Design and Implementation of a VLAN

MARIO ERNESTO GOMEZ-ROMERO, MARIO REYES-AYALA, EDGAR ALEJANDRO
ANDRADE-GONZÁLEZ, JOSE ALFREDO TIRADO-MENDEZ
[1]Electronics Department
Metropolitan Autonomous University
Av. San Pablo 180, Col. Reynosa Tamaulipas, Azcapotzalco, C. P. 02200, México, D. F.
MEXICO
[2]Communications Section
CINVESTAV-IPN
Av. IPN, Col. San Pedro Zacatenco, Gustavo A. Madero, C. P. México, D. F.
MEXICO
mra@correo.azc.uam.mx

Abstract: - In this paper a policy based VLAN design and implementation is shown. The main goal of this work was to increase the security level of the LAN, in order to reduce the access to undesirable sites and to avoid the presence of hackers in the net. Other important goal was the network optimization to avoid time wasting.

Key-Words: - LAN, VLAN, security, Internet, TCP, IP, switching, WGS.

1 Introduction

The Local Area Network (LAN) is widely used because a large number of applications imply some user in the same broadcast domain. There is kind of LAN named virtual LAN (VLAN), in this sort of network a group of hosts with a set of common requirements provides communication. It is important to emphasize that the group of hosts should be in the same broadcast domain, despite the same place [1], [2], [3].

The limited access to a network protects information and reduces the navigation in undesirable sites. The users normally want to waste time in web pages like news, sports, games, for example.

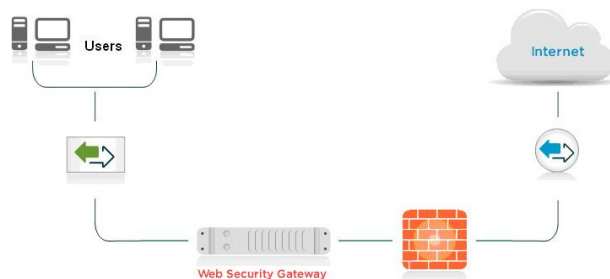The concept of Web Security Gateway (WGS) in a LAN is shown in the Figure 1.

Figure 1. WSG in a LAN

Other networks like Metropolitan Area Network (MAN) or Wide Area Network (WAN) are not compatible with virtual technologies, because the elements of the VLAN normally share routing and switching.

This paper has the following structure: the section two is dedicated to analyze the features of the designed and implemented VLAN, the section three describes the solution, the main results obtained are shown in the section four, and finally, the conclusions are in the section five.

2 VLAN

A VLAN is a set of LAN stations that are connected by software. As consequence, a VLAN does not require a physical link, besides these stations can be in different locations. It is clear that a VLAN has the same attributes than a physical LAN [4], [5], [6].

The users are not involved in VLAN, but many companies are interested in these technologies. For example, there are many ways to configure the network. The most important techniques to configure the VLAN are analyzed in detail in the following subsections [6].

2.1 Membership by Port Group

In this case, the VLAN has a set of physical ports with one or more routers. Each router may have a VLAN, but a VLAN usually has several switches. Some port-based VLAN cannot include a physical segment. The port based VLAN is illustrated in the Figure 2. In that Figure two VLAN are implemented:

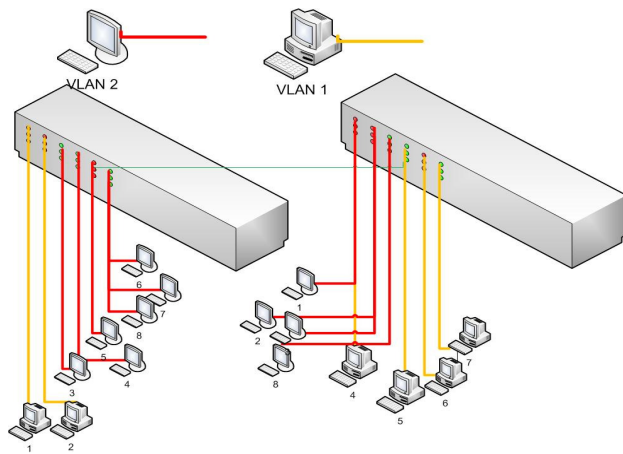red and yellow. Both networks have stations in different locations.

Figure 2. Port based VLAN

2.2 Membership by MAC Address

This kind of VLAN eliminates the Port based VLAN, because the end stations are grouped by Media Access Control (MAC) address. The location of the VLAN stations can vary, because the MAC addresses are in the Network Interface Card (NIC). In other words, the VLAN is user oriented.

There is a very important disadvantage in MAC address based VLAN, all the workstations should be initialized; after that they can be relocated.

2.3 Layer-3 based VLAN

In this variation, the VLAN uses the protocol in order to distinguish the workstations that it has. It is very important to emphasize that layer-3 based VLAN can use the switches to connect the users. Other feature is the compatibility with TCP/IP, instead of IPX, DECnet or AppleTalk, because these do not imply initial configuration.

2.4 Policy based VLAN

The Policy based VLAN is the most powerful, dynamic and flexible; because it can be reorganized in order to satisfy the needs of personnel or departments. The changes are based in a set of rules, the main parameters that these rules involve are the resources optimization and security.

3 Problem Solution

In Figure 3, initial physical architecture of the network to be designed and implemented is shown in the Figure 4. The security level was the most important feature in the design and implementation of the VLAN presented here.
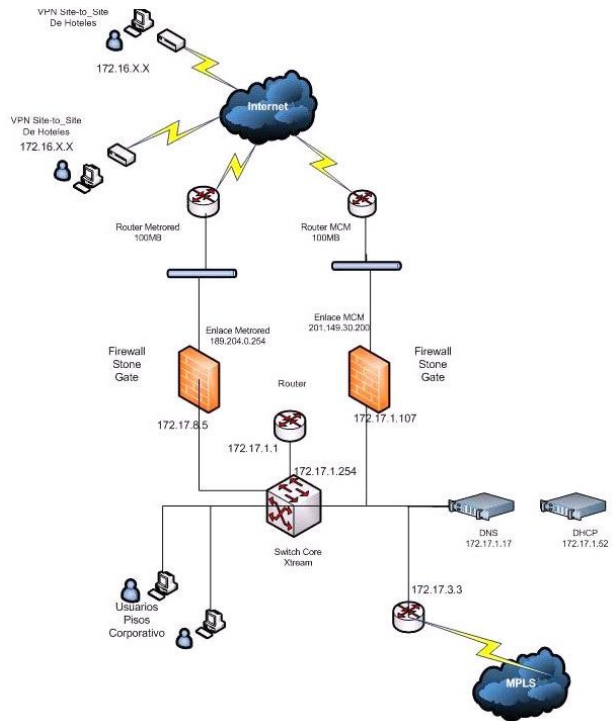

Figure 3. Initial Network

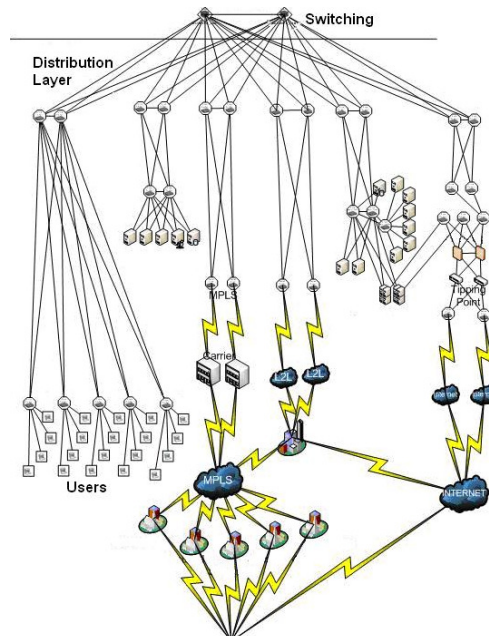After WSG implementation, the network has the distribution illustrated in the Figure 4.

Figure 4. WSG in a LAN

The figure 5 shows physical and logical implementation carried out, in that solution the network uses an explicit proxy.
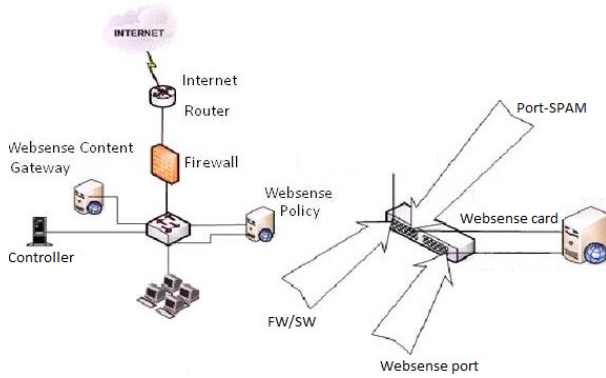
Figure 5. VLAN with explicit proxy

The most important features of the VLAN are: internet access only for company operation, real time user monitoring, limited navigation and privacy.

4 Results

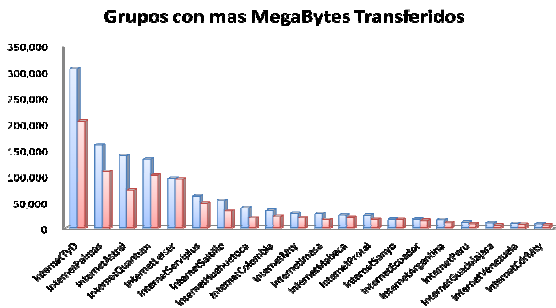In Figure 6 the transfer top is plotted, in this case twenty groups are shown.

Figure 6. Groups with more Mega-Bytes transferred

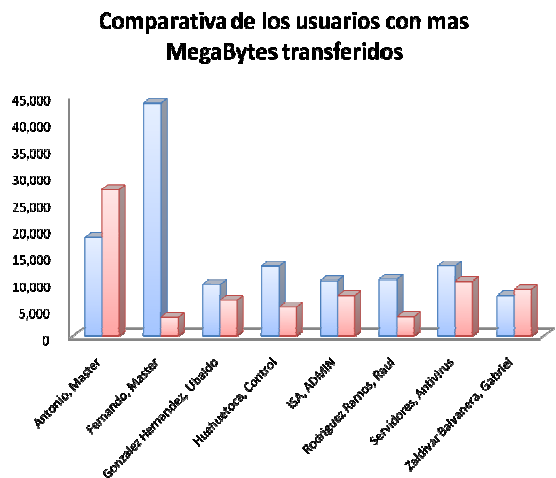In comparison with Figure 6, in Figure 7 the users with more Mega-Bytes transferred are illustrated.

Figure 7. Users with more Mega-Bytes transferred

Finally, the Figure 8 illustrates the sites visited with more information transferred in the network.
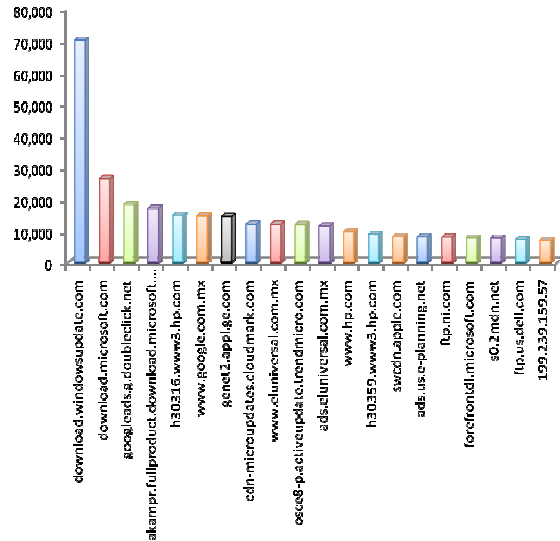

Figure 8. Sites with more Mega-Bytes trasferred

5 Conclusions

In this paper, the design and implementation of a policy based VLAN was carried out. The main goals were: to optimize the network resources, to give security and to provide a real-time users monitoring, in order to avoid time wasting.

The most important results were a lot of plots that indicate the user navigation and the information transferred by them.

As a result of this work, the solution implemented can be changed according to current organization requirements. This is especially useful, because the workstations can be easily relocated if necessary.

References:
[1] Andrew S. Tanenbaum, *Computer Networks*, Prentice Hall, Fourth Edition, 2002.
[2] William Stallings, *Data and Computer Communications*, Prentice Hall, Eight edition, 2006.
[3] A. Valenti, S. Pompei, F. Matera, G. Tosi Beleffi and D. Forin, "Quality of service control in Ethernet passive optical networks based on virtual private LAN service technique", *Electronics Letters*, Vol. 4, No. 19, 2009, pp. 992-993.

[4] Xiaoying Wang, Hai Zhao, Mo Guan, Chengguang Guo, Jiyong Wang, "Research and Implementation of VLAN based on service", *Proceedings of the Global Telecommunications Conference (GLOBECOM)*, December 2003, pp. 2932-2936.

[5] Minli Zhu, Mart Molle, "Design and Implementation of Application-based Secure VLAN", *Proceedings of the 29th Annual IEEE International Conference on Local Computer Networks (LCN'04)*, November 2004, pp. 407-408.

[6] Xin Sun, Yu-Wei Sung, Krothapalli, S.D., Rao, S.G., "A Systematic Approach for Evolving VLAN Designs", *Proceedings of the IEEE INFOCOM 2010*, March 2010, pp. 1-9.