

Deploying IPv6 on a Cisco IOS router with a Tunnel Broker

The time has finally come! Just a few days ago, major internet companies participated in IPv6 Launch Day – meaning from this point forward, they will be running their production systems and making their services available to you via the IPv6 in addition to IPv4. Amongst this good news, however there is a good chance that you may be with an Internet Service Provider (ISP) that has not yet provided IPv6 connectivity to your location. I wanted to introduce you to a way that you can connect a small network to the IPv6 internet by way of a Tunnel Broker – **for free**.

Moving forward, the only requirements needed for this type of connection are a consistent WAN/internet connection (cable modem, optical, T1 or similar), a static public IP address (or at least one that does not change very often) and a compatible router or host. For the purposes of this article, I am going to walk through the process of utilizing a Cisco router as our tunnel endpoint. Even if you do not have a Cisco router to use for this purpose, much of the information contained in the article is still relevant to the process – so don't stop reading yet. Most routers and computer operating systems can be used for setting up this type of IPv6 tunnel; be sure to check out the information on your tunnel broker provider's website for information on connecting other types of equipment. On that note, while there are a number of tunnel broker services you can choose from, in this article I am going to configure [Hurricane Electric's tunnelbroker.net](#). In order to keep this article of reasonable length, I am going to assume your Cisco router is already setup and usable for internet access. Finally, in order for your Cisco device to support this IPv6 tunnel configuration, your router must support IPv6 Static Routing. You can check the compatibility of your router's software on Cisco's [site](#).

Let's get started. First head over to <http://tunnelbroker.net> and register for an account. After you have created your account and logged in to the site, you will need to setup a tunnel by clicking on "Create Regular Tunnel" on the left side menu. In order to establish the tunnel you will have to provide Hurricane Electric the public IPv4 address of your router. This is known as your IPv4 endpoint and you will provide it to Hurricane Electric at the top of the form. In the next section, they will present a suggestion to you as to which of their tunnel servers should be the other endpoint - the other side of your tunnel. Normally their suggestion is best, however be sure they have managed to select the closest server to you based on your geographic location. Next click "Create Tunnel" at the bottom of the page. Hurricane Electric will attempt to ping your IPv4 address at this point to verify you have provided a functional address. If you are disallowing ICMP (tsk, tsk), you will need to allow IPv4 ICMP from their server - a pop-up window will appear with the address you need to allow.

After the tunnel has been created, you can return to your accounts Main Page. Near the bottom of the main content on your page, you will see the tunnel you configured; click on the one you just created to see more detailed configuration information. On this first page, take care to notice near the top in the first section there is a line marked "Client IPv4 Address." If your public IP address ever changes, come back to this page and update your tunnel with your new public IP address. This will allow you to update your tunnel endpoint to your new address without having to reconfigure the tunnel completely. After you have familiarized yourself with this information, click the middle tab for "Example Configurations." In the pull down menu, choose Cisco IOS. This will present you a generated list of commands you can paste into your Cisco router to connect it to the Hurricane Electric Tunnel Broker service. More than likely, this will work as is; however, you should verify that the tunnel interface they provide you (Tunnel0) is not already in

use on your equipment. If it is, change the two tunnel interface references to an available number, ex. Tunnel1 or Tunnel2. Copy and paste this configuration to your Cisco router in enable mode. If all goes well, you should see your tunnel become active. You can also see the status of your tunnel by issuing the following command:

```
show int tunnel0
```

Now that we have connected the WAN side of your router to Hurricane Electric, you will next need to provide your IPv6 network configuration to your private or LAN interface. You will need to set this up on whichever interface that is connected to your private network. In this article, I am going to assume that to be the VLAN 1 virtual interface. If you go back to your Main Page on tunnelbroker.net and click on your configured tunnel again, you will see a "Routed IPv6 Prefixes" section toward the bottom of the "Tunnel Details" section. We are looking for the "Routed /64:" address space. What you see listed in this section is your IPv6 network address for your "private" network. Remember, in IPv6, all globally usable IP addresses are public – even for machines on your "private" network. This is YOUR address space in the public IPv6 world – at least by way of this tunnel. You will need to reference this network number on your router. For my example, I am going to assume that my network number is: 2001:FACE:11:16c::/64. On my router, I need to configure my interface for VLAN 1 by issuing the following commands:

```
conf t
int vlan 1
ipv6 address 2001:FACE:11:16c::1/64
exit
ipv6 unicast-routing
exit
```

What I have done in the previous set of commands has been to define the static IPv6 address for VLAN 1 with the network number that Hurricane Electric provided and making the host address 1, noted by the 1 following the two colons. This address can be represented in the following formats:

```
2001:FACE:0011:016c:0000:0000:0000:0001
2001:FACE:11:16c::1
```

In the shortened form, and unbroken set of 0's can be represented by "::" and leading 0's in each set of 4 HEX numbers can be omitted. The series of commands above also enables IPv6 routing on the Cisco device. This is the only configuration you should need to supply to begin to explore the IPv6 internet on your private network. You do not need to configure DHCP for IPv6 on your private network (though you can do that), the router, by default, will send out information known as "Router Advertisements" to your private network that includes the network number/prefix. Clients on your network with their IPv6 protocol enabled will then generate their own IPv6 address by appending a host ID to the provided network address.

The configuration provided by the previous steps is all that is needed to provide basic connectivity to the IPv6 internet. However, it does not provide for a barrier (such as a firewall) between your (now public) clients and the "public" internet. That is outside of the scope of this article, but this can be rather easily accomplished by creating an inbound and outbound IPv6 access-control list and applying it to the newly created tunnel interface on the router. When you do go about



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protecting your IPv6 networks, ICMPv6 (at least certain parts of it) is expected to work end-to-end; be sure to allow that though your inbound ACL.

To test your connection on a client, first verify your computer has obtained a valid IPv6 address. In order to determine that, look at the IP addresses your computer has and verify you have an IPv6 address that begins with the network number that you setup on your router (and was provided by tunnelbroker.net). Next, test your IPv6 connectivity by trying to ping Google. On a Windows machine open a command prompt window and try to ping Google:

```
C:\Users\Rusty>ping -6 www.google.com
Pinging www.l.google.com [2001:4860:4001:801::1014] with 32 bytes of data:
Reply from 2001:4860:4001:801::1014: time=24ms
```

Or on Linux:

```
mars:~$ ping6 -n www.google.com
PING www.google.com(2001:4860:4001:802::1011) 56 data bytes
64 bytes from 2001:4860:4001:802::1011: icmp_seq=1 ttl=57 time=21.6 ms
```

Next, open a web browser and visit <http://test-ipv6.com/>. Be aware on most every client that has both an IPv6 and IPv4 address (dual stacked), your computer will prefer the IPv6 connection.

Beyond what we have setup here, there are certainly much more advanced configurations you can begin to add onto your IPv6 connection – both in terms of security and what is provided to your private clients by manipulating the Router Advertisement or setting up a DHCPv6 server. In the meantime, this configuration will get you up and running, ready to explore the IPv6 internet – which, if all goes to plan, will look, act and feel just like the internet you are already familiar – just with longer IP addresses. If your organization has questions about IPv6 and how to go about getting online with this exciting advancement in Internet connectivity, we welcome the opportunity to work with you as we make this transition together.