Network Traffic Modeling, Case Study: The University of Jordan

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Abstract*: Network traffic modelling is the process of describing the dynamic behavior of network by random processes. The issue that it is hard to fully predict the demand on any network from service provider point of view, so it is important to find an accurate traffic model to maintain the quality of service. This paper focus on analyzing the internet traffic in the University of Jordan network as a case study. The reading and monitoring of the traffic was done with appreciated support from the service provider (JU Net Co.).

***Index Terms*: Network traffic, Traffic model Quality of Service (QoS), Internet Service Provider (ISP), Markov Traffic Models, Poisson Traffic Model, Long-tail traffic models.**

I. INTRODUCTION

Nowadays the world became loaded with various issues that require instant solutions, one of these issues are the network traffic that generates overcrowding, conflict and impact over computer networks. It is found that monitoring the flow inside the network can be helpful to provide information about the structure of the network traffic, this information can be helpful in finding solutions for networks problems.

The performance of infrastructure-less networks such as MANETs, degrades in the case of end-to-end paths. The multipath routing protocols is used to improve the performance of the communication networks in such situations [1]. The performance of a network becomes a crucial issue in disasters cases, in such cases moving to the affected areas of the network has considerable effect on nodes availability and the continuity of the networks functions [2]. Nodes that creates the highest and other traffic data are important to solve congestion problems, and help to understand the dynamic behaviour of the flow and stability of the network. These data can also be helpful for the administrator to predict bandwidth theft attacks and denial of service (DoS) [3]. There is no one single model that can be used effectively for modelling traffic in all kinds of networks, each kind has a suitable technique. Data collection process on a long term traffic is considered a valuable resource for data that help for better understanding of the network dynamicity [4].

In this paper we will introduce an analytical representation of traffic models in the University of Jordan to discover the random processes and explain the behavior of the network [5].

The University of Jordan is connected to the service provider using Fibre Optics connections rented from National Electric Power Company (NEPCO), there are two main data centres that have the responsibility of connecting the University to the wide internet, these two sites are Tariq site and point-of-presence (POP) site. The university itself connects to Cisco router of type (ASR 900 Software (PPC LINUX IOSD-UNIVERSALK9-M), Version 15.6(2) SP2, and RELEASE SOFTWARE (fc2)).

All the data that used in this paper is provided by the internet service provider (JU Net) which collect it using the Solar Winds monitoring tools.

II. RELATED WORKS

There are a group of researchers who studied the behavior of the network of Ahmadu Bello University (ABU), Zaria, Nigeria. Their data was collected using Wireshark (Version 165, SVR Rev 40429) over 90 days in a schedule of 15 minutes daily, 30 minutes weekly and 2 hours monthly. They also use MATLAB to analyze and monitor the collected data [6].

A. Traffic Models

In this section we will briefly present some of the most known network traffic models, traffic is measured by analyzers or sniffers, those are hard and software for counting and documenting the packets rate (7). Analyzing networks traffic is essential for determining faults, errors, energy wasting cases, unauthorized access, and may help to mark and address future problems [8].

B. The Poisson Traffic Model

The Poisson model can be mentioned as the oldest used traffic model. This traditional traffic model happened when the number of incoming packets follow the Poisson distribution where the length of each incoming pocket modelled as an exponential distribution. One of the cases when the Poisson model is best fit is in time dependant Poisson processes when the mean rate is not constant [9].

C. Long-Tail Traffic Models

This traffic model has a tail that taper off gradually rather than sharply, it is a sub type of the heavy tailed distributions. This model can briefly describe as the distribution that have wide number of occurrences far from the centre.

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In this model the infinitely decreasing part of the traffic is much longer,

allowing for realistic chances of generating large numbers.

D. Markov Traffic Models

Markov traffic model is a stochastic model describing a sequence of possible events in which the probability of each event depends only on the state attained in the previous event. This model appears when traffic flow in bursts with pauses like in voice communication [9].

III. METHODOLOGY

This study focuses on enhancing the experience of the student, teachers and all the staff who are connected to the internal network of the University of Jordan. This target can be achieved by following the below steps:

1. Select monitoring tool: This tool provides the ability to monitor and collect data about the traffic that flow from the internal network of the university to the wide using an effective monitoring software, which is in our case a Solar Winds software provided by the internet service provider (ISP).
2. Collecting data: The data of the traffic is collected daily 24 hours over two months: March and April of 2018.

Analyzing the data: Since the data is collected using Solar Winds then there is no need to visualize it, because the system has the ability to extract the data in many formats.

IV. RESULTS

The collected data includes: both transmitted and received rates per day and week, with time intervals one hour, and per month with time intervals two hours over the period of two months.

The traffic behaviour was as shown in the below figures.

After the traffic is being studied for many days, it is found that the behaviour of the traffic is almost the same, so in figure 1 a random day is taken as a sample, it shows that the traffic starts increasing significantly at 7:00 AM and decreasing after 2:00 PM, and from 10:00 AM until 12:00 PM there is a quiet behaviour in comparison with the other intervals.

Figure 2 shows that the traffic behaviour is almost the same to be repeated during the studying days.

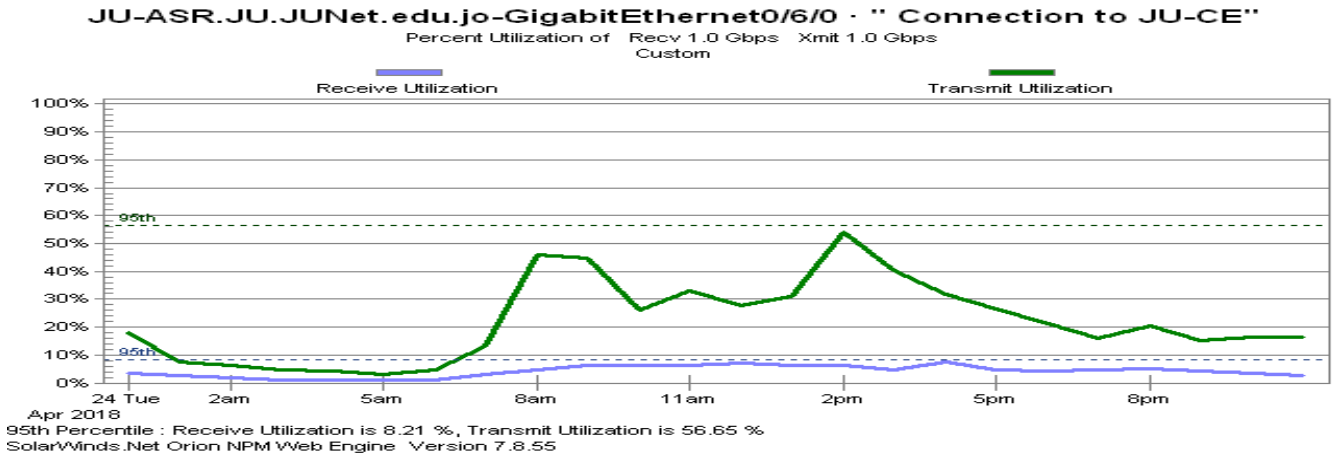

Figure 1: . Daily traffic flow in the University of Jordan

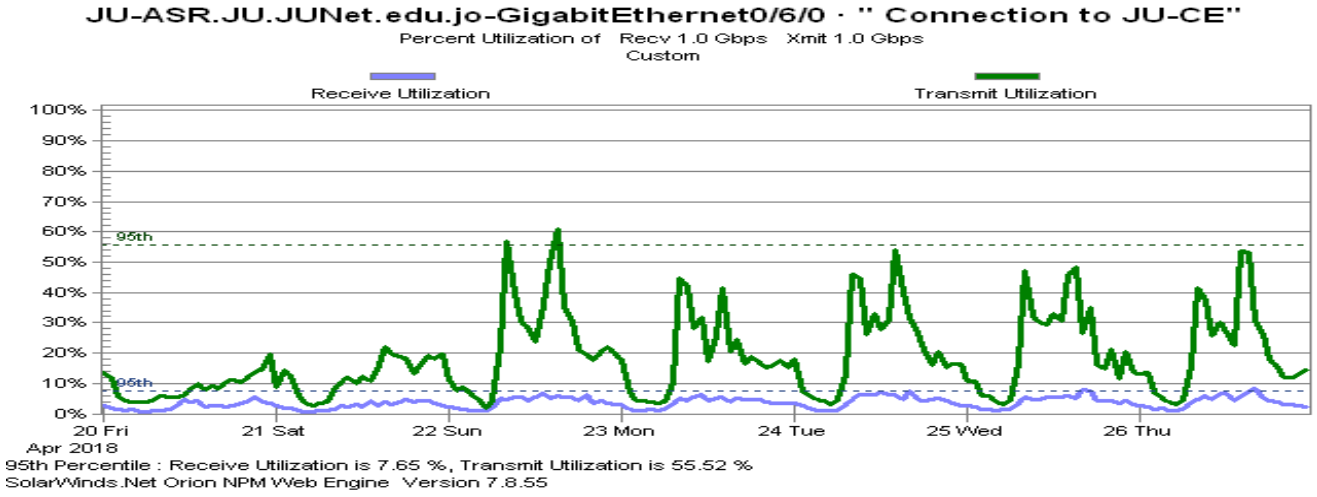

Figure 2: Weekly Traffic flow in the University of Jordan

Figure 3 shows that the traffic behaviour is almost same to be repeated every month.

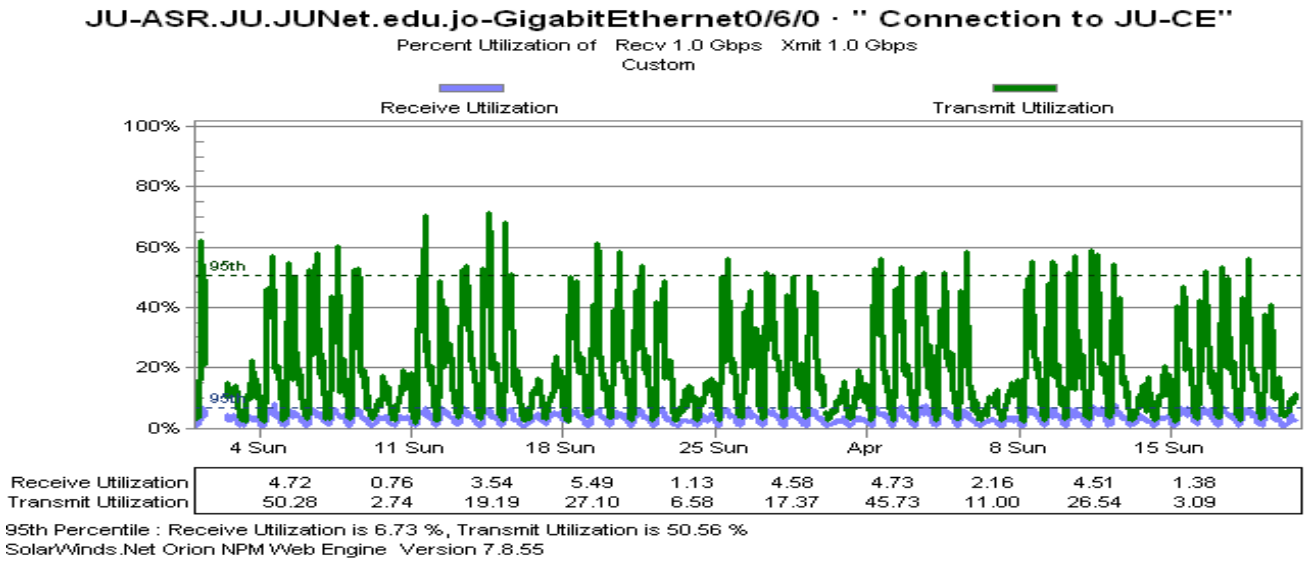

Figure 3: Traffic flow in the University of Jordan for March and April -2018

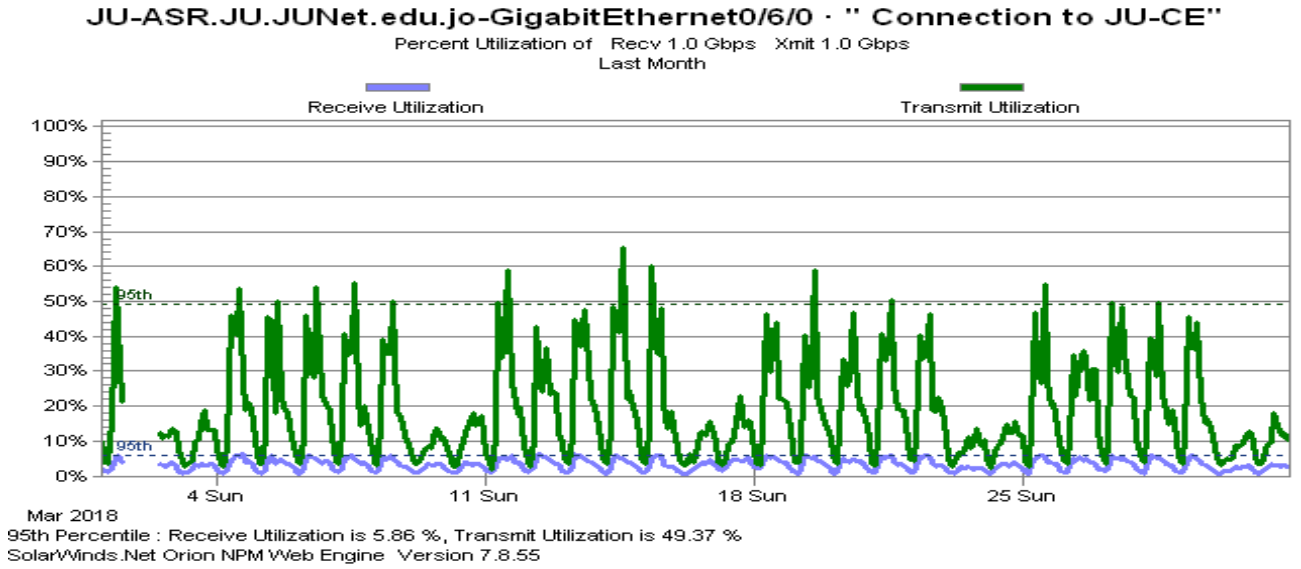

Figure 4: Traffic flow in the University of Jordan for March-2018

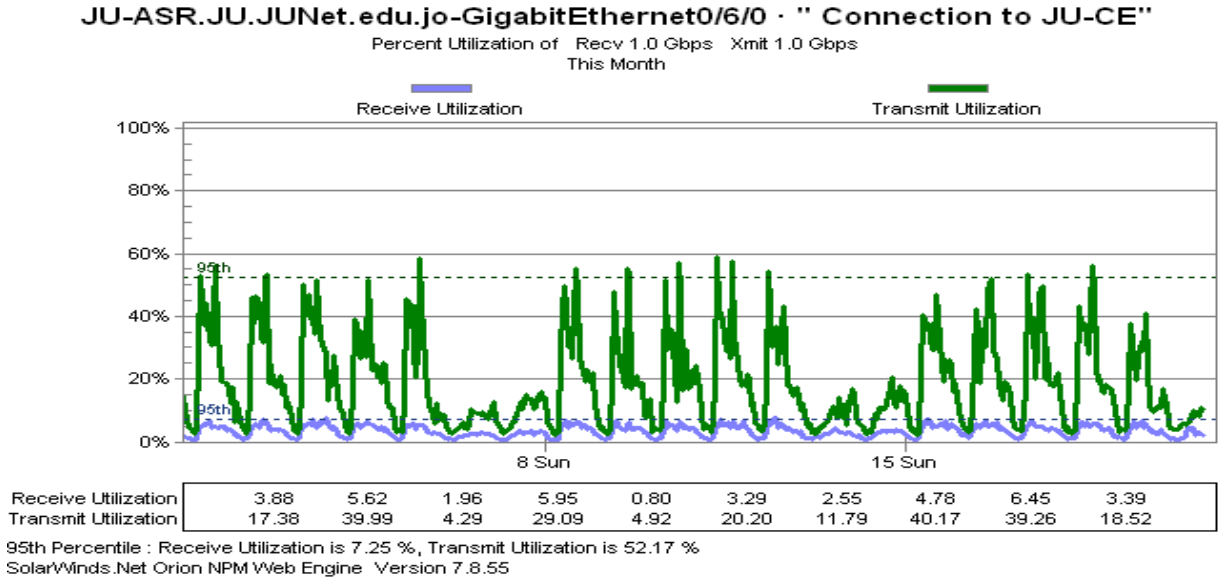

Figure 5: Traffic flow in the University of Jordan for April-2018

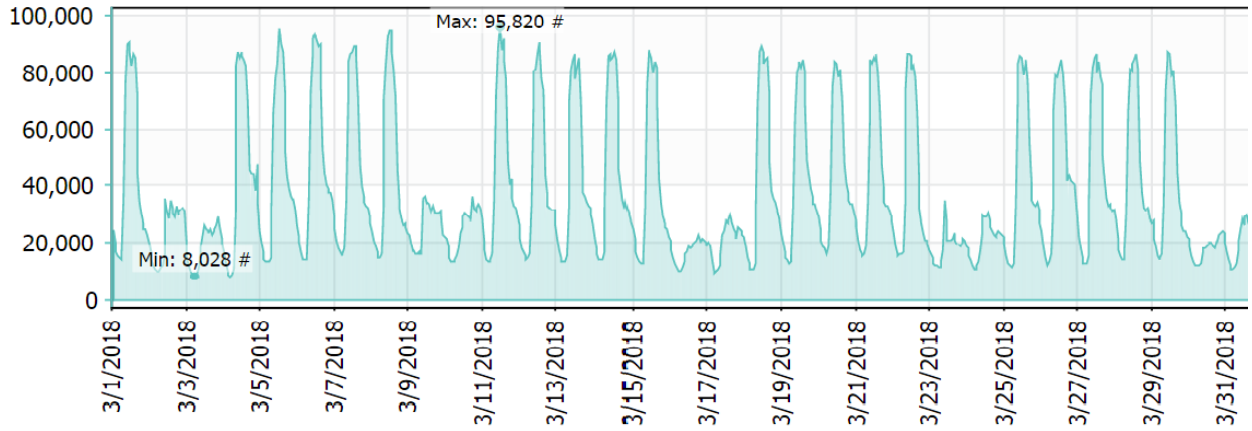

Figure 6: Number of sessions for March-2018

V. CONCLUSION

This network traffic analyses shows that receiving utilizations are less than 8% in about 95% of the time, while the transmitting utilizations are less than 58%.

It is also shows that the network traffic behavior is repeated weekly, which indicates that the network of the University of Jordan can be described as a stable one, and no need to change the bandwidth of the network.

The research result points that the network will be effective for any user, and it helps users to finish their work easily without any delay.

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AUTHORS PROFILE

Dr. Manaseer has a PhD in Computer Science from the Department of Computing Science at the University of Glasgow. His main area of research is Computer Networks and Embedded Systems. Currently, Dr. Manaseer is an active researcher in the field of Mobile Ad Hoc Networks. More specifically, his research on MANETs is focused on MAC layer protocols. Before obtaining his PhD, He got his Masters in in Software Engineering from the University of Jordan.