

Re: What's the benefit of using superscopes?

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 - *Date:* 31 May 2005 06:00:03 -0700
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What is Superscope?

A superscope is a collection of individual scopes that can be managed as a single administrative unit. That's what the book says, so it must make sense, right? Well if that doesn't make much sense to you, join the club. Let's see if we can shed some light on what superscopes are and what they can be used for.

A superscope is actually a collection of individual scopes. When you group different scopes together into a single superscope, you can do the following:

Place DHCP clients from multiple network IDs on the same physical segment

Allow remote DHCP clients from multiple network IDs to obtain an address from a DHCP Server

Place multiple DHCP Servers on the same physical segment, with each DHCP Server being responsible for a different scope.

The superscope will allow the DHCP Server to answer requests from DHCP clients from different network IDs. Now, you might ask, can't you just create multiple scopes on a DHCP Server and then everything will be cool? Let's see what happens.

Multiple Scopes on a Single DHCP Server

Imagine that you have configured a DHCP Server with two scopes serving the entire address range for the following network IDs:

192.168.1.0/24
192.168.2.0/24

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The DHCP Server has a single network interface, and its IP address is 192.168.1.5. You want the DHCP Server to answer requests from clients on its locally attached network 192.168.1.0/24, and from the remote network, 192.168.2.0/24. The remote DHCPRequest messages are forwarded through BOOTP Relay. What will happen when a request from a client on the 192.168.2.0/24 makes a request to this DHCP Server?

The request is forwarded through the BOOTP Relay to the DHCP Server. The DHCP Server checks the giaddr field in the DHCPRequest or Discover message to see what network ID the request is coming from. The DHCP Server compares this information with the network ID assigned to its local interface. If the network ID in the request and the network ID of the DHCP Server's interface is the same, the DHCP Server will check to see if it has a scope that can service the request. If it does have a scope, it continues the DHCP negotiation.

However, if the request from a network ID that is different from that of the DHCP Server, the DHCP Server will see if it has a superscope that includes an address pool that can service that network ID. If it does not have such a superscope, then it will send a NACK packet, and the DHCP client must start all over again.

How about adding multiple IP addresses to the DHCP Server's Interface? In this way, the DHCP Server would be able to compare the source network ID with the addresses on its interface, and see that the source was on the same network ID as the DHCP Server. Now it wouldn't need to look for a superscope.

This will not work! It will not work because when you bind multiple IP address to a single adapter on the DHCP Server, the DHCP Server service will only use the primary IP address to make its assessments. It will not use any of the secondary IP addresses bound to the adapter.

A solution to this problem could be to include a second NIC on the DHCP Server and assign it a primary address on the 192.168.2.0/24 network ID. However, using a superscope is a lot easier and a lot cheaper than adding new hardware.

What About Multinets?

A multinet is a single physical network segment that supports multiple network IDs. A Windows 2000 DHCP Server can be used to support multinet configurations. When would you want to configure a multinet? Perhaps when you've used up all the IP addresses in the scope that you've already configured on the physical segment,

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and you want to add more hosts to that segment. In this case, a multinet is your solution.

A multinet presents the same problems, and the same solutions as our example above. You can either add multiple network interface cards to the DHCP Server or assign an IP address on each card dedicated to the required network IDs, or you can create a superscope.

Multiple DHCP Servers on a Single Physical Segment

Perhaps you considered the possibility of placing multiple DHCP Servers on the same physical segment to solve the problem of issuing IP address for multiple network IDs. Let's take a look at what might happen here.

We have two DHCP Servers, DHCP-1 and DHCP-2. The DHCP Servers contain scopes that include all addresses for the following network IDs:

DHCP-1 192.168.1.0/24
DCHP-2 192.168.2.0/24

Now imagine that a DHCP client with IP address 192.168.1.10 needs to renew its IP address. When the client sends out its DHCPRequest message to renew its address, that request is broadcast to the entire segment. Therefore, either DHCP Server can receive the message. If DHCP-2 receives the message, it will check the network ID on the request and compare that with the network ID on its local interface and find that the source network ID is different from its own network ID. Since these are different, DHCP-2 will look for a member scope in a superscope that can service this request. Since there is no superscope to service the request, DCHP-2 will send a NACK to the client.

After receiving the NACK, the DHCP client then has to begin the discovery process from the beginning and send out a DHCPDiscovery packet. Let's say that DHCP-2 is the first to respond to the DHCPDiscover packet, and assigns the clients the IP address of 192.168.2.15. Hey look at that! The client is now a located on a different network ID. And what's really rich is that the whole thing could start all over again, and the DHCP client could end up on network ID 192.168.1.0/24 again.

The Solution

The solution is to configure superscopes on both DHCP Servers, and then exclude all the addresses on one of the scopes. For example:

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DHCP-1

Superscope

192.168.1.1-192.168.1.254

192.168.2.1-192.168.2.254

Exclude:

192.168.2.1-192.168.2.254

DHCP-2

Superscope

192.168.1.1-192.168.1.254

192.168.2.1-192.168.2.254

Exclude:

192.168.1.1-192.168.1.254

With this configuration, what happens to the DHCP client that tries to renew its IP address, 192.168.1.10?

If DHCP-2 receives the DHCPRequest message, rather than sending a NACK, it will just ignore the message, because it does have a scope for the client's network ID, but just doesn't have any addresses available because they've all been excluded. The client will try again, and perhaps again, and sooner or later will contact DHCP-1 and renew its IP address. The key here is that when you configure the scope for network ID 192.168.1.0/24 and then exclude all the addresses in the scope and make it part of the superscope, DHCP-2 will ignore requests from clients from that network ID.

Conclusion

If you didn't know about the utility of superscopes, you do now. You now know that putting multiple scopes on a single DHCP Server and letting 'er rip won't do the job, and so you have to consider the network IDs of the clients that need to access the DHCP Server, and the IP addresses and network interfaces on the DHCP Server.

Superscopes allow you to not add extra network interfaces to your DHCP and still be able to service DHCP clients from multiple network IDs. They also allow you to place multiple DHCP Servers on a single physical segment and prevent clients from obtaining IP addresses on a different network ID as well as reducing the number of NACKS send by the DHCP Server. This will help reduce the number of NACK entries in your Event Log as well.

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- **References:**

- ◆ ***What's the benefit of using superscopes?***

- ◆ *From:* Tim . Richardson1

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