Video - VLSM Example (11 min)

In this scenario the task is to subnet the 172.16.0.0/23 network to create the following subnets: one network for 200 hosts, one network for 100 hosts, one network for 50 hosts, one network for 25 hosts, one network for 10 hosts, and 4 point-to-point networks for 2 hosts each. Before I begin to create these subnets I need to check to see if I even have enough addresses in this address space to create all of these subnets.

So, by writing out the network and the subnet mask in binary we see that we have a /23 subnet mask here's 23 ones in binary, the last bit is in the two's place if we look at this eight bit grouping in the third octet we see that the last one is in the two's place. That means the subnets would go up by two. So, the next subnet will be 172.16.2.0/23 so the address space that we're working with goes from 172.16.0.0 all the way up to 1.255.

Let's see if this is enough addresses to create all of these subnets for this specified amount of hosts. I can see that starting from a /23 subnet mask we have nine host bits. So, effectively there's 512 hosts. If we look at each one of these subnets that we're going to need to create I cannot create a 200 host subnet, but I can create a subnet for 256 hosts. That number does not reflect the usable hosts, but the total number of addresses in the subnet. Similarly, I'm unable to create exactly a 100 host subnet, but I can create a 128 host subnet. A 64 subnet, a 32 subnet, a 16 subnet, and four 4 host subnets will satisfy these requirements. If I add up all of these numbers, 256, 128, 64, 32, 16, and 4 subnets of 4 the total number is 512. So, I'll have exactly enough host addresses to create these sized subnets and meet the requirements.

Once again, these numbers here for the subnet sizes that we'll create do not reflect the usable host addresses, but the total number of addresses in the host portion of the subnet ranges including the network address and the broadcast address. So, let's get started subnetting this network using VLSM, Variable Length Subnet Masks, and working from largest subnets to smallest subnets in order to create all of the subnets required. So, working from largest to smallest the first thing I need to do is to create a network for 256 hosts to satisfy the 200 host requirement. What I can do is, is I can subdivide this single network of 512 hosts into two smaller subnets of 256 hosts each. So, instead of having a 172.16.0.0 network /23, I change the subnet mask to /24, this creates two networks, 0.0 and 1.0, each subnet having 256 or eight host bits. Notice how the subnet mask has changed from /23 to /24 and I now have two 256 host subnets. What I can now do is keep the first of these subnets and subdivide the second one. To do this I simply take this 172.16.1.0/24 subnet and change it from /24 to /25. So, now I have the 172.16.1.0/25 subnet this creates another subnet 172.16.1.128 both subnets have a magic number of 128, meaning the networks go up by 128. So, I've taken this one network of 256 hosts and subdivided it into two networks of 128 hosts each.

Now, I have a subnet to meet this second requirement. Moving on from there I'll keep the first of these subnets and then further subdivide the second one. So now, we no longer have the 1.0 network, in its place we have the 1.0 subnet and 1.128 subnet. Then, I subdivide the .128 subnet into two smaller subnets /26 each. So now, there's no longer a .128 subnet, there's two subnets in its place, a 128 subnet and a 192 subnet. Both of these subnets have a /26 subnet mask. If I was to write this subnet mask in the binary conversion table here we would see that in the fourth octet /26 means that the last one in the subnet mask is in the 64's place and the networks go up by 64. Furthermore, with a /26 subnet mask you only have one, two, three, four, five, six host bits and 2 to the 6th power is 64 meaning there's 64 hosts, 62 usable per subnet. I now have my 256 hosts subnet, I have my 128 hosts subnet, and my 64 host subnet. I can subdivide the second of these two subnets into two smaller subnets of 32 hosts each. To do this, I take the .192 subnet and subdivide it by changing the subnet mask from /26 to /27 creating two subnets of 32 hosts each. So now, I'm no longer using the .192 subnet /26 I'm using it as .192/27 subnet and a .224/27 subnet.

From here, I still need a subnet for 10 hosts, I can take the second of these two subnets for 32 hosts and subdivide them to two 16 host subnets. To do this we take the .224/27 subnet change the subnet mask from /27 to /28 and now I have two smaller subnets. From here, I take the second of these 16 host subnets, I only need one. The second one I'll use for four subnets of four hosts each. So now, instead of the .240/28 subnet I have the .240/30, the .244/30, the .248/30, and the .252/30 subnets. Looking at the subnets that've been left we have the 172.16.0.0/24 subnet, this is good for 256 hosts. We have the 172.16.1.0/25 subnet, this is good for 128 hosts. The 172.16.1.128 subnet /26 is good for 64 hosts. And, the .192/27 subnet is good for 32 hosts. The .224/28 is a 16 host subnet. And then, the last four subnets /30 each, .240, .244, .248, and .252 are good for four hosts each. Once again, these sizes do not reflect the usable hosts in each subnet, but the total number of addresses in the host portion. For usable host addresses you need to minus two from each subnet.

If we examine the host addresses closely we'll see that none of the subnets overlap. In other words, this 172.16.0 subnet goes from zero all the way up, since it's /24 to 255. You can see that the next subnet starts at 172.16.1.0 so the two subnets do not overlap. Similarly, this second subnet goes from zero to 127 and we can sees that from host zero to 127 the next subnet at 172.16.1.128/26 that there's no overlap. This subnet ends at 127, the next subnet begins at 128, and so on and so forth. In the end, we've created nine subnets of different sizes, a 256, a 128, a 64, a 32, a 16, and four 4 host subnets. This is VLSM and it allows us to create subnets or networks specific to the needs of the network.