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Analysis and Simulation of VLAN Using Cisco Packet Tracer

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Abstract

The acronym for Virtual Local Area Network, or Virtual LAN, is VLAN. We build this unique network from one or more pre-existing LANs. In order to provide scalable, dependable, and secure services regardless of location, today's networks must always be accessible from anyplace. Reducing users and workgroups that are separated is the main objective of a network. Each system must have the ability to interact with other systems and transmit necessary data. In addition, physical systems and equipment must be able to provide sufficient security, dependability, and performance. It makes it possible to unite a collection of devices from several wired and wireless networks into a single logical network. A VLAN that can be managed similarly to a physical area network is the end result. To construct a VLAN, network hardware such as switches and routers has to support VLAN configurations.

Keywords: VLAN, cisco packet tracer, networking, wireless networks, Wi-Fi

INTRODUCTION

The requirement to use personal computers for information sharing within an organization—such as files and databases, messages, and other types of sharing—led to the development of computer networking. Whether the company occupies a single building or a sizable campus, networking the computers is essential.

Cannot be stressed enough. A Local Area Network (LAN) links computers within a certain geographic area, as its name suggests. It offers low-cost transmission media with high-bandwidth communication [14].

Corporate LANs are now highly visible and active core assets that businesses rely on to support daily operations that are essential to their performance in the marketplace, having grown from passive background business components. The network of today is a strategic tool that needs to be available from anywhere at all time, providing scalable, dependable, and secure services regardless of location [15]. Reducing isolated users and workgroups is a network's primary goal. Every system needs to be able to communicate with other systems and deliver the information that is needed. Physical systems and devices should also be able to sustain and offer adequate security, dependability, and performance. When a LAN acts as a gateway for the Internet or an intranet, resource sharing is presumably just as crucial [16]. Because of this, system managers require specialized equipment to assist them in designing and maintaining LANs [16]. The effects of a hardware upgrade, a topology change, an increase in traffic load, or the adoption of a new application on the network can be predicted with the use of a simulation program. Thus, Cisco Packet Tracer is used to construct a LAN network in this article. A multitasking network simulation program

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called Cisco Packet Tracer (CPT) can be used to carry out and analyze a range of network tasks, including implementing different topologies, choosing the best path based on different routing algorithms, setting up suitable servers, subnetting, and examining different network configuration and troubleshooting commands [16]. The process of designing a network and initiating communication between end user devices involves the selection of suitable networking devices, such as hubs, switches, and routers, as well as the physical connection of cables to fast Ethernet and serial ports from the packet tracer component list [4]. Since networking equipment is expensive, it is preferable to use a packet tracer first in order to grasp the idea and operation of the network [4]. As its name implies, a virtual LAN (VLAN) is basically a logical LAN. The main difference between physical LANs and VLANs is that, unlike physical LANs, hosts on different LAN segments can be logically grouped together using VLANs [1–4].

Every VLAN is handled as if it were a distinct subnet or broadcast domain. For this reason, we need to employ a router or a layer 3 switch in order to transfer packets between VLANs. Switches with VLANs set assign certain interfaces to one broadcast domain and others to another. We'll configure two VLANs on a switch for this lesson. The next step will be to set up a router so that the two VLANs can communicate with one another. The acronym for Virtual Local Area Network, or Virtual LAN, is VLAN. We build this unique network from one or more pre-existing LANs. It makes it possible to unite a collection of devices from several wired and wireless networks into a single logical network. A VLAN that can be managed similarly to a physical area network is the end result. To construct a VLAN, network hardware such as switches and routers has to support VLAN configurations. By following these instructions, you can construct LAN-B in a similar manner. Then, link LAN-A and LAN-B using a Cross-Over connection. This is how your end network will seem [5–8].

In today's complicated networking environments, virtual local area networks are essential. Solutions that enable networks to be segmented for increased security, scaled, and latency-free are needed by organizations. VLANs enable several LANs and related devices to communicate wirelessly over the internet, whereas LANs are used to connect a collection of devices, including computers and printers, to a server via cables. The five different kinds of virtual networks are described below [8–12].

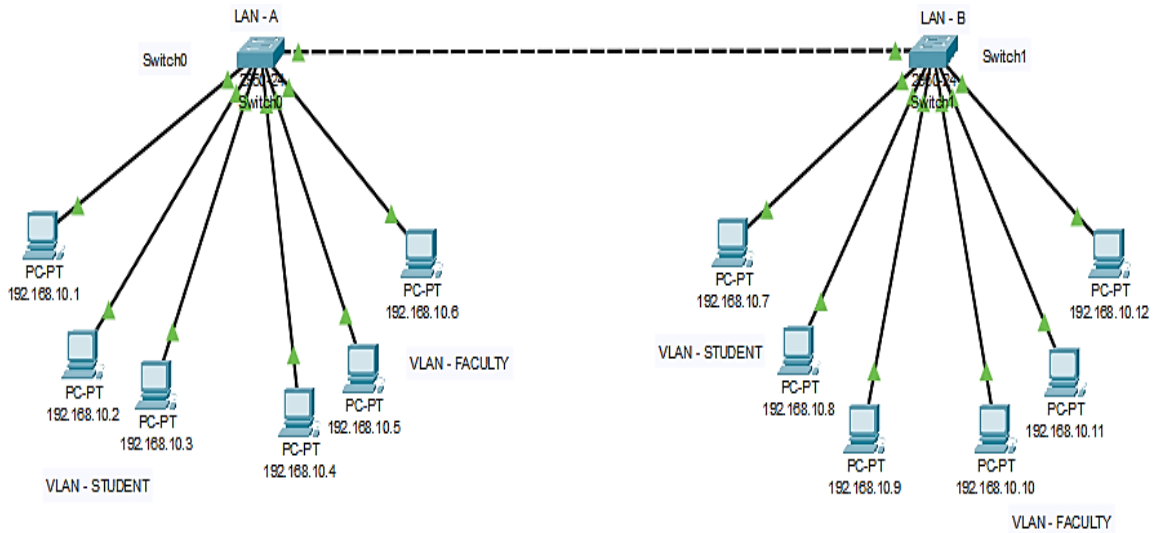

Figure 1. Vlan using cisco packet tracer.

We may verify that our VLAN configuration is complete by transferring data packets under LAN-A between two hosts. From 192.168.10.1 to 192.168.10.3, let's ping. 192.168.10.1 is the host that needs to be chosen, and then we need to choose Desktop → Command Prompt. Execute the subsequent command to reach 192.168.10.3. Vlan Using Cisco Packet Tracer is shown in Figure 1.

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Vlan Networking

What happens if two stations that are a part of two distinct physical LANs require a virtual connection? Every major LAN equipment vendor now offers Virtual LANs (VLANs) as a standard component of their switched LAN solutions (Pal and Pal, 2013). Through broadcast, traffic from one workstation on the LAN reaches other workstations. This is undesirable because it could allow unauthorized people to obtain certain classified information. Additionally, a poor broadcast may cause a network collision. Internal networks of colleges, businesses, and commercial networks are designed using virtual local area networks (VLANs). A data link layer technique called VLAN is used to create multipoint networks. Broadcast domains are the logical pieces that make up the LAN network. The platforms, functionalities, and groups of devices that are virtually connected but may or may not be physically connected form the basis of the workstation division. Network administrators and engineers can create a logical network from a physical network by using VLAN. Using this technology, a large, complex network can be divided into smaller networks for easier management, enhanced security, and better performance.

A virtual LAN serves as a useful layer of intercommunication between LANs and related devices. Switch ports, which assist in grouping many devices from different LANs, are crucial parts of this kind of network design. Device-to-device communication and data sharing become easier to control and more practical in this way [13, 14].

Cisco Packet Tracer

It offers a simulated environment with easy-to-understand descriptions and animations showing how different networking devices, including computers, routers, switches, wireless access points, links, and applications, operate together. Although there are various problems with the Virtual Trunking Protocol (VTP), little study has been done because of the complexity of VTP-based settings. In this work, we primarily address a number of security-related VLAN design issues [15–16].

In Cisco Packet Tracer, Create the Network Topology as Shown Below

Create 2 VLANs on the switch: VLAN 10 and VLAN 20. You can give them custom names. VLAN network topology is shown in Figure 2

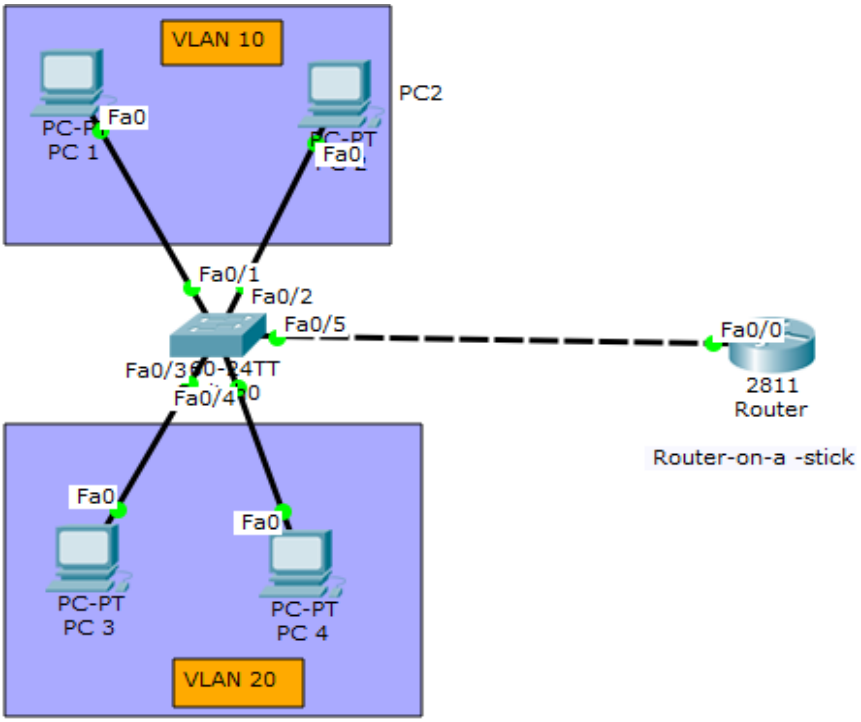

Figure 2. Vlan network topology.

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```
Switch#config terminal
Switch(config)#vlan 10
Switch(config-vlan)#name SALES
Switch(config-vlan)#vlan 20
Switch(config-vlan)#name IT
```

Assign switch ports to the VLANs

Recall that every VLAN is seen as a distinct broadcast domain.

Additionally, keep in mind that switch ports may be either access or trunk before configuring.

- A single VLAN is given one access port. These ports are set up as switch ports that link to regular network card-equipped devices, like a networked PC.
- One access port is allotted to a single VLAN. These ports are configured as switch ports that connect to standard devices with network cards, such as a networked PC.
- To connect to our PCs, we will set up switch interfaces fa 0/1 through fa 0/4 as access ports in our scenario. Here, VLAN 10 is allocated to interfaces fa 0/1 and fa 0/2, whereas VLAN 20 is assigned to interfaces fa 0/3 and fa 0/4.
- Since traffic will be transferred between the two VLANs via the router, switch interface fa0/5 will be set up as a trunk port.

Assign static IP addresses to the four PCs which are located in the separate VLANs. PC1 and PC2 fall in VLAN 10 while PC3 and PC4 fall in VLAN 20

PC1 IP address **192.168.1.10** Subnet mask **255.25**5.255.0 **Default gateway** 192.168.1.1
PC2: IP address **192.168.1.20** Subnet mask **255.25**5.255.0 **Default gateway** 192.168.1.1
PC3: IP address **192.168.2.10** Subnet mask **255.25**5.255.0 **Default gateway** 192.168.2.1
PC4: IP address **192.168.2.20** Subnet mask **255.2**55.255.0 **Default gateway** 192.168.2.1

And it is now abundantly evident that when allocating IP addresses, we handle a VLAN in the same manner as a physical LAN.

Let's try testing connectivity now, both within and between VLANs.

To test communication between hosts in the same VLAN:

Ping both PC1 and PC2 within VLAN 10. The ping test ought to be effective.

To check the connection of hosts in various VLANs:

Use PC1 in VLAN 10 to ping PC3 in VLAN 20. Ping will undoubtedly fall short here. Why? due to the lack of inter-VLAN routing supported. I hope you can see how we divided the hosts into two logical networks—which may be thought of as distinct broadcast domains—using VLANs.

We now need to take additional steps in order to enable communication between the hosts in the two VLANs. You can probably predict what happened. The router will be set up to allow inter-VLAN connection. Let's get on that immediately.

Configure inter-VLAN routing on the router

We'll set up the router to allow communication over a single physical interface between the two vlans. In what way is this made possible? The router's lone physical interface will be split up into logical interfaces, or sub interfaces. After that, each sub-interface will act as the VLAN's default gateway. This configuration, known as router on a stick (R.O.A.S.), enables communication between the VLANs via a single physical interface.

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Test inter-VLAN Connectivity

Here, we'll check the connectivity of PCs in various VLANs. Remember that inter-VLAN routing is enabled by the router.

Use PC1 in VLAN 10 to ping PC3 in VLAN 20. Ping ought to function flawlessly if everything is set up correctly.

Routing

We'll set up the router to allow communication over a single physical interface between the two vlans. In what way is this made possible? The router's lone physical interface will be split up into logical interfaces, or sub interfaces. After that, each sub-interface will act as the VLAN's default gateway. The single physical interface will be used to facilitate communication across the VLANs in this configuration, known as router on a stick (R.O.A.S.).

A routing protocol is a set of guidelines that outlines the data needed to choose a path between any two computer network nodes. We can refer to routing algorithms as the language a router speaks with other routers to exchange information about the reachability and status of the network. They are in charge of determining the optimal path for borderless communication. Bridging and routing are frequently contrasted.

CONCLUSION

Depiction of the network, VLANs cannot now be fulfilled because they operate on Layer 2 (switch) rather than Layer 3 (router). By keeping devices operating with sensitive data on a separate VLAN, this paper will be more beneficial to the company in terms of the proper implementation of VLAN and security. By implementing VLAN and gaining access to technologies like Access Control List (ACL) and Inter-VLAN, the Lab's network security was raised. To accommodate the demand for access to the VLAN Server, Inter-VLAN can connect various network segments or VLANs.

It is anticipated that the application of this new network topology will enable the optimization of applicable network resources. The need that at least one VLAN interface on the InterVLAN-capable switch be configured with an IP address is essential to the InterVLAN routing service.

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