control systems shown in Figure 5. The flow having the solid line is the normal flow where congestion control is applied. The flow has dashed line are flaws which are applied the modification that is affected by the variation.

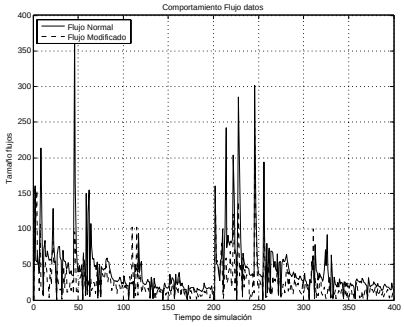

Figure 5: Behavior of traffic flows.

6. Conclusion

This article has presented a proposal for congestion control, where they have merged two important concepts, on the one hand is the CAPM econometric model that works with time series calculating average, variances and co-variances.

Taking the analogy of the stock market as a LAN network and the actions of the bag as the services they produce traffic on the LAN network, where the model is a parameter Silvers $E(r_m)$ which is the rate of return performance for an asset to this investigation that was a changed parameter (n) is the number of traffic flows on the network.

The results show that the form in which the congestion control is performed works, with the modification made, although only shown the behavior of a variable is expected to work with others.

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Biography

Martha M Cuellar is currently serving as a professor at San Mateo College, where she is leading the research group Bimat. she has a specialization in pedagogy and a specialization in finance. Her current studies are a master's degree in education where it focuses on the quality of education in the Colombian sector. She is an economist and her interests are on the stock exchange.

Joaquín F Sánchez is currently teacher at the Universidad San Mateo, in the area of telecommunications engineering. he is magister in telecommunications and their area of interest are mobile networks and congestion control in data networks. He is currently advancing doctoral studies in computer science, where research in implementing compilers.