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VLAN CONFIGURATION USING THREE LAYER SWITCHING

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ABSTRACT

VLANs are widely used in today's enterprise networks to improve Ethernet scalability and support network policies. However, we describe how six academic department use VLANs to achieve a variety of goals. We will follow the hierarchical internetworking model (3-tier architecture i.e; core layer, distribution layer and access layer) to simulate all faculties of University. Multilayer switch is used in core and distribution layer and in access; layer layer-2 switch is used. In distribution layer, four multilayer switches are used for implementing six faculties. Distribution Switch 1 and 2 is used as redundant of one another and Distribution Switch 3 and 4 is used as redundant of one another. We can implement VLAN of all faculties of University by configuring VTP in Distribution Layers switch as server mode and access layer switch as client mode and configuring vtp domain as ju1 and ju2. We argue that VLANs are ill suited to some of these goals (e.g., VLANs are often used to realize access control policies, but constrain the types of policies that can be expressed). Furthermore, the use of VLANs leads to significant complexity in the configuration of network devices. Virtual LAN is logical units that commonly share information. Common dedicated VLANs in a campus would include its science and business departments. For reasons of efficiency, broadcast domain boundaries should be created to align with these functional workgroups/.A scenario where we would be able to create an alignment would be where arts and biological department users might be commingled, sharing the same floor (and the same workgroup switch) in a building. VLANs allow switches to be quickly reconfigured so that logical network alignment can remain consistent with workgroup requirements)

KEYWORDS: ***VLAN,Layer,Switching,VTP,LAN,Newtworking***

I. INTRODUCTION

Most every Enterprise network today uses the concept of virtual LANs (VLAN). Before understanding VLANs, we must have a very specific understanding of the definition of a LAN [1]. Although we can think about and define the term "LAN" from many perspectives, one perspective in particular will help we understand VLANs: A LAN consists of all devices in the same broadcast domain. Without VLANs, a switch considers all interfaces on the switch to be in the same broadcast domain [1].

In other words, all connected devices are in the same LAN. (Cisco switches accomplish this by putting all interfaces in VLAN 1 by default.) With VLANs, a switch can put some interfaces into one broadcast domain and some into another based on some simple configuration. Essentially, the switch creates multiple broadcast domains by putting some interfaces into one VLAN and other interfaces into other VLANs. These individual broadcast domains created by the switch are called virtual LANs. Therefore, instead of all ports on a switch forming a single broadcast domain, the switch separates them into many, based on configuration. It is that simple. Consider the type of equipment that is already installed and whether an increase in speed on some segments is worth the cost of buying new equipment.

II. THREE LAYER SWITCHING

Core layer: This layer is considered the backbone of the network and includes the high-end switches and high-speed cables such as fiber cables. This layer of the network does not route traffic at the LAN. In addition, devices in this layer do no packet manipulation. Rather, this layer is concerned with speed and ensures reliable delivery of packets. The core layer is responsible for fast and reliable transportation of data across a network. The core layer is often known as the backbone or foundation network because all other layers rely upon it. Its purpose is to reduce the latency time in the delivery of packets [3].

Distribution layer: This layer includes LAN-based routers and layer 3 switches. This layer ensures that packets are properly routed between subnets and VLANs in our enterprise. The distribution layer is responsible for routing.

It is at this layer where we begin to exert control over network transmissions, including what comes in and what goes out of the network. We will also limit and create broadcast domains, create virtual LANs, if necessary, and conduct various management tasks, including obtaining route summaries. In a route summary, we consolidate traffic from many subnets into a core network connection

Access layer: This layer includes hubs and switches. This layer is also called the desktop layer because it focuses on connecting client nodes, such as workstations to the network. This layer ensures that packets are delivered to end user computers. The access layer contains devices that allow workgroups and users to use the services provided by the distribution and core layers. In the access layer, we have the ability to expand or contract collision domain using a repeater, hub, or standard switch. In regards to the access layer, a switch is not a high-powered device. A collision domain describes a portion of an Ethernet network at layer 1 of the OSI model where any communication sent by a node can be sensed by any other node on the network [3].

III. IMPLEMENTATION

In this project, we will follow the hierarchical internetworking model (3-tier architecture i.e.; core layer, distribution layer and access layer) to simulate all faculties of Jahangirnagar University. Multilayer switch is used in core and distribution layer and in access; layer layer-2 switch is used.

Cisco has defined a hierarchical model known as the hierarchical internetworking model. This model simplifies the task of building a reliable, scalable, and less expensive hierarchical internetwork because rather than focusing on packet construction. It focuses on the three functional areas, or layers, of our network:

We can implement VLAN of all faculties of Jahangirnagar University by configuring VTP in Distribution Layers switch as server mode and access layer switch as client mode and configuring vtp domain as ju1 and ju2. Basically, the VTP server distributes and synchronizes VLAN information to VTP-enabled switches throughout the switched network, which minimizes the problems caused by incorrect configurations and configuration inconsistencies and inter VLAN routing is implemented in Distribution Layer switch by configuring A Switched Virtual Interface (SVI) is a logical interface configured within a multi-layer switch compared to an external router to where a trunk is required. An SVI can be created for each VLAN that exists but only one SVI can be mapped to each VLAN. An SVI is virtual in that there is no physical port defined yet it can perform the same functions for the VLAN as a router interface and can be configured in much the same way as a router interface. The SVI for the VLAN provides Layer 3 processing for packets to or from all switch ports associated with that VLAN.

The advantages of using a SVI are that it is much faster than router on a stick as everything is hardware switched and there is no need for traffic to go out of the switch to come back in. There is no need for external links from the switch to the router, which cuts out the single point of failure when using a router on a stick method. As using a SVI is virtual, we cut down the possible faults that may occur on the router on a stick method, as there is no need for a physical link. SVI's can also be applied to Ether Channels so this gives an advantage of not becoming congested on the link and also if one link fails redundancy is still there for the SVI configured. Lastly as already explained, as the packets do not have to leave the switch to a router and back again as with the router on a stick method there is a lower latency. A disadvantage is that multi-Layer switching devices are much more expensive than a simple Layer 2 switch, which supports VLANS and a cheap router, which supports Layer 3. In distribution layer, four multilayer switches are used for implementing six faculties. Distribution Switch 1 and 2 is used as redundant of one another and Distribution Switch 3 and 4 is used as redundant of one another.

IV. CONFIGURATION

The figure shows the Catalyst 3750G-24PS switch, one of many Cisco switches that support Layer 3 routing. The icon that represents a Layer 3 switch is shown, but a brief description of the switch virtual interface (SVI) technology that allows a Layer 3 switch to route transmissions between VLANs is helpful [7].

Commands for Configuring Distribution Switch 1:

```
Switch (config) # vtp mode server
Switch (config) # vtp domain ju1
Switch (config) # vtp password cisco
Switch (config) # vlan 10
Switch (config) # name math_physical_sciences
Switch (config) # vlan 20
Switch (config) # name biological sciences
Switch (config) # vlan 30
Switch (config) # name social sciences
Switch (config) # exit
Switch (config) # interface range fastEthernet 0/1-4
Switch (config) # switchport trunk encapsulation dot1q
Switch (config) # switchport mode trunk
Switch (config) # switchport trunk native vlan 1
Switch (config) # exit
Switch (config) # ip routing
Switch (config) # interface fa0/5
Switch (config) # no switchport
Switch (config) # ip address 172.16.10.1 255.255.255.0
Switch (config) # no shut
Switch (config) # interface fa0/6
Switch (config) # no switchport
Switch (config) # ip address 172.16.11.1 255.255.255.0
Switch (config) # exit
Switch (config) # interface vlan 10
Switch (config) # ip address 192.168.10.1 255.255.255.0
Switch (config) # no shutdown
Switch (config) # exit
Switch (config) # interface vlan 20
Switch (config) # ip address 192.168.20.1 255.255.255.0
Switch (config) # no shutdown
Switch (config) # exit
Switch (config) # interface vlan 30
```

Switch (config) # ip address 192.168.30.1 255.255.255.0
Switch (config) # no shutdown
Switch (config) # exit
Commands for Configuring Distribution Switch 2:
Switch (config) # vtp mode server
Switch (config) # vtp domain ju1
Switch (config) # vtp password cisco
Switch (config) # interface range fastEthernet 0/1-4
Switch (config) # switchport trunk encapsulation dot1q
Switch (config) # switchport mode trunk
Switch (config) # switchport trunk native vlan 1
Switch (config) # exit
Switch (config) # ip routing
Switch (config) # interface fa0/5
Switch (config) # no switchport
Switch (config) # ip address 172.16.12.1 255.255.255.0
Switch (config) # no shut
Switch (config) # interface fa0/6
Switch (config) # no switchport
Switch (config) # ip address 172.16.13.1 255.255.255.0
Switch (config) # exit

Configuration Issues of Access Layer:
However, Access Layer switch is configured as VTP client mode and configuring vtp domain as ju1 in switch 1, switch 2 and switch 3 and ju2 for this reason all VLAN information is automatically passes from distribution switch to access switch. Finally assign the switch port to corresponding VLAN and assign different IP block to different VLAN.

Commands for Configuring Core Switch 1:
Switch (config) #int fa0/1
Switch (config) #no switchport
Switch (config) #ip add 172.16.10.2 255.255.255.0
Switch (config) #no shut
Switch (config) #exit
Switch (config) #int fa0/2
Switch (config) #no switchport
Switch (config) #ip add 172.16.10.2 255.255.255.0
Switch (config) #no shut
Switch (config) #exit
Switch (config) #int fa0/3
Switch (config) #no switchport
Switch (config) #ip add 172.16.30.1 255.255.255.0
Switch (config) #no shut
Switch (config) #exit

Switch (config) #router ospf 1
Switch (config) #network 172.16.0.0 255.255.0.0 area 0
Switch (config) #exit

Commands for Configuring Core Switch 2:
Switch (config) #int fa0/1
Switch (config) #no switchport
Switch (config) #ip add 172.16.12.2 255.255.255.0
Switch (config) #no shut
Switch (config) #exit
Switch (config) #int fa0/2
Switch (config) #no switchport
Switch (config) #ip add 172.16.13.2 255.255.255.0
Switch (config) #no shut
Switch (config) #exit
Switch (config) #int fa0/3
Switch (config) #no switchport
Switch (config) #ip add 172.16.31.1 255.255.255.0
Switch (config) # no shut
Switch (config) #exit
Commands for Routing:
Distribution Switch:
Switch (config) #router ospf 1
Switch (config) #network 172.16.0.0 255.255.0.0 area 0
Switch (config) #network 192.168.0.0 255.255.0.0 area 0
Switch (config) #exit
Core Switch:
Switch (config) #router ospf 1
Switch (config) #network 172.16.0.0 255.255.0.0 area 0
Switch (config) #exit
Router:
Router (config) #int fa0/0
Router (config) #ip add 172.16.30.2 255.255.255.0
Router (config) #no sh
Router (config) #int fa1/0
Router (config) #ip add 172.16.31.2 255.255.255.0
Router (config) #no sh
Router (config) #router ospf 1
Router (config) #network 172.16.0.0 255.255.0.0 area 0
Router (config) #network 200.200.200.0 255.255.255.0 area 0
Router (config) #exit

V. RESULT

Use the show VLAN brief command on Distribution Switch 1

```
VLAN Name                 Status        Ports
---- -------------------------------- --------- -------------------------------
1    default              active        Fa0/1, Fa0/2, Fa0/3,    Fa0/4
                                        Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                        Fa0/9, Fa0/10, Fa0/1    Fa0/12
                                        Fa0/13,Fa0/14,Fa0/15,Fa0/16
                                        Fa0/17,Fa0/18,Fa0/19,Fa0/20
                                        Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                        Gig0/1, Gig0/2
10 math physical sciences active
20 biological   sciences  active
30 social sciences        active
1002 fddi-default         active
1003 token-ring-default   active
1004 fddinet-default      active
1005 trnet-default        active
```

Use the show VLAN brief command on Distribution Switch 3

VLAN	Name	Status	Ports
1	default	active	Fa0/5, Fa0/6, Fa0/7,Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gig0/1, Gig0/2
40	business studies	active	
50	arts humanities	active	
60	law_dept	active	
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

Use the show show VTP status command on Distribution Switch 2

Switch 2# show vtp status
VTP Version : 2
Configuration Revision : 0
Maximum VLANs supported locally: 1005
Number of existing VLANs : 5
VTP Operating Mode : Server
VTP Domain Name :
VTP Pruning Mode : Disabled
VTP V2 Mode : Disabled
VTP Traps Generation : Disabled
MD5 digest : 0x7D 0x5A 0xA6 0x0E 0x9A 0x72 0xA0 0x3A
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
Local updater ID is 0.0.0.0 (no valid interface found)

VI. CONCLUSION

We have surveyed six campus networks to better understand and illustrate how VLANs are used in practice. Our analysis indicates that VLANs are used for many objectives that they were not originally intended for, and are often ill suited for the tasks further; the use of VLANs complicates network configuration management. We believe future enterprise networks should look at ways to minimize the use of VLANs and explore more direct ways to achieve the network administrators' objectives with the goal to make management easier for campus and enterprise administrators. To extend our understanding of the VLAN usage in practice, we call for operators of campus and enterprise networks to participate in the survey available at performance. Inspecting layer 3 addresses in packets is more time consuming than looking at MAC addresses in frames. For this reason, switches that use layer 3 information for VLAN definition are generally slower than those that use layer 2 information. It should be noted that this performance difference is true for most, but not all, vendor implementations.

The future of Virtual Local Area Network (VLAN) is wide open to companies from large 1000 plus employees to small businesses with 10 plus employees. The VLAN will help reduce traffic, increase security, and make it easier for the IT department to manage.

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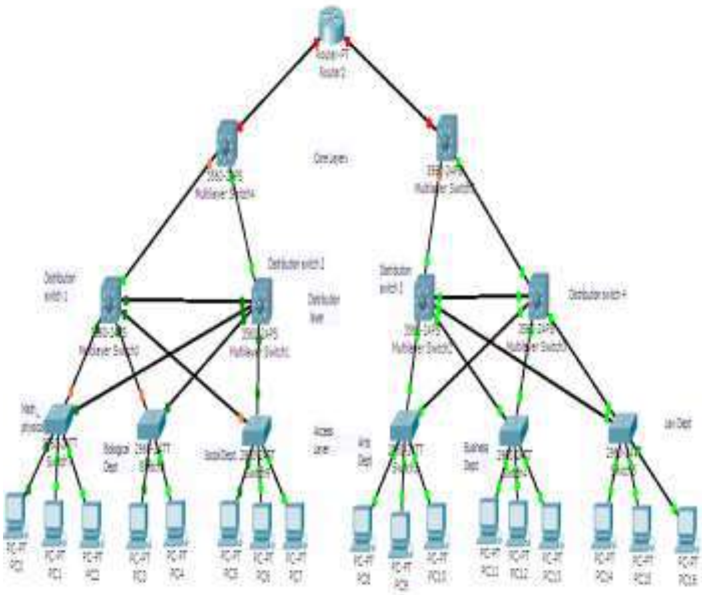

Fig.1. University Campus VLAN

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