Network Congestion and Latency

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***Abstract*- The problem of network lag has affected people's modern life. Internet companies are also trying to find breakthroughs and improve the Internet environment. In this paper, an effective software engineering solution to network lag is proposed. Through a large number of data collection methods, this study investigates the main factors causing network lag and establishes a solution of reliability, applicability and availability. This research could help improve modern networks and provide suggestions for future research.**

***Keywords*—unifi, software engineering, congestion**

I. INTRODUCTION

The Internet provides such a powerful and universal capability that it can be used for almost any purpose that relies on information and is accessible to everyone connected to one of its constituent networks. Internet access refers to the ability of individuals and organizations to connect to the Internet using terminals, computers, or other devices such as mobile phones or tablets. Internet service providers (ISPs) are the gateway and bridge for network end-users to enter the Internet. For Unifi, Malaysia's largest telecommunications company, getting a reliable and stable Internet connection is challenging. Systems that manage dedicated Internet bandwidth provided by ISPs play a critical role in network performance. Therefore, it is very important to study another method to solve the network speed delay. The world is a better place when problems are improved and solved.

A. Network Traffic Requirements

The Internet has become the key for people all over the country, providing useful resources for studying, communicating, or getting to work. As packages became cheaper and the number of applicants increased, Internet connections became slower and demand for bandwidth increased. This also reduces the bandwidth provided, resulting in ineffective access to many resources. However, most ordinary households do not have the money to increase efficiency by buying more bandwidth and upgrading network infrastructure. In addition, using this approach to overcome the problem is wasteful and only adds to the economic burden, so an optimized solution is needed to make efficient use of the available bandwidth necessary.

In addition, properly designed applications to manage each household need to prove that it can enable users to improve the efficient use of the Internet based on the way that technical network characteristics allow traffic classification, bandwidth allocation and bandwidth sharing. For some families, the bandwidth provided by UNIFI cannot meet the requirements of users and cannot get ideal use. In the age of the Internet, VoIP and video are becoming indispensable services. Rational use of broadband is beneficial to reduce the waste of broadband and improve the benefits of study and office (Joseph, n.d.).

B. Use broadband effectively

During MCO, most home users are under pressure to connect to the Internet. The popularity of the Internet has become an important asset for them, and strong connectivity has become a necessity. Internet availability is critical for any household during the pandemic to fully focus on the worldwide information society and improve the quality of education and office productivity. The Internet has also opened the door to a wealth of data to help students learn and teachers teach during the pandemic. Some households do not have substantial income to buy more bandwidth to meet demand and therefore do not have reliable Internet access.

The widespread use of elearning resources during MCO, as well as the use of pictures, videos and interactive content on websites, has increased the demand for bandwidth per household. Therefore, maximizing the utilization of bandwidth and developing efficient bandwidth management system are of great significance to determine the quality of service delivery. The final system should help families rationally use bandwidth, reduce unnecessary traffic and improve the performance of Internet access (Camilius Sanga, 2010).

C. Rational Use of Broadband

It is very important to establish an effective network resource management and user satisfaction experience. The quantity of data that can be sent in a given length of time, measured in bits per second or bytes per second, is known as bandwidth. Bandwidth management, also known as traffic shaping, means that important requests are satisfied first before low-demand applications or devices are satisfied. Network management is to maintain and ensure that all users use network resources according to their predefined configurations to prevent poor network performance caused by network congestion and reduce the output speed of devices on the network. Bandwidth management system is a network concept for efficient use and management of available bandwidth resources (Simon, 2005).

D. The Role of Bandwidth

Bandwidth management refers to the many approaches and technologies that a company utilises to maximise its bandwidth resources. Reduce unnecessary bandwidth usage while providing ideal service to customers. Connectivity of network infrastructure is critical for seamless access to the Internet. Bandwidth management is fundamental to delivering seamless data flows. Bandwidth is the amount of media that

carries information from a source to a destination. If the route for transmitting data is large, more packets can be sent to the client device. In addition, bandwidth determines the speed at which information is exchanged, usually for Intranet connections. The greater the bandwidth allocation, the faster the connection, and the faster the data can be uploaded and downloaded. Bandwidth is measured in bits/s, kilobits/second (KBPS), Megabits/second (Mbps) and gigabits/second (Gbps) (Shahriar Maswood et al., 2020). Reliable, usable Internet access is unavailable to most large access networks during peak hours. Enhancing the execution of data delivery is critical if the workplace has the necessary needs and benefits from Internet access.

To optimize the performance of any existing network, a monitoring and control mechanism called bandwidth management is essential and doing so is no longer a luxury. The demand for more bandwidth is on the rise. The number of network users increases due to the increasing use of bandwidth-consuming applications, and the overall bandwidth usage keeps increasing. Therefore, the need for effective bandwidth monitoring and utilization management becomes increasingly important to guarantee first-class service delivery and should always be a priority (AN EFFECTIVE BANDWIDTH MANAGEMENT BY COMPRESSION TECHNIQUE FOR PERFORMANCE ENHANCEMENT IN A SYSTEM, n.d.).

E. Improvement of Network Efficiency

With the development of network field and the rise of network technology, it is very difficult to deal with traditional network. Changing the traditional network structure is a sensible approach. To solve this problem, a software defined network technology is proposed, which improves the management of network resources and makes the network more compatible. Due to the limitation of network resources, load balancing is one of the focal points that must be measured under the condition of satisfying QoS. Load balancing is a kind of behavior that distributes data traffic among various resources to maximize network efficiency and reliability. Load balancing is based on the normal network, so it is not efficient(Kessler & Bachmann, 2022).

The SDN controller has a global view of the network and can provide an enhanced load balancing system. Load balancing is the process of splitting the workload across multiple resources to avoid any overloading of network resources. It is used to improve throughput, reduce response time, optimize traffic, and improve overall cluster performance. Load balancing can be applied to software and physical devices to distribute the overall load among multiple resources of the same type. Load balancing can be done statically, dynamically, or a combination of the two. In addition to minimizing response time and resource consumption, proper load balancing helps maximize scalability and throughput, thus avoiding any single resource overload, etc. (Neghabi et al., 2018).

II. SIMILAR SYSTEM

A. SolarWinds Bandwidth Analyzer Pack

Identifying the fundamental causes of network slowdowns requires monitoring network utilisation and traffic. The Bandwidth Analyzer Pack is a network traffic monitor that analyses network utilisation and bandwidth using SNMP monitoring technologies and traffic data. To discover, diagnose, and address network performance issues, you may monitor and analyse bandwidth performance and traffic patterns.

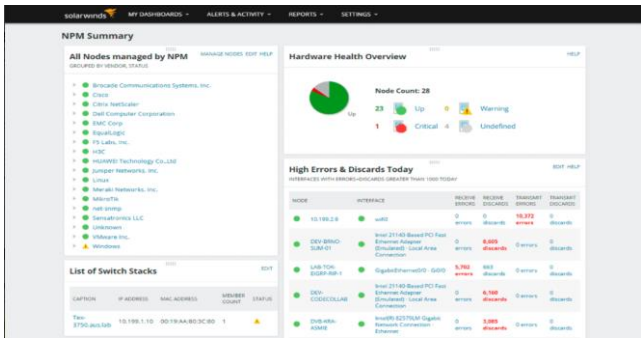

Fig. 1. SolarWinds Bandwidth Analyzer Pack

Easily understand network bandwidth usage with interactive charts and graphs. With the Bandwidth Analyzer Pack, you can use data from NetFlow, J-Flow, sFlow, NetStream, and IPFIX technologies built into most routers to identify the users, applications, and protocols that occupy the most Bandwidth.

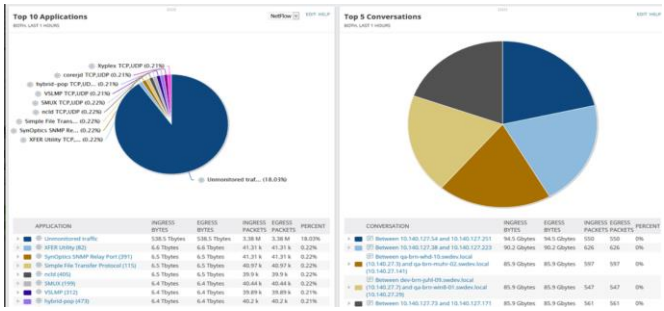

Fig. 2. SolarWinds Bandwidth Analyzer Pack

Leverage predefined QoS policies to ensure that VoIP or any other cloud-based critical applications get bandwidth priority. With the SolarWinds Bandwidth Analyzer Pack, you can measure the traffic level mapped to each class before and after the policy is applied to determine if your QoS policy is effective. Monitoring network usage helps prevent bandwidth problems.

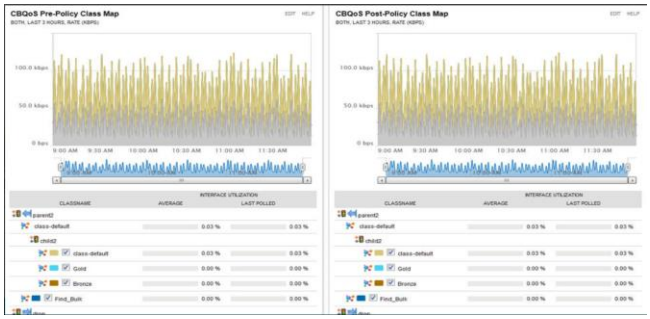

Fig. 3. SolarWinds Bandwidth Analyzer Pack

B. PRTG

PRTG is a unified monitoring solution that allows you to monitor practically any IP-enabled item. PRTG is made up of the PRTG core server, which handles things like setup, data administration, and web server, as well as one or more probes that gather data and monitor devices through sensors.

Fig. 4. PRTG

Fig. 5. SFlow Monitoring overview

"Sensors" are the basic monitoring pieces of PRTG. One sensor typically monitors one measurable value in your network, such as switch port traffic, server CPU load, or disc drive free space. On average, 5-10 sensors per device or one sensor per switch port are required. Custom alerts provide you SMS, email, or push notifications when there is a bandwidth issue. This guarantees that you can respond quickly to any bandwidth concerns and solve issues before they worsen.

TABLE I. SOLARWINDS BANDWIDTH ANALYZER PACK VS PRTG

	SolarWinds Bandwidth Analyzer Pack	PRTG
Network Scanning, Auto Discovery, Mapping & Visualization Maps	yes	yes
WMI ICMP SNMP	yes	yes
DB Functionality and Alerts	yes	yes
SLA Monitoring	yes	yes
Hardware Monitoring	yes	yes
Active Directory Alerts and Monitoring	yes	yes
Reports and Graphs of Historic Trends	yes	yes
Smart Device App: iOS, Android	yes	no

III. PROBLEM STATEMENT, AIMS AND OBJECTIVES

The existing Unifi network infrastructure has several issues, with peak Internet connection speeds being an issue and sometimes restrictions on pings and download upload rates. This will cause users to encounter some obstacles when accessing network resources or network videos as well as innocent frame hops, network congestion cannot be used. The page timed out or did not load (I never seen such an incompetency and negligence from a service provider., 2020). During MCO, everyone was at home, adults had to go to work, kids had to go to school online, and people were often frustrated with the Internet connection and instability(Content, 2020). As more and more unified members use the network, the network service must be improved to provide a good experience for customers (The Advantages of High Speed Internet, n.d.).

The main goal of the system is to provide a stable and fast Internet connection, and to effectively manage network bandwidth in a way that prioritises speed and experience. To provide users with fast and reliable Internet connections in order to achieve high-speed Internet connection systems on home user networks. The system to be developed should have the following capabilities.

- Develop effective bandwidth management systems to enhance existing network infrastructure.
- Automatically notifies Internet companies when problems don't improve
- Automatically assign network speed to the type of user browsing

IV. RESEARCH METHODOLOGY

A. *Respondents*

The respondents was conducted among students, teachers, and workers. They will be the main target of the survey because they need the Internet so frequently that it will help to share and come up with innovative ideas. Through the social platform proposed in this study, the reasons are investigated, and the problems are faced together.

B. *Sampling*

The sampling technique most suitable for this study is quota sampling. Quota sampling can get people's preferences. The best research results can be obtained through a large number of interviews and surveys.

C. *Questionnaire*

A certain amount of data can be collected through questionnaires. In the questionnaire, objective data can be collected through a series of questions and answers to strengthen the research. In addition, the questionnaire should not only be provided to a single group but should involve various groups to better put forward opinions. When the subject of the question does not understand, also carefully explain so that the questioner can better answer. Finally, the collected questionnaires are analyzed and the most important information is extracted.

V. PROPOSED SYSTEM OVERVIEW

Fig 6. shows the latest solution. This method is very simple to use and easy to learn for both adults and children. Users need to log in to use the function. Users can choose the most suitable network usage map to view network usage distribution and control network traffic. Automatically notifies the network company that there is a problem when everything is down.

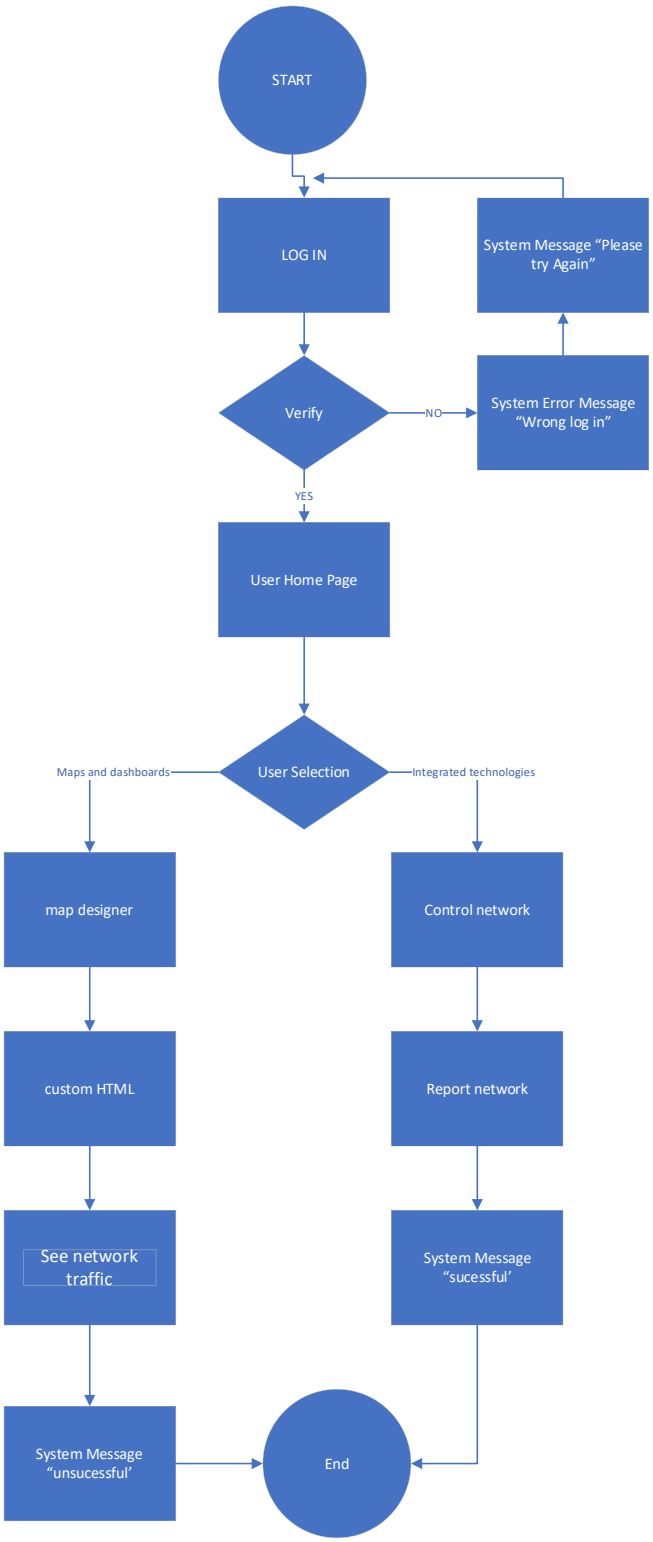

Fig. 6. Idea Sharing Process Flowchart

VI. CONCLUSION

In this research, the impact of the Internet on people can be said to be very serious. We must make our lives better and better through constant change and progress. The control of network flow rate is only a temporary solution and cannot effectively solve the impact of network speed lag. In the rapidly changing future, we hope to achieve greater success in the speed of the Internet so that every home and worker can access smooth and fast Internet.

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