# Transcript: Subnetting with Adrian Brown

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## [Opening music with voiceover]

WGU's IT audio series, flexible, portable, profound.

## Speaker #1 (Dave Huff):

Welcome, Dave Huff here from the College of IT and today, I've got Adrian Brown with us.

Adrian is one of the course instructors in our networking areas, so welcome Adrian. How are you doing today?

## Speaker #2 (Adrian Brown):

I'm doing great. Thanks, Dave.

## Speaker #1 (Dave Huff):

Good. Hey, what's a common thing that seems to trip up students in your networking courses? What's one of the common conversations that you find yourself having a lot?

## Speaker #2 (Adrian Brown):

Well, one of the common conversations we tend to have a lot with our students tend to center around subnetting, that tends to be one of those sticking points.

## Speaker #1 (Dave Huff):

Well, yes. Why don't you tell me a little bit about it? What's subnetting and what's your inside take on it?

## Speaker #2 (Adrian Brown):

Okay. Well, subnetting, it's simply the dividing up of a larger network into smaller parts. Typically, when we look at an actual network or an IP address, we're talking about 32-bits, because we're referring to mostly IPv4, which is 32 total bits. Using these bits, Dave, we can actually subdivide that larger network, like we would do a pizza and create smaller pieces or slices if you will, to give out to our participants.

## Speaker #1 (Dave Huff):

Okay, so how does that work?

## Speaker #2 (Adrian Brown):

Well, basically, we're going to, in the phrases is borrow, but I always like to say steal. We're basically going to steal or borrow host bits and add those bits to the network portion. Let me start by saying an IP address or a network address is consisting of both network bits and host bits, and when we add the two together, it will equate to 32. So we're going to be shifting some bits from the host portion over to the network portion to create these divisions we need.

## Speaker #1 (Dave Huff):

This matters because this is how the IP address is routed, right? The routers need to know what the network address is so that they know how to route traffic as it comes through networks.

## Speaker #2 (Adrian Brown):

Absolutely, as routers find the proper path for packets to go through, but packets have to have a source and destination IP address which identifies which networks are going to go between.

## Speaker #1 (Dave Huff):

Okay. Well, tell us how the bits work. How are the network and the host, how are they identified when subnetting?

## Speaker #2 (Adrian Brown):

Well, the bits are identified based on what we call the subnet mask. The subnet mask is a very important portion of the IP address because it's going identify that network bits and the host bits you have remaining. Once again, stealing host bits or borrowing will turn our network from one large network into smaller pieces.

## Speaker #1 (Dave Huff):

Okay. What's an example we can talk through?

## Speaker #2 (Adrian Brown):

Well, let's start with a subnet address of 172.16.0.0, which happens to be a Class B subnet or network as some people say. Now typically, a Class B will have 16 network of bits and 16 host bits but we're going to do something, we're going to borrow some of those bits. As a matter of fact, we're going to borrow six. Now, we're going to borrow six, turning that into a slash 22.

## Speaker #1 (Dave Huff):

Yeah, from a slash 16, got it. Okay, go ahead.

## Speaker #2 (Adrian Brown):

Yeah, and that's going to leave us with 10 host bits. Well, what this really does is by stealing six bits, we're going to end up with 64 subnets. We're going to go from one big network to 64 smaller networks, and typically students find that part easy, but here's where they find the difficulty trying to discern the actual subnet ID, as well as the broadcast, as well as the usable range.

## Speaker #1 (Dave Huff):

Please walk us through it.

## Speaker #2 (Adrian Brown):

Oh, sure, sure. Let me tell you about two pieces of information that we are going to get or gain from our subnet mask, that's going to make life so much easier here. When we decided to steal those six bits and that turned our network portion or identified our network portion as having now 22 bits or a slash 22. When we look at the mask, bear in mind, each subnet mask is comprised of four groups of eight bits. What's going to happen is we're going to turn on 22 of these bits. The first eight, which we will call the first octet, will be turned on, that's 255. The second group of eight will be turned on, that's 255. Then the third, we're going to turn on the first six. Now, when I say first six, I'm going from left to right. So what we're going to see is the bit that represents 128, the one that represents 64, the next one that represents 32, the one that represents 16, eight, and then four are all going to be turned on.

## Speaker #1 (Dave Huff):

When you turn on, you mean they'll have a one in there?

## Speaker #2 (Adrian Brown):

They're going to have a one, yes.

## Speaker #1 (Dave Huff):

Got it.

## Speaker #2 (Adrian Brown):

There going to be a one, and that means we're going to take those numbers, 128, 64, 32, 16, 8, and 4 and add them up, and that's going to give us 252. Now, we're not going to use the last two of that particular octet and none of the fourth octet. So our subnet mask can be represented as either a slash 22 or we could say 255.255.252.0.

## Speaker #1 (Dave Huff):

In binary, that would be eight ones in the first octet, eight ones in the second octet. Then the first six ones in the third octet with the zero, zero and then all zeros in the fourth.

## Speaker #2 (Adrian Brown):

That's correct, and it's interesting you say that because noticed in the third octet, it is the first six bits that we're going to turn into a one. Well, that's going to give us two useful pieces of information. We're going to call those pieces of information number one. We're going to call it the interesting octet because between the individual segments or subnets, that's the octet that's going to be changing. As we go from one subnet to the other, we're going to watch the third octet change. The next piece of information is going to be called the block size, and that is the increment by which that subnet is changing. As we noted, we said we're going to use the 128, the 64, 32, the 16, the eight, and the four. Notice the last one we mentioned was four, so the last bit that gets turned on has a decimal value by itself of four. That's going to be our block size. Our third octet, which is our interesting octet, is going to be changing by a degree of or increment of four from subnet to subnet.

For instance, our first network address was 172.16.0 in third octet dot zero. The next subnet will be 172.16.4 in the third octet, dot zero. The next one will be 172.16.8, and it will continue on to add four from each subnet in the third octet. So, the next one will be dot 12 in the third octet, and then we can keep going from there.

## Speaker #1 (Dave Huff):

It's like in decimal, if we're counting by hundreds, we don't really care about what's in the first two decimal places. It's just the third one for us that would increment, and every time that changes, we go up by a 100.

## Speaker #2 (Adrian Brown):

Absolutely. Our first two octets are going to stay the same 172.16, and it's the third octet that's going to be changing, that's why it's so interesting.

## Speaker #1 (Dave Huff):

What about the host addresses? How do we figure a host address or the range of host addresses once we know what the subnet mask or the subnet is?

## Speaker #2 (Adrian Brown):

Well, to figure out our range, we're going to figure out the broadcast first. Find the broadcast for a subnet simply means being able to identify the next subnet and subtracting one from that.

For instance, we had 172.16.0.0 but our next subnet was 172.16.4.0. We're going to subtract one bit from the fourth octet of that 172.16.4.0, and that's going give us the broadcast of the previous network 172.16.0.0. So, we're going to end up with a broadcast of 172.16.3.255, and that's the broadcast for the very first subnet we had.

## Speaker #1 (Dave Huff):

That's when the host address and just has all ones.

## Speaker #2 (Adrian Brown):

That's right.

## Speaker #1 (Dave Huff):

That's what's represented by the three in the third octet and the 255.

## Speaker #2 (Adrian Brown):

Absolutely.

## Speaker #1 (Dave Huff):

Perfect, I got it.

## Speaker #2 (Adrian Brown):

Absolutely.

## Speaker #1 (Dave Huff):

We can't assign that to a host because that's the broadcast address that goes across the whole network.

## Speaker #2 (Adrian Brown):

That's right. If you're going to send a message to everyone in the network, that's the address that will be used.

## Speaker #1 (Dave Huff):

Okay, and there's another address; it's restricted for the host. That's just when it's all zeros, the other end of the bookend?

## Speaker #2 (Adrian Brown):

That's the other end. That's called the subnet ID or a network ID. That's the 172.16.0.0 in our example.

## Speaker #1 (Dave Huff):

Okay. Well, I tell you that clears up a lot of things for me.

Adrian, thank you for walking me through that, for walking us through it. Appreciate your expertise and we'll be back, folks with another addition to our audio series soon.

## Speaker #2 (Adrian Brown):

Thanks, Dave.

## Speaker #1 (Dave Huff):

Yep, thanks.

## Speaker #3:

Now that we've finished discussing subnet, here's a bit of a challenge for you. Let's say you've been given the network address 172.16.100.0/24, and you've been told to subnet it further into each smaller subnets. Your goal will be to figure out your new mask and the broadcast address for the first of those eight subnets. Once you've figured out your solution, please submit it to your assigned CI, and let's see whether or not you've gotten it right.

Until next time, happy subnetting.

## [Closing music with voiceover]

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