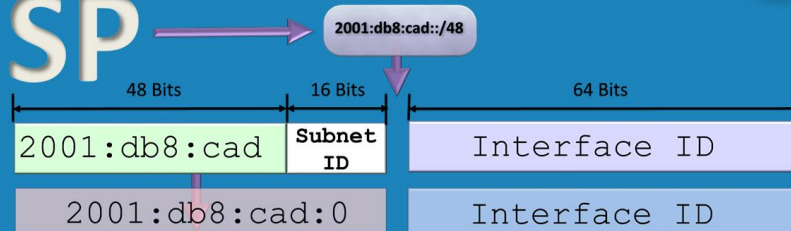


ITFreeTraining

ISP



IPv6 Subnetting

For the free video please see
<http://itfreetraining.com/ipv6/subnetting>

This video will look at how to subnet in IPv6. Due to IPv6 having a much larger address space, the process of subnetting is very different from subnetting in IPv4.

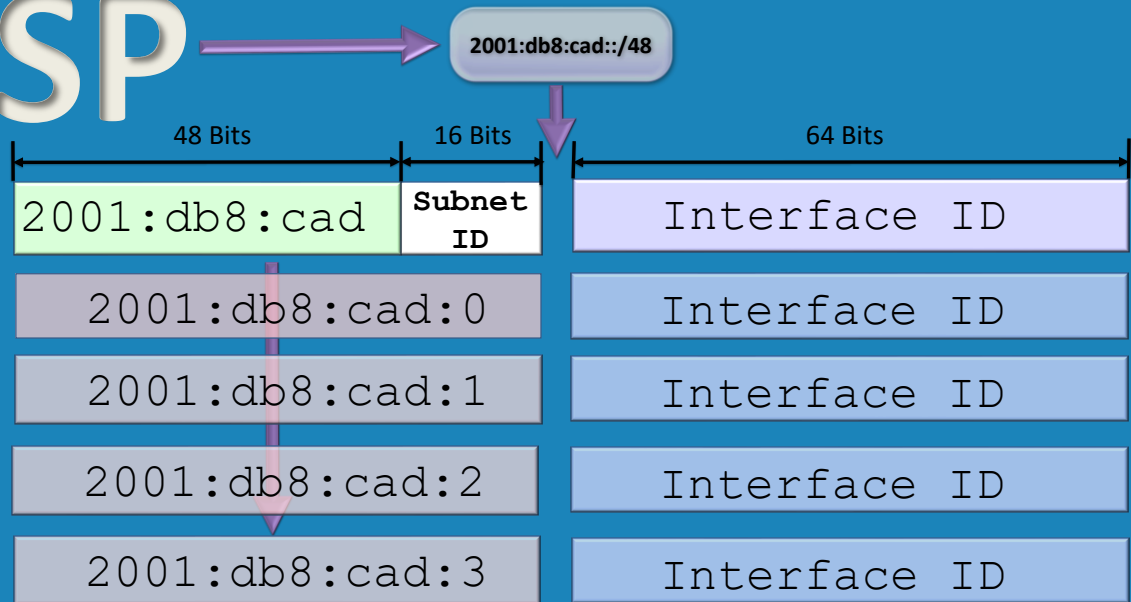
IPv6 Subnetting

- Dedicated 16 bits just for subnetting
- Subnet masks are no longer required

0:23 Given that IPv6 has a much larger address space than IPv4, 16 bits of an IP Address is dedicated to subnetting. In IPv4, a subnet mask had to be used to determine which parts of the IPv4 address would be used to define the network and which parts of the IP Address would be used to define a host on the network. Due to IPv6 having 16 bits dedicated for subnetting, the subnet mask is not required.

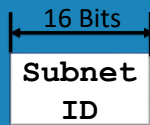
Simple IPv6 Subnetting Example

ISP



0:58 In this example, the administrator has been given an IPv6 address of `2001:d8b:cad::/48`. IPv6 uses a 128 bit address, so this means that the first 48 bits have already being allocated. The next 16 bits are used for the dedicated subnet ID and the last 64 bits are used for the interface ID. The interface ID is configured using DHCP or statically assigned by the node. Administrators are free to configure the subnet ID bits any way they choose. The simplest subnet ID is to have the subnet ID being all zeros. If you want to add another network, change the subnet ID to one. To add another network, change the subnet ID to two and so on. This is a very simple way to allocate subnets. In small networks, this is a good choice for the administrator, as it is not too complicated and is easy to set up.

IPv6 Subnetting Example



Country 4 bits



0???

⋮

f???

State 4 bits



?0??

⋮

?f??

Office 4 bits



???0?

⋮

??f?

Department 4 bits



???0

⋮

???f

2:16 In this example, the subnet ID has been broken into four giving four bits for each part. Working with addresses that are aligned to four bit boundaries makes it easy to work with. This is because the breakdown is aligned with the values in the address. For example, the first value will represent the country. This value ranges from zero to f. So looking at the first value in the subnet ID, this will tell you the country the address has been allocated to. For example, you could have any address starting with zero for America and one for England. The second value in the subnet ID in this example is allocated to state. If we take the American one as an example an address starting with 00 would be America and the first state; 01 would be American and the second state. If we were to look at an address starting with 1. This would mean the address is for England. The first county in England would start with zero, thus the subnet ID would start with 10. The second county would have a value of one meaning the address would be 11. Further bits are allocated to offices and departments. So taking an example subnet ID of 1432 would mean the country is England, the county is the fourth county, the office is the third office and the department in that office would be the second. Working with 4 or 8 bit boundaries makes it easy to work out which network the subnet ID is referring to.

Harder IPv6 Subnetting Example

- Given 2001:db8:cad::/48 from ISP

Country 5 bits



State 6 bits



Office 3 bits



Networks 2 bits



4:11 In this example, the 16 bits of the subnet ID will be divided up in the following way; 5 bits for the country, 6 bits for the states, 3 bits for offices and 2 bits for networks. When the subnet ID is not divided up based on 4 bit or 8 bit boundaries, the process is more complicated. In this example the online subnet calculator <http://gestioip.net> will be used.

Demonstration IPv6 Subnetting

- <http://gestioip.net>
- <http://subnetonline.com>

04:44 Demonstration of IPv6 Subnetting

1. Open Internet Explorer and go to: <http://gestioip.net>
2. Scroll down the page and select the link "subnet calculator online".
3. Select the option "IPv6" at the top of the page. By default IPv4 will be selected.
4. Enter in the IP Address that you wish to subnet. In this example, the address 2001:db8:cad:: will be used.
5. Select the prefix length as 48 from the pulldown box.
6. Press the 'calculate' button. In this case, the original address allocated by the ISP will be the only address shown. This is because none of the bits of the subnet ID have been allocated.
7. At the bottom of the screen will be the option to create additional networks using the subnet ID. In this example 32 subnets are required which would require 5 bits. 5 bits is not shown so press the 'more' button to show additional options. Once the additional options have been shown, select "32 networks /53"
8. Subnet-level I will be shown with a network prefix of 53, since 5 bits have been allocated for level I subnets.
9. Below subnet-level I is subnet-level II. To divide the subnet ID up further, select an option. In this case, 6 bits are required for the states, so the option "64 networks /59" will be chosen. This will allocate the bits that are required.
10. The option subnet-level III will appear. In this example, 3 bits are required for offices, so I will select the option "8 networks /62".
11. The last network is for networks which requires 2 bits. Under subnet-level IV

select the option “4 networks /64”.

12. All the 16 bits of the subnet ID have been allocated. To see the network, select the option “CREATE PLAN”.
13. The IPv6 calculator will then allow you to enter in a name for each network. For the first network, enter in “Country” and press the send option.
14. For the next level enter in “State” and press the send option.
15. For the next level enter in “Office” and press the send option.
16. The last option will ask the number of networks that you want to create for the last network. In this example, this will be 4 networks. Once 4 has been entered, press the send option.
17. The final screen will show the first network for each level of subnet except for the last network which will be broken down into individual subnets.

08:20 Demonstration of Subnetonline

1. Open the website <http://subnetonline.com>
2. Select the option “IPv6 Subnet Calculator” from under the “SUBNET CALCULATORS” menu.
3. In the address textbox, enter in “2001:db8:cad::” and from the pulldown select a prefix length of “/48”.
4. In the Subnets textbox, enter in 17 and press the button “Add Level”. This will add 17 subnets to the first level of subnets. In this example there are 5 bits allocated to the first level of subnets, and this would make a maximum number of 32 subnets or networks. This calculator will show all possible networks with the values given. If there are too many networks the process will fail. To ensure that this does not happen, the first level subnet value is kept as low as possible.
5. To add a second level of subnets, I will enter in the value of 33. Since 6 bits have been allocated to states the highest number of networks would be 64. To keep the number of networks expanded low to ensure it does not fail, the value 33 was chosen. This is the smallest value that will require 6 bits.
6. For the next level enter in 5. The office networks require 3 bits. The lowest value that will use 3 bits is 5.
7. For the last level enter in 4. The lowest number that could have been entered in here would have been 3 to require 2 bits, however, in this example 4 networks will not be enough to cause the subnet calculator to fail.
8. To view the network, press the button “Calculate Subnets”. If the process fails, you may need to reduce the number of subnets or networks that you entered in. Remember that, the process is exponential, so higher number of networks a level 1 which greatly increase the number of networks generated at level 1 but reduce the number of networks that can be created at lower levels. High numbers at low levels have less of an effect.
9. Once the networks have been generated, the original network will be shown with the prefix of 48. To expand the network, press the ‘plus’ value on the left of it.

This will show the next level of subnets. Pressing the 'plus' value on the left of this will show the next level of subnets and so forth. Looking closely at the different networks, you should notice that there is a certain value that is added to the last network to get the next network. The subnet calculator does the hard work of working out what this value will be. In a later video, I look at the maths involved in working out this subnet value.

See <http://YouTube.com/ITFreeTraining> or <http://itfreetraining.com> for our always free training videos. This is only one video from the many free courses available on YouTube.

References

"Installing and Configuring Windows Server 2012 R2 Exam Ref 70-410" pages 210-211

"IPv6 Subnet Calculator" <http://www.subnetonline.com/pages/subnet-calculators/ipv6-subnet-calculator.php>

"IPv4/IPv6 subnet calculator" http://www.gestioip.net/cgi-bin/subnet_calculator.cgi

Credits

Trainer: Austin Mason <http://ITFreeTraining.com>

Voice Talent: HP Lewis <http://hplewis.com>

Video Production: Kevin Luttman <http://www.KevinLuttman.com>

Quality Assurance: Brett Batson <http://www.pbb-proofreading.uk>