Traffic Analysis on a Campus Information Network

Hitoaki YOSHIDA, Takeyuki SUZUKI*, and Toshirou IYAMA**

Computer Center, Iwate University, 3-18-8 Ueda, Morioka, Iwate 020-8550
TEL: 019-621-6095 FAX: 019-621-6095 E-MAIL: hitoaki@iwate-u.ac.jp

*Computer Center, Iwate University, 3-18-8 Ueda, Morioka, Iwate 020-8550
TEL: 019-621-6096 FAX: 019-621-6097 E-MAIL: takeyuki@iwate-u.ac.jp

** Mechanical Engineering, Iwate University, 4-3-5 Ueda, Morioka, Iwate 020-8551
TEL: 019-621-6418 FAX: 019-621-6418 E-MAIL: iyama@iwate-u.ac.jp

Abstract

Traffic analysis at a gateway to the Internet in Iwate University suggests that saturation before a true upper limit exists. Resulted regression curves predicted satisfactory traffic value after the increase of the line speed. The saturation also shows a warning level of traffic at the gateway. The result will be useful for management of a computer center or an information-processing center in a university.

Keywords

traffic, regression analysis, campus information network

1. Introduction

Management of a computer network has played an important role at a computer center or an information-processing center of a university in recent years. In particular, there are two key points, network traffic at a gateway to the Internet and network traffic of streaming data in a campus information network. The two key points are discussed in detail based on network traffic data of Iwate University (1998-1999) in this paper. A campus information network has been connected to SINET with 1.5 Mbps at a most national university except SINET nodes and etc. [1]. Network traffic congestion at the gateway has become serious problem due to rapid development of IT. It is a common problem in national universities.

The campus information network of Iwate University used to be connected with TOPIC (at Tohoku University) using 1.5 Mbps SD line (full-duplex), and the line speed has been increased to 6 Mbps since December in 1999. Traffic at the changed day is predicted using regression analysis on the basis of traffic data in 1998.

2. Traffic Analysis at a Gateway to the Internet

Saturation before a true upper limit

Monthly averaged network traffic is shown in **fig.1**, which had been recorded from 1998.1 to 1999.11 in Iwate University.[2] Both input and output traffic had increased steadily during 1998. The traffic had been saturated during 1998.12-1999.9 if an exceptional value in 1999.2 can be neglected. It suggests that saturation starts from 1.13-1.25 Mbps (75-83%) before a true upper limit, 1.5 Mbps.

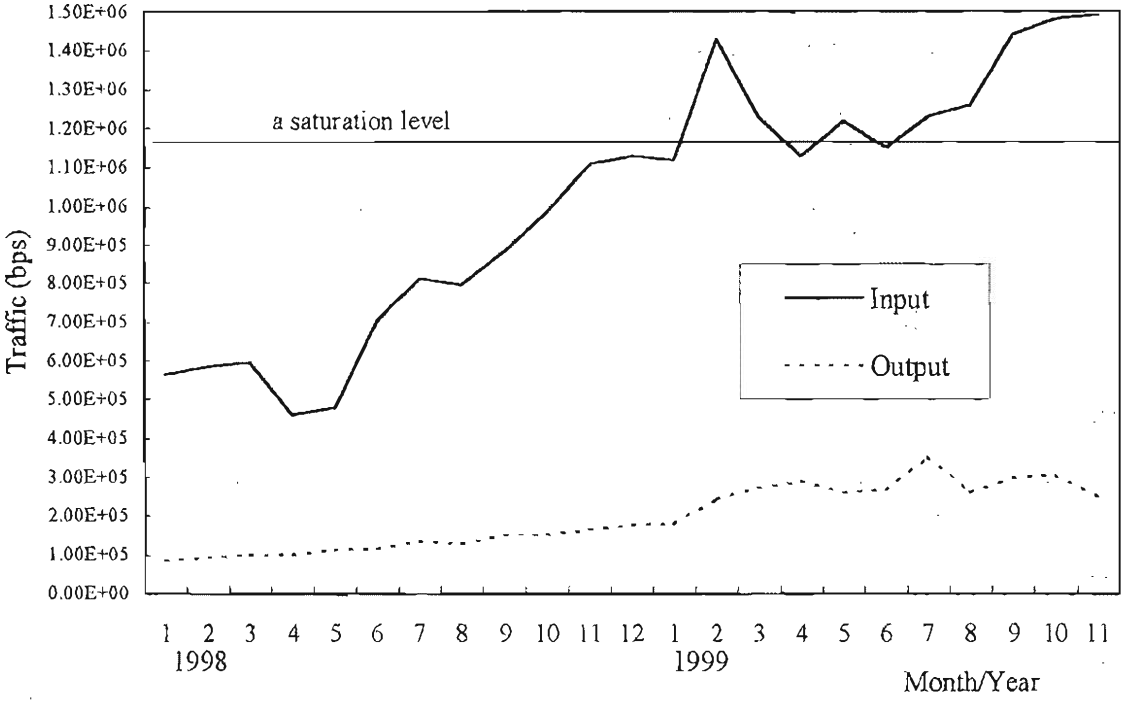

Figure 1: Monthly averaged traffic at a gateway of Iwate University (1998-1999).

Actually, most users claimed inconvenience of the network during the saturation period. For example, ftp was hard to complete transfer, and mail sometimes could not be delivered to commercial mail servers under poor network condition. A minimum of the traffic still existed near dawn. While, in 1999.2 and 1999.9-10 the traffic reached nearly a true maximum probably through unavoidable circumstances, and then the minimum of the traffic vanished. It is unusual event, because the traffic always reached the upper limit even on Sunday and even at dawn. Daemon process or autopilot application software probably worked to transfer data, continuously. Under the circumstances an upstream supplier gave up feeding the news server of Iwate University with Internet news. Normal network services are hard to serve above the saturation level. It should be improved when traffic reaches the saturation level.

Interestingly, linear increase of output traffic stopped in 1999, too. The correlation between the input traffic and the output traffic is shown in **fig.2**. It shows a fine positive correlation even after 1998.12 (correlation coefficient: R^2 =0.975). The cause of the fine correlation will be discussed in a further publication.

Prediction of traffic with regression analysis

Fig.3 illustrates regression analysis of the gateway traffic in Iwate University. Only data before the saturation level are used for analysis, that is, only data in 1998 are used. The input data fits a quadratic function (R^2 = 0.913), and the output data fits finely a linear function (R^2 = 0.970). The regression curves predict traffic in the future. An open circle shows a measured value in 1999.12 after the increase of the line speed to 6Mbps, and an open triangle shows a measured value in 1999.12 after the increase. The predicted input value is 3.57 Mbps and the empirical value is 3.31 Mbps. The predicted output value is 0.27 Mbps and the empirical value is 0.32 Mbps. It shows the regression analysis is well predicted the future traffic.[3]

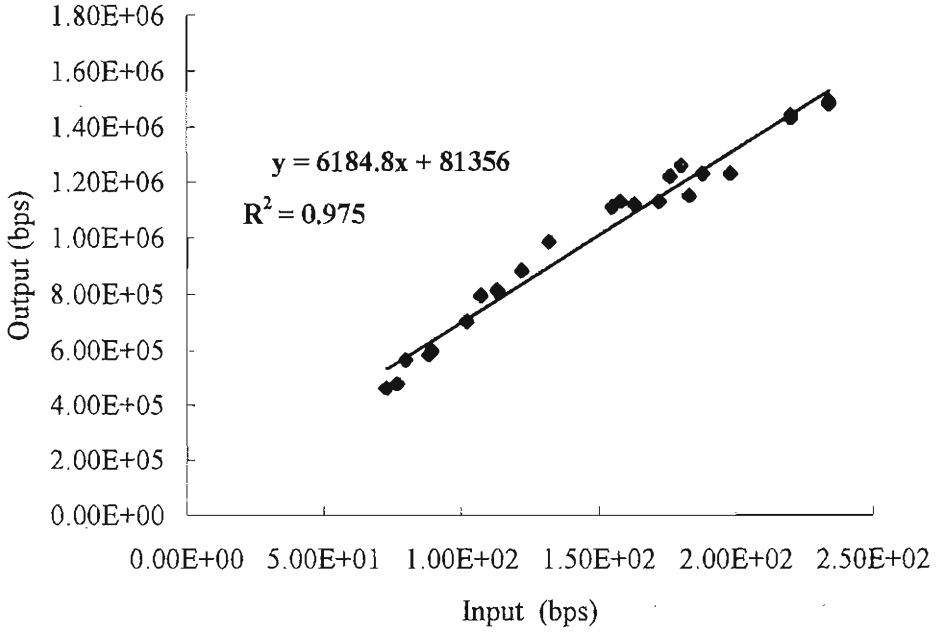

Figure 2: Correlation between input and output traffic (1998.1-1999.11).

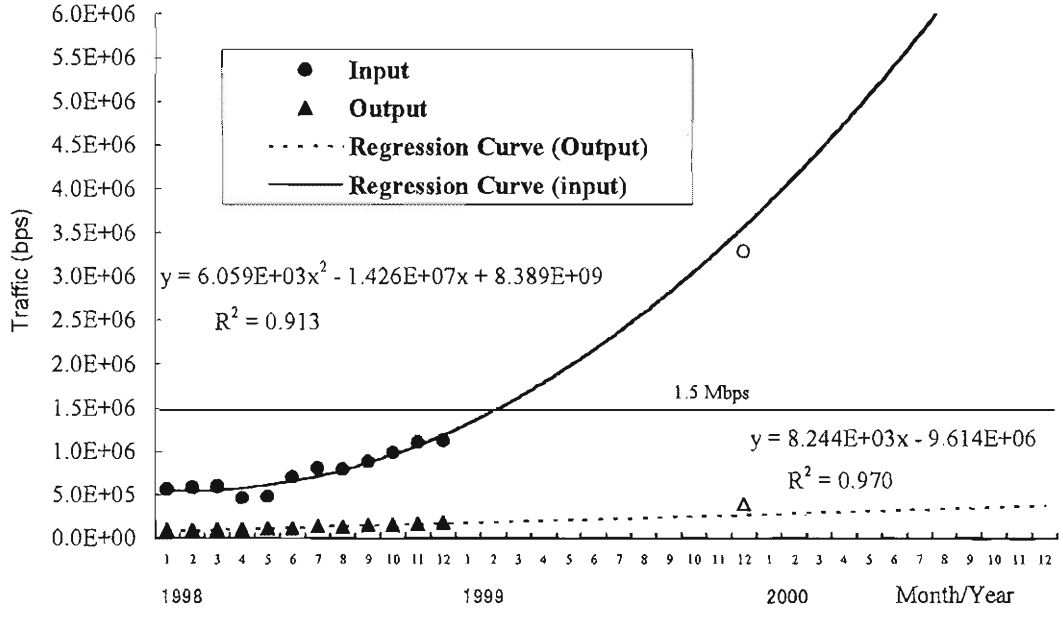

Figure 3: Prediction of traffic at the gateway to the Internet.

4. Summary

Traffic analysis at a gateway to the Internet in Iwate University suggests that saturation before a true upper limit exists. If data before saturation is used for regression analysis input and out put data fit a quadratic function (R^2 = 0.913), and a linear function (R^2 = 0.970), respectively. The regression curves predicted satisfactory value in 1999.12 after the increase of the line speed. The saturation also shows the warning level of traffic at the gateway.

The result will be useful for management of a computer center or an information-processing center in a university.

References and Notes

[1] M. Harayama, S. Sato, and A. Tanaka, "Trend Survey on Computer Center of National Universities in JAPAN in '94-'99", Journal for Academic Computing and Networking, No.3, p31, 1999.

[2] Traffic data in Iwate University was monitored with a network monitor system using SNMP that is developed by Sony System Design, Inc.

[3] As for recent data it will be discussed in a further publication, because hardware trouble of the gateway router prevented the correct data collection at the beginning of 2000.