IPv6 Device Configuration

John Barlow

Mostly aimed at turning a device into an IPv6 router.

Using the Tunnel Broker

- Go to http://broker.aarnet.net.au/ to register. That page has a link to the Freenet6 site …
- Download and install the client software from the Freenet6 web site.
  - Software is available for a number of platforms, including Windows and Linux. The source code is also available for Unix.
- Set up reverse DNS (not essential).
- Configure the client software.
- Configure routing on your computer (not essential).
- Run the client software (rerun at intervals).

How do I use *6to4* ?

- See http://www.6bone.net/6bone_6to4.html
- {Free,Open,Net}BSD Platform
  - Merged with KAME Stack
  - See http://www.kame.net/ and http://www.kfu.com/~nsayer/6to4/ and http://www.feyrer.de/NetBSD/6to4.html
- Linux platform (Debian, SuSE, RedHat, etc.):
  - On Linux see http://www.bieringer.de/linux/IPv6/status/IPv6+Linux-status-distributions.html
  - On USAGI see http://www.linux-ipv6.org/
- MS Windows platform
  - See http://www.microsoft.com/ipv6 and http://research.microsoft.com/msripv6/docs/6to4.htm

6to4 Linux

- For general info see http://www.bieringer.de/linux/IPv6/status/IPv6+Linux-status-distributions.html
- Read page 3 of http://www.onlamp.com/pub/a/onlamp/2001/06/01/ipv6_tutorial.html

6to4 BSD

- General configuration, see http://www.6bone.net/6bone_6to4.html
- {Free,Open,Net}BSD Platform
  - Merged with KAME Stack
  - See http://www.kame.net/ and http://www.kfu.com/~nsayer/6to4/ and http://www.feyrer.de/NetBSD/6to4.html

6to4 Solaris

- Much like Linux (eg: Redhat)
- Read http://supportforum.sun.com/freesolaris/techfaqs.html?techfaqs_2946
- Search the web.

6to4 Mac

- Much like BSD …

6to4 Microsoft

- XP:
  - ipv6 install
  - netsh interface IPv6 6to4 set relay 192.231.212.5
    - (netsh command is optional) …
    - Should set relay to 192.88.99.1 but …
- 2000 / NT4:
  - Download and install MSRIPv6 stack
    - http://research.microsoft.com/msripv6/msripv6.htm
  - 6to4cfg –R 192.231.212.5
- 98, 95, etc.:
  - http://www.hitachi.co.jp/Prod/comp/network/pexv6-e.htm
- MS Windows general:
  - See http://www.microsoft.com/ipv6 and http://research.microsoft.com/msripv6/docs/6to4.htm

Router FreeBSD

/etc/rc.conf additions:

```
# 'zebra' route daemon already started …
# router_enable="YES"
# router="/usr/local/sbin/zebractl"
# router_flags="start"

ipv6_enable="YES"
ipv6_network_interfaces="auto"
ipv6_gateway_enable="YES"
ipv6_ifconfig_xl0="2001:388:1c10:2::1 prefixlen 64"
ipv6_ifconfig_lo0="2001:388:1c10:ff::1 prefixlen 64"

# Enable the sending of route advertisments ..
rtadvd_enable="YES"
rtadvd_interfaces="xl0"
```

Router FreeBSD BGP

/usr/local/etc/zebra/bgpd.conf

```
hostname bgpd.darwin
password XXXXXXXX
enable password XXXXXXXX
log file bgpd.log
log stdout

router bgp 65200
  no bgp default ipv4-unicast
  neighbor 2001:388:1c00:1::1 remote-as 65100
  neighbor 2001:388:1c00:1::1 description to Cairns

  address-family ipv6
    network 2001:388:1c10::/44
    network 2001:388:1c10:1::/64
    aggregate-address 2001:0388:1c10::/44
    redistribute connected
    neighbor 2001:388:1c00:1::1 activate ! Cairns
```

Router FreeBSD Router Advert

/usr/local/etc/radvd.conf

```
interface xl0
{
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
    AdvHomeAgentFlag off;
    prefix 2001:388:1c10:2::/64
    {
     AdvOnLink on;
     AdvAutonomous on;
     AdvRouterAddr off;
     AdvPreferredLifetime 120;
     AdvValidLifetime 300;
    };
};
```

Router RedHat 7.3

/etc/sysconfig/network, add:

NETWORKING_IPV6=yes

if you want a router uncomment:

#IPV6FORWARDING=yes

Run the command:

service network restart

Router RedHat 7.3

/etc/sysconfig/network-scripts/ifcfg-eth0

IPV6INIT=yes

IPV6ADDR=2001:388:1c01:3::1/64

IPV6ADDR_SECONDARIES=… …

Run the command:

/etc/sysconfig/network-scripts/ifup-ipv6 eth0

Router RedHat BGP

```
/etc/zebra/bgpd.conf
hostname bgpd.bourke
password XXXXXXXXXX
enable password XXXXXXXXXX
log stdout
log file /var/log/zebra/bgpd.log
!
router bgp 65400
  no bgp default ipv4-unicast
  neighbor 2001:388:1c00:5::1 remote-as 65500
  neighbor 2001:388:1c00:5::1 description to Cairns

  address-family ipv6
    network 2001:388:1c01::/48
    aggregate-address 2001:388:1c01::/48
    redistribute connected
    neighbor 2001:388:1c00:5::1 activate
```

Router RedHat Router Advert

/etc/radvd.conf

```
interface eth0 {
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
    AdvHomeAgentFlag off;
    prefix 2001:388:1c01:3::/64 {
    AdvOnLink on;
    AdvAutonomous on;
    AdvRouterAddr on;
    };
};
```

Router RedHat, reboot

chkconfig radvd on

chkconfig zebra on

chkconfig bgpd on

/etc/init.d/radvd start

/etc/init.d/zebra start

/etc/init.d/bgpd start

IPv6 and Microsoft Windows

Bill Cerveny

Windows 2000

- Windows 2000 with Service Pack 1 installed
  - Must install IPv6 “Technology Preview”
  - Installing with Service Pack 2: see http://msdn.microsoft.com/Downloads/sdks/platform/tpipv6/faq.asp

Windows XP

- Windows XP
  - Integral part of the operating system
  - Must be turned on (command window, run *ipv6 install*)
  - “Developer Preview”
  - No support for file and print sharing, DNS messages over IPv6, IPv6 support for WinInet, IPHelper and DCOM APIs

Windows XP with SP1

- Windows XP with Service Pack 1 (SP1)
  - IPv6 is a supported protocol, even though network connections display as “Microsoft IPv6 Developer Edition”

Windows .NET Server 2003

- IPv6 functionality built into ping, tracert, pathping, netstat, route, telnet, ftp
- File and print sharing over IPv6 site-local addresses
- IPv6-enabled Internet Explorer and Internet Information Services (IIS)
- IPv6-enabled Windows Media Services
- IPv6 support for Windows Sockets, RPC, IPHelper, DCOM and WinInet APIs
- Literal IPv6 addresses not support by .NET's wininet.dll

IPSec

- IPsec supported except:
  - ESP for the IPv6 doesn’t support data encryption
  - IPsec in the IPv6 protocol doesn’t support the use of Internet Key Exchange (IKE) for negotiating security associations (SAs)
  - IPsec for IPv6 traffic completely independent from IPsec for IPv4.

IPv6-enabled Operating System Tools

- Ipconfig
- Route
- Ping
- Tracert
- Pathping
- Netstat
- Netsh
- ipsec6

Recommended Reading

- *Understanding IPv6*, Joseph Davies, Microsoft Press, 2003
  - Good general IPv6 text
  - Lots of examples from .net Server 2003

Limitations

- No support yet for PPP, PPTP or L2TP
- No Microsoft application support (i.e. Office tools)

Microsoft’s Experimentation with IPv6 Apps

- http://www.threedegrees.com
- Instant Messenger like application which uses IPv6
- Currently in beta

References

- http://www.microsoft.com/ipv6
  - Frequently Asked Questions about the IPv6 Protocol for Windows XP
  - Frequently Asked Questions about the IPv6 Protocol for the Windows .NET Server Family
  - Windows .NET Server 2003 Technical Overview of Networking and Communications

Cisco Router Configuration

- Rule #1: What Would v4 do?
  - Enable routing
    - ipv6 unicast-routing
  - Configure Interfaces
    - ipv6 address
  - Configure Routing Protocols

Cisco Configs

- LAN Interface

```
interface Ethernet0/0
 ip address 192.168.1.254 255.255.255.0
 ipv6 address 2001:468:123:1::2/64
```

Cisco Configs

- Tunnel Interface

```
interface Tunnel1
 description IPv6 to Abilene
 no ip address
 no ip redirects
 no ip proxy-arp
 ipv6 address 3FFE:3700:FF:105::2/64
 tunnel source ATM2/0.1
 tunnel destination 192.168.193.14
 tunnel mode ipv6ip
```

Cisco Configs

- ATM PVC

```
interface ATM2/0.3 point-to-point
 description My GigaPoP
 no ip redirects
 no ip proxy-arp
 pvc MyGigaPoP 3/66
  ubr 155000
  encapsulation aal5snap
 !
 ipv6 address 2001:468:FF:555::1/64
```

Cisco Configs

- IGP - most sites will use RIPng for now, but IS-IS is also available. OSPFv3 is on the way. . .

```
ipv6 router rip ipsix
 redistribute connected
interface Ethernet1/0
 ipv6 rip ipsix enable
 ipv6 rip ipsix default-information orig
```

- Static

Cisco Configs

- BGP - added to your existing IPv4 BGP config

```
router bgp 64555
 bgp router-id 192.168.2.1
 neighbor Abilene-v6 peer-group
 neighbor Abilene-v6 remote-as 11537
```

Cisco Configs

- BGP continued. . .

```
address-family ipv6 unicast
 neighbor Abilene-v6 activate
 neighbor Abilene-v6 soft-reconfiguration in
 neighbor Abilene-v6 prefix-list to-Abilene-v6 out
 neighbor 2001:468:555:200::6 peer-group
   Abilene-v6
 network 2001:468:4ff::/48
 aggregate-address 2001:468:4ff::/48 summary-
   only
```

Cisco Configs

- BGP continued. . .

```
ipv6 route 2001:468:4ff::/48 Null0
!
ipv6 prefix-list to-Abilene-v6 seq 10 permit
    2001:468:4ff::/48
```

Cisco Configs

- Securing Console Access

```
ipv6 access-list V6VTY permit
   2001:468:4ff::/48 any
. . .
!
line vty 0 4
 ipv6 access-class V6VTY in
```

Add to your existing configuration:

```
outer bgp 65300
neighbor 2001:220:1C00::1 remote-as 65500
address-family ipv6 unicast
 neighbor 2001:220:1C00::1 activate
 network 2001:220:1C43::/48
 aggregate-address 2001:220:1C43::/48 summary-only
exit-address-family
pv6 route 2001::220:1c43::/48 Null0
```

Cisco Show Commands

- show bgp
- show bgp summary
- show ipv6 bgp neigh <addr> routes
- show ipv6 bgp neigh <addr> advertised
- show ipv6 route
- show ipv6 interface
- show ipv6 neighbors

The Cisco Show

show ipv6 interface ! show all v6 address etc.

show bgp sum ! show summary of neighbors' BGP state

show bgp ! show all v6 BGP-learned routes

show bgp neigh [addr] routes ! what he's *sending*

show bgp neigh [addr] advertised ! what *you're* sending

show ipv6 route ! show all v6 routes

Juniper Router Configuration

- Rule #1: What Would v4 do?
  - Enable routing - already there. . .
  - Configure Interfaces
    - family inet6 address
  - Configure Routing Protocols and RIBs

Juniper Configs

- Interface (physical)

```
interfaces {
    fe-0/1/0 {
        unit 0 {
            family inet6 {
                address 2001:468:123::1/64;
            }
        }
    }
```

Juniper Configs

- Interface (tunnel)

```
interfaces {
    ip-0/3/0 {
        unit 0 {
            tunnel {
                source 192.168.2.2;
                destination 192.168.45.2;
            }
            family inet6 {
                mtu 1514;
                address 2001:468:123::1/64;
            }
```

Juniper Configs

- Router Advertisement - not enabled by default

```
protocols {
    router-advertisement {
        interface fe-0/3/0.0 {
            prefix 2001:468:123::/64;
        }
    }
}
```

Juniper Configs

- Routing setup

```
routing-options {
    interface-routes {
        rib-group {
            inet6 ifrg6;
        }
    rib inet6.0 {
        aggregate {
            route 2001:468:4ff::/48;
        }
    }
```

Juniper Configs

- Routing setup continued. . .

```
    rib-groups {
        ifrg6 {
            import-rib [ inet6.0 inet6.2 ];
        }
    }
    router-id 192.168.2.1
}
```

Juniper Configs

- IGP - RIPng and IS-IS are both available

```
protocols {
    ripng {
        group local {
            export redist-direct;
            neighbor fe-0/1/0.0;
        }
    }
}
policy-options {
    policy-statement redist-direct {
        from protocol direct;
        then accept;
    }
```

Juniper Configs

- BGP

```
protocols {
    bgp {
        group Abilene-v6 {
            type external;
            family inet6 {
                unicast;
            }
            export to-Abilene-v6;
            peer-as 11537;
            neighbor 2001:468:555:200::6;
        }
    }
}
```

Juniper Configs

- BGP continued. . .

```
policy-options {
    policy-statement to-Abilene-v6 {
        term accept-aggregate {
            from {
                route-filter 2001:468:4ff::/48 exact;
            }
            then accept;
        }
        term reject {
            then reject;
        }
    }
}
```

Juniper Show Commands

- show bgp summary
- show route advert bgp <addr>
- show route rece bgp <addr>
- show route table inet6.0 (terse)
- show interfaces
- show ipv6 neighbors