



Chapter IV

Virtual Local Area Networks

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INTRODUCTION

Why Virtual LANs?

With the availability of so many high-density, wire-speed Layer 3 switches, why would a network administrator choose to implement Virtual LANs (VLANs) today? The first (and most obvious) answer is cost. Layer 3 switches cost more than Layer 2 switches, and usually have less density, making them a natural fit at the very core of the network, leaving Layer 2 switches to handle Distribution Layer aggregation of wiring closet switches or Data Center switching. Layer 2 switches are often much simpler to implement, and can be implemented with less technical difficulty than routing. VLANs have also recently been reborn in Metropolitan Area Networks (MANs) based upon Ethernet technology as a Virtual Private Networking (VPN) solution.

VLANs are now a required feature in any switched LAN solution. The increasing capacity and performance of switches has enabled users to dedicate switch ports to every user on the network, increasing the need for control over broadcast and multicasts throughout the network. To best understand VLANs, it is useful to study how networks evolved into needing VLANs.

The History of VLANs

In the early 1990s, bridges were replaced with shared media hubs and collapsed backbone routers in order to segment networks at Layer 3 and contain broadcast traffic. However, the broadcast demands of shared segments began to overpower the available bandwidth and decrease the effective throughput of networks. Each segment would usually contain between 20 and 150 users. In the hub environment,

this was the most effective network design, and the number of users that shared a segment determined throughput. This encouraged users to microsegment networks in order to achieve the maximum throughput on each segment.

Networking vendors then introduced Layer 2 switches, which allowed each port on a switch to receive the full bandwidth of the segment instead of sharing it with all of the ports. Now, networks could be divided into smaller segments, enabling increased bandwidth per segment without paying for expensive router ports. Unfortunately, the continued deployment of switches, dividing the network into more and more segments, did not reduce the need for broadcast containment. Routers still provided the necessary broadcast containment, but now broadcast domains capable of supporting 500 or more users were possible. Since the performance of most routers at this time was limited to a few tens of megabits, this meant that the router became the central bottleneck in networks.

It became necessary to design a technology that would reduce the need for routers in the network, and the concept of Virtual LANs (VLANs) was introduced. VLANs allowed switches to internally segment broadcast domains without the need for routers, increasing the performance of networks while reducing the cost of implementing high-speed networks. With VLANs, networks could be built with just a few routers to pass traffic between the network segments without sacrificing broadcast containment. With the implementation of VLAN switching, broadcast

Figure 1: Shared media networks

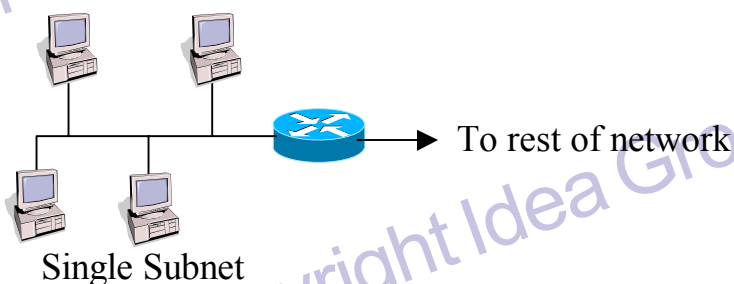
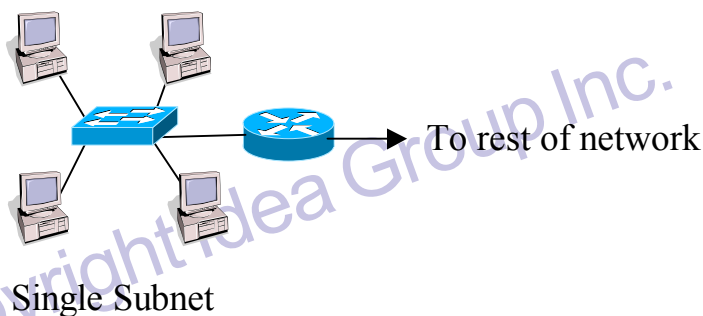


Figure 2: Layer 2, switched network designs



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