Technoarete Transactions on Applications of
Information and communication Technology (ICT) in Education
Vol-2, Issue-2, April 2023

e-ISSN: 2583-1127

Evaluating the Virtual Local Network's Effectiveness at Enhancing the Performance of the Local Network

Hadya S. Hawedi [1], Turkia M. Belhassan [2], Elham A. Egfier [3], Abdulghader Abu Reemah A Abdulla [4*], Adamu Sa'ad Madaki [5]

[1] Faculty of Information Technology Alasmarya Islamic University, Libya
[2, 3] School of Applied Sciences and Engineering, IT Dep, Libyan Academy, Libya
[4] Faculty of Education, Computer Dep, Bani Waleed University, Libya
[4, 5] Faculty of Information Science and Technology University Kebangsaan Malaysia, Malaysia
*Corresponding Author Email: [4] abdulghaderabureemah@bwu.edu.ly

Abstract

Institutions use local networks for communication, information exchange, and service facilitation, but these networks often experience slow performance and instability due to various factors such as poor network design, increased traffic, and a lack of reliability, privacy, and security. To address these issues, the virtual local network (VLAN) is employed. The purpose of this research is to highlight the importance of VLANs. The performance of VLANs is evaluated by reviewing previous studies and highlighting its key features and services, such as security, scalability, and segmentation of the broadcast domain into multiple areas where each VLAN has its own broadcast domain. To improve the capacity and efficiency of the local network, it is recommended that network engineers and organizations adopt VLAN technology.

Keywords

Access, Broadcast, LAN, Trunk, VLAN.

INTRODUCTION

Networks are a collection of hardware and software components that are connected to each other through various transport methods in order to exchange data and share resources and information. Networks can be categorized based on their form, geographical location, and type. Local Area Networks (LANs) are a specific type of local network [1]. These networks used by businesses, universities, banks, and other organizations can have one user or thousands, which can cause bottlenecks and packet collisions due to data flow in a single broadcast field, resulting in data loss and network resource waste, and lowering the efficiency of data transmission. To maintain data and authenticate files, VLAN networks are required. Local networks lack a high level of security and privacy, and if they are physically divided, it would require more equipment and cables, which would increase the cost and alter the network's structure [2]. Due to these and other reasons, local networks are not commonly used by organizations. Many network engineers use virtual VLAN networks to increase the performance of local networks. In these networks, the local network is divided into several virtual or fictitious networks, and the number of virtual VLAN networks divides the broadcast area into smaller areas, each of which has its own broadcast area.

THE RESEARCH PROBLEM

The local network is commonly used by organizations to facilitate communication and internal processes. However, because the local network only has one broadcast field, this can lead to collisions, congestion, and increased network traffic. Additionally, due to the different departments within an institution, there is a lack of privacy, reliability, and security on the network. Despite having adequate bandwidth, the network may appear slow and unreliable due to issues with network design, a high number of connected devices, local network protocols (MAC protocol), and resource abuse from accessing websites and programs that consume a lot of bandwidth. Poor network design is a major challenge that modern enterprises face and it affects various services, which motivates responsible groups to focus on improving local network performance by evaluating the network's service quality [3].

RESEARCH OBJECTIVES

A. To clearly define the concept of a virtual local network.
B. To show the significance of a virtual local network in enhancing local network performance effectively.

RESEARCH METHODOLOGY

This research has employed both the content analysis method and the descriptive methodology in previous studies.

PREVIOUS STUDIES

The study of [4] found that the use of virtual local area networks (VLANs) can improve the performance of

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computer networks by providing more stability in terms of throughput, latency, jitter, and packet loss compared to traditional local area networks (LANs). Another study [5] aimed to improve the performance of business networks by modeling and correcting an existing local network using VLANs. Another study [6] found that VLANs can help to reduce network traffic load, expenses, and improve reliability. A study [7] found that VLANs can reduce the impact of denial of service (DoS) attacks. Study [8] found that the use of VLANs in wireless networks can decrease delays and increase productivity. Study [9] aimed to improve LAN performance by using IEEE 802.1Q VLAN switching techniques. Overall, all the studies indicate that VLANs can significantly enhance the performance of local networks in terms of stability, security, and network traffic load.

Virtual Local Area Network VLAN

Virtual Local Area Network (VLAN) is a type of sub-network that logically isolates different IP networks and subnets within the same switched network. This allows for multiple IP networks and subnets to exist on the same network, and enables network administrators to create separate groups of devices that operate independently of one another, but still share the same infrastructure. VLANs offer benefits such as security, scalability, and broadcast storm mitigation, as well as simplifying troubleshooting and maintaining network integrity [10]. Additionally, VLANs allow for the creation of specific access and security policies for different user groups within the network.

LAN & VLAN with Network Protocols and Design

VLANs are a way to divide a LAN into multiple broadcast domains, allowing for better organization and security of a network. VLANs can be connected through access links, which connect a single VLAN to end devices, or trunk links, which can carry traffic from multiple VLANs between network devices. Cisco's Packet Tracer is a tool that allows users to simulate and emulate network configurations, including those utilizing VLANs [11].

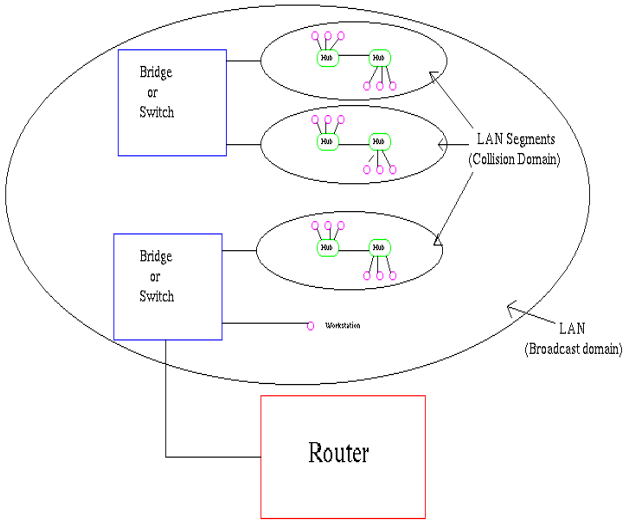

Figure 1. Physical view of a LAN.

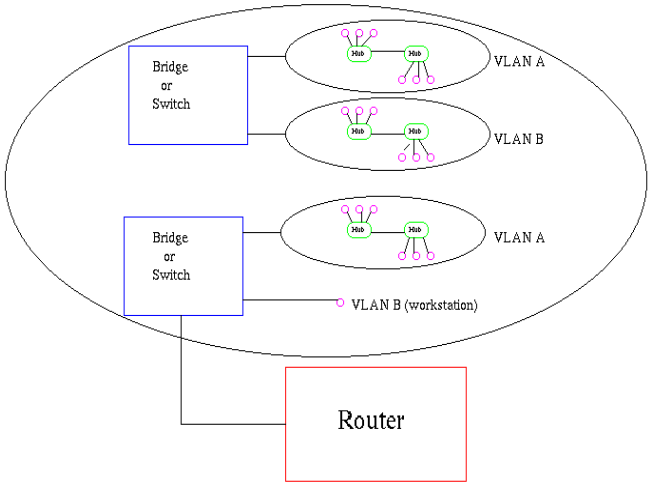

Figure 2. Physical view of a VLAN.

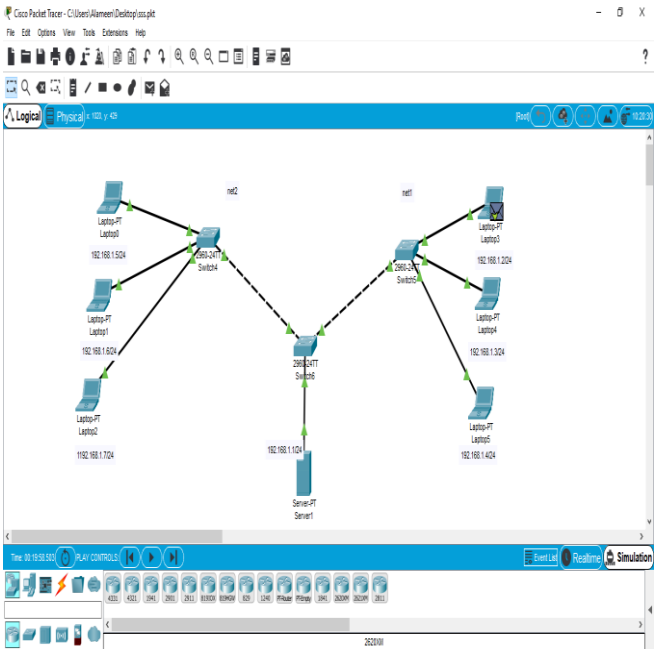

Figure 3. Lap3 sends massage into lap 4

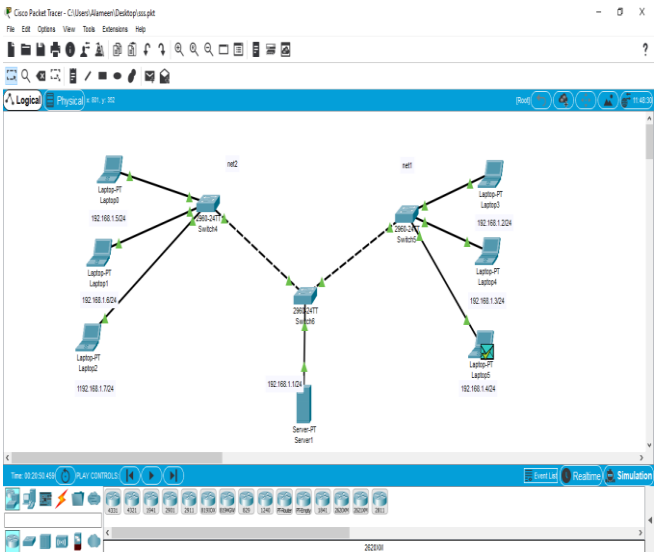

Figure 4. Lap1 send massage into lap 5

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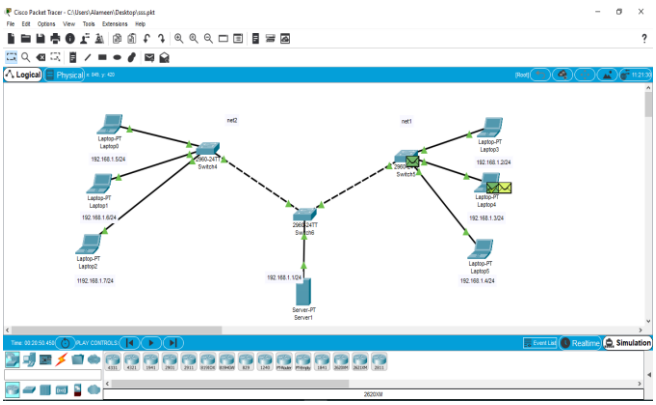

Figure 5. Lap0 send massage into lap 4

Also, VLANs are used as an alternative approach to limit broadcast traffic by breaking up a larger network into smaller, logical sub-networks. These sub-networks, or VLANs, limit the broadcast range and improve network performance by reducing the amount of unnecessary traffic. VLANs can be configured by allocating specific workstations or devices to different virtual local networks, creating separate broadcast zones. This can help to improve the overall performance and efficiency of a local area network (LAN).

It is also VLANs are used to improve network performance by reducing unnecessary broadcast traffic and providing better security by logically separating users and departments. VLANs enable administrators to control traffic between virtual local area networks and provide flexibility by removing physical restrictions of the network. They are commonly used to separate the user network from the server network and to prevent unauthorized access to crucial application servers, databases, and other private information. VLAN networks divide a large broadcast range into smaller broadcast areas, providing a more secure and efficient network structure compared to a flat local network.

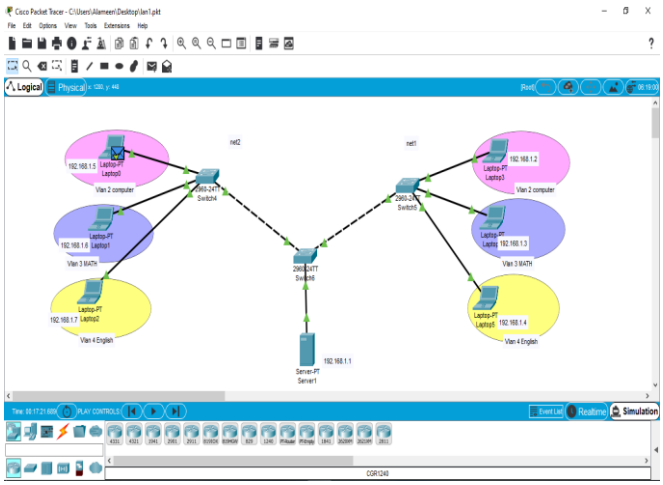

Figure 6. Three Vlans Networks send message inside Vlan 2

CONCLUSION

In conclusion, the use of virtual local area networks (VLANs) allows for the separation of a single local network into multiple sub-networks based on tasks rather than location. This allows for communication within a single network without the need for a router and offers protection and privacy by segregating a portion of the network from the rest. VLANs also provide flexibility and ease in managing the network by allowing for the addition and removal of various devices and reducing traffic flow and network congestion by having separate broadcast domains for each VLAN. Overall, VLANs can improve network performance by reducing the quantity of broadcasts and increasing privacy and security.

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