IPv6 host configuration

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Contributions

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IPv6 Support – Operating Systems

Vendor	IPv6 Support	Versions	More Info
Microsoft	YES	XP and .NET server 2003, CE .NET Pocket PC 2003	http://www.microsoft.com/ipv6
Sun	YES	Solaris 8, 9 and 10	http://wwws.sun.com/software/solaris/ipv6/
IBM	YES	z/OS Rel. 1.4, AIX 4.3 OS/390 V2R6 eNCS	http://www-3.ibm.com/software/os/zseries/ipv6/
BSD	YES	OpenBSD 2.7, NetBSD 1.5	http://www.kame.net/
Linux	YES	RH 6.2, Mandrake 8.0, SuSE 7.1, Debian 2.2	http://www.bieringer.de/linux/IPv6/status/IPv6+Linux-status-distributions.html
HP/Compaq	YES	HP-UX 11i Tru64 UNIX V5.1 OpenVMS V5.1	http://h18000.www1.hp.com/ipv6/next_gen.html
Novell	YES	Netware 6.1	http://www.novell.com/documentation/lg/nw65/index.html?page=/documentation/lg/nw65/readme/data/ajzlp6r.html
Apple	YES	MAC OS X 10.2	http://developer.apple.com/macosx/

IPv6 on Windows

- Full support
  - Windows XP SP 1 and later (Adv Net or SP2 recommended)
  - Windows Server 2003 (no full application support)
- Technology preview
  - Windows XP with no SP
  - Windows 2000 (no compatible with SP2 or later)
- Developer Edition
  - Windows NT 4.0 (source was available)
- No official support but third party products available
  - Windows 95/98/ME
- Supported features:
  - autoconfiguration, IPv4 tunnel, 6to4 tunnel, 6to4 relay, ISATAP tunnel, IPSec (manual keying)

IPv6 in Windows XP

- Not installed by default, and installation varies on service packs
- SP1 additions:
  - vendor support
  - GUI installation
  - configuration via netsh command
- SP2 additions
  - Teredo client
  - host-specific relay support
  - IPv6 firewall

IPv6 installation in Windows XP

- No service packs
  - type ipv6 install from the command prompt
- SP1
  - install protocol “Microsoft IPv6 Developer Edition” from Connection Properties window
- SP2
  - install protocol “Microsoft TCP/IP version 6” from Connection Properties window

Windows XP configuration/1

- Command for IPv6 configuration
  - netsh interface ipv6
  - ipv6 (will be discontinued, not present in Windows Server 2003)
- Autoconfiguration is working
  - netsh interface ipv6 4
  - interface 1 - loopback
  - interface 2 - ISATAP
  - interface 3 - 6to4 interface
  - interface 4... – real network interfaces
  - interface 5 – Teredo interface

Windows XP configuration/2

- Set manual address
  - `netsh ipv6 interface {add|set} address [interface=] <interface> [address=] <address>`
  - `<interface>` – interface name or index
  - `<address>` – address in IPv6 format
- Deleting manual address:
  - `netsh ipv6 interface delete address [interface=] <interface> [address=] <address>`

Windows XP configuration/3

- Set/remove static IPv6 route:

```
netsh ipv6 interface {add|set|delete} route
  [prefix=]<prefix>/<length>
  [interface=]<interface> [[nexthop=] <address>]
```

- Applications:
  - ipconfig, netstat, ping6, tracert6, pathping
  - All Wininet.dll based applications
    - ftp, telnet, IExplorer, Windows Media Player
- Windows 2003 server
  - `netsh interface ipv6 (only!)`
  - file/print sharing-et (site-local) supported over IPv6
  - IIS and media server
  - No Support: Exchange/Outlook ort OutlookExpress

Windows XP configuration/4

- Neighbor cache:
  - `netsh interface ipv6 show neighbors (ipv6 nc)`
- IPv6 routing table
  - `netsh interface ipv6 show routes (ipv6 rt)`
- Reconfiguration
  - `netsh interface ipv6 renew (ipv6 renew)`
- Address selection policy
  - `netsh interface ipv6 show prefixpolicy`
  - `netsh interface ipv6 set prefixpolicy [prefix=]<prefix>/<length> [precedence=]precedence [label=]label`

What Windows cannot do with IPv6

- DNS messages over IPv6
  - not for Windows XP, but Windows Server 2003 can, there is a builtin proxy for it.
- DNS update
  - Dynamic DNS update for IPv6 addresses supported – only global address registered – with stable address (force it `ipconfig /registerdns`)
- IPv6 support for file and print sharing
  - Windows 2003 can
- IPv6 support for the WinInet, IPHelper, and DCOM APIs

Windows XP configuration/4

- IPSec
  - `ipsec6 sp/sa/s/l`
  - No ESP support by default
- .NET
  - IPv6 support, but IPv6 literal address does not work
- IPv6 firewall support after SP2 or Advanced networking pack
- IPv6 teredo support after SP2 or Advanced networking pack
- Application:
  - www.threedegrees.com - instant m[illegible]saging + p2p stream sharing
- Further information: http://www.microsoft.com/ipv6
- Important! You should switch on IPv6 support if you have IPv6 connectivity or you have to tweak RFC3484 knobs.

Windows XP configuration/5

- Windows XP ICF – same rules for IPv4 and IPv6
  - Show configuration:
    - `netsh firewall show globalport`
    - `netsh firewall show adapter`
  - Set configuration
    - `set globalport [port#=enable|disable] [name=name] [protocol=tcp|udp]`
    - `set adapter [name] [icmp type#=enable|disable] [port port#=enable|disable [name=name] [protocol=tcp|udp]] [ignoreglobalport port#=enable|disable] [name=name] [protocol=tcp|udp]] [filtering=enable|disable]`
    - `set logging [filelocation=<location>] [filesize=integer] [droppedpackets=enable|disable] [successfulconnections=enable|disable]`
- After SP2
  - in the firewall you can configure Path MTU discovery support
  - per process configuration possible
- Further information:
  http://www.microsoft.com/technet/community/columns/cableguy/cg0104.mspx

Reminder about RFC3484

- Multiple source addresses: - linklocal, global, tunneling, mobile, choosing IPv6 or IPv4 for communication – which one to select?
  - implement sorting in getaddrinfo()- via policy table:

prefer native IPv6

Prefix	Precendence	Label
::1/128	50	0
::/0	40	1
2002::/16	30	2
::/96	20	3
::ffff:0:0:/96	10	4

prefer IPv4

Prefix	Precendence	Label
::1/128	50	0
::/0	40	1
2002::/16	30	2
::/96	20	3
::ffff:0:0:/96	100	4

IPv6 on *BSD

- Supported:
  - autoconfiguration, IPv4 tunnel, 6to4, MLDv1, IPSec, Jumbogram, ICMP mode information query, TRT, privacy extension
- Available: since FreeBSD 4.0, OpenBSD 2.7, NetBSD 1.5
- KAME extension:
  - NAT-PT, DHCPv6, PIM-(S)SM, multicast DNS, EDNS resolver, ISATAP (not any more), anycast (integrated)

FreeBSD configuration /1

- Installation: not necessary, the default kernel has it
- The installer asking for IPv6 support:
  - `ipv6_enable="yes" in /etc/rc.conf`
  - Autoconfiguration is working
- `ifconfig -a`

FreeBSD configuration /2

- Manual address configuration
  - `ipv6_prefix_fxp0="2001:db8:1:2"`
  - `ipv6_ifconfig_fxp0="2001:db8:1:2 ::1 prefixlen 64"`
  - then `/etc/netstart`
  - or `ifconfig`
- Neighbor cache:
  - `ndp -a`
- routing table:
  - `route/netstat`

FreeBSD configuration /3

- Configuration of further addresses
  - `ipv6_ifconfig_if0_alias0="fec0:0:0:5::2/64"`
- What about if you don't have IPv6 connectivity
  - ip6addrctl(8) program – according RFC3484 you can adjust default address selection

```
#preferip4connection_policy
#Prefix        Precedence Label
::1/128               50     0
::/0                  40     1
2002::/16             30     2
::/96                 20     3
::ffff:0:0/96        100     4
```

FreeBSD configuration /3

- Reconfiguration
  - `rtsol fxp0`
- Applications:
  - ping6, traceroute6, ftp, telnet, r* commands, sendmail, apache, Mozilla, proftpd, OpenSSH, LPD, NFS/YP (FreeBSD 5.0 tól), courier-imap ,irc, openldap, tftp, tcpdump, inn, tin
- Further information:
  `http://www.freebsd.org ,`
  `http://ipv6.niif.hu/faq ,`
  `http://www.hs247.com ,`
  `http://www.kame.net`

Configuring routing on FreeBSD - tunneling

- Configure an IPv6 in IPv4 tunnel
  - ifconfig gif1 create
  - ifconfig gif1 tunnel @IPv4_source @IPv4_dest
  - ifconfig gif1 inet6 @IPv6_address up
- Configure an IPv6 in IPv6 tunnel
  - ifconfig gif1 create
  - ifconfig gif1 tunnel @IPv6_source @IPv6_dest
  - ifconfig gif1 inet6 @IPv6_address up

Configuring routing on FreeBSD – static routes

- Configure a static route
  - Default route

```
route add -inet6 default fe80::X:X:X:X%interface
route add -inet6 default X:X:X:X::X (if global address)
```

  - Others

```
route add -inet6 X:X:X:X:: -prefixlen YY X:X:X:X::X
route add -inet6 X:X:X:X:: -prefixlen YY
fe80::X:X:X:X%interface
```

- %*interface* notation

  If link-local address, need to specify on which interface the address is available

Configuring routing on FreeBSD – permanent tunnels

- Add to `/etc/rc.conf`
  - Create tunnel interfaces

    `cloned_interfaces="gif0 gif1"` – number of tunnels
  - Configure tunnel

```
gifconfig_gif0="10.1.1.1 10.1.1.2"
ipv6_ifconfig_gif0="2001:db8:1:2::1 prefixlen 64"
```

  - Configure static routes

```
ipv6_static_routes="net1"
ipv6_route_net1="2001:db8:0000:0006:: -prefixlen 64
  gif0"
```

Configuring routing on FreeBSD/3

- RIPng: route6d daemon

  `route6d`

  `-L` ***`IPv6_prefix,interface`*** (receives only prefixes derived from ***`IPv6_prefix`*** on interface ***`interface`***)

  `-N` *`interface`* (do not receive and advertise routes on interface)

  `-O` *`IPv6_prefix, interface`* (advertise only on interface the IPv6 prefix)

Configuring routing on FreeBSD/4

- Router advertisement: /etc/rtadvdv.conf
- ```
  default:\
  :chlim#64:raflags#0:rltime#1800:rtime#0:retrans#0:\
      :pinfoflags="la":vltime#2592000:pltime#604800:mtu#auto:
  ```
- ```
  ef0:\
  :addr="2001:db8:ffff:1000::":prefixlen#64:tc=default:
  ```

IPv6 on Linux

- Supported:
  - autoconfiguration, IPv4 tunnel, 6to4
  - since Kernel 2.2.x recommended at least 2.4.8
- USAGI patch (mostly included in 2.6.x series)
  - Node information query, anycast, ISATAP, privacy extension, IPSec, applications, bug-fix, mobile IP

General Linux configuration/1

- Kernel compile options:
  - CONFIG_IPv6=m/y
  - If the IPv6 module is loaded, file `/proc/net/if_inet6` should be present
  - IPv6 module can be loaded by `modprobe ipv6`
- Autoconfiguration supported
- `ifconfig`

General Linux configuration/2

- Address configuration
  - `ifconfig <interface> inet6 add <ipv6address>/<prefixlength>`
- Neighbor cache:
  - `ip -6 neigh show`
- IPv6 routing table:
  - `route -A inet6/netstat`

Redhat configuration/1

- # Enabling Global IPv6 support

`/etc/sysconfig/network` file:

```
NETWORKING_IPV6="yes"
```

- # Enabling IPv6 support on a particular interface

`/etc/sysconfig/network-scripts/ifcfg-eth0` file:

```
IPV6INIT="yes"
```

- # Configuring IPv6 interface address

`/etc/sysconfig/network-scripts/ifcfg-eth0` file:

```
IPV6ADDR="3FFE:2F00:20::291D:6A83/48"
```

- # Default route configuration:

`/etc/sysconfig/static-routes-ipv6` file:

```
eth0 ::/0 3FFE:2F00:20::922:A678
```

Fedore configuration/1

- (Fedora Core 2 only) Append to `/etc/sysconfig/network:`
  - `NETWORKING_IPV6=yes`
  - `IPV6_DEFAULTDEV="your exit device e.g. tun6to4"`
- (Fedora Core 1 only) Append to /etc/sysconfig/network:
  - `NETWORKING_IPV6=yes`
  - `IPV6_GATEWAYDEV="your exit device e.g. tun6to4"`
- 6to4 gateway- Append to /etc/sysconfig/network-scripts/ifcfg-eth0:
  - `IPV6INIT=yes`
  - `IPV6TO4INIT=yes`

Redhat configuration/2

- Applications:
  - ping6, traceroute6, tcpdump, tracepath6, apache, bind, imap (xinetd), sendmail, openssh, telnet, ftp, mozilla, lynx, wget, kde, xchat,
- Further information:
  - http://www.bieringer.de/linux/IPv6/ http://www.hs247.com, http://www.linux-ipv6.org/

Debian configuration/1

- Main URL:

  http://people.debian.org/~csmall/ipv6/
- Enabling IPv6

  You should put "`ipv6`" in "`/etc/modules`"
- Address configuration: "`/etc/network/interfaces`" :

```
iface eth0 inet6 static
address 2001:XXXX:YYYY:ZZZZ::1
netmask 64
```

Debian configuration/2

- Tunnel configuration: "/etc/network/interfaces" :

```
iface tun0 inet6 v4tunnel
   endpoint A.B.C.D
   address 2001:XXXX:1:YYYY::2
   gateway 2001:XXXX:1:YYYY::1
   netmask 64
```

Debian configuration/3

- RA configuration on Debian router

"/etc/radvd.conf" :

```
interface eth0
{
   AdvSendAdvert on;
   AdvLinkMTU 1500;
   prefix 2001:XXXX:YYYY:ZZZZ:/64 {
      AdvOnLink on;
      AdvPreferredLifetime 3600;
      AdvValidLifetime 7200;
   };
};
```

Debian configuration/4

- Configuration on router:

```
net.ipv6.conf.all.autoconf = 0
net.ipv6.conf.all.accept_ra = 0
net.ipv6.conf.all.accept_redirects = 0
net.ipv6.conf.all.forwarding = 1
net.ipv6.conf.all.router_solicitations = 0
```

- Firewalls

```
iptables -I INPUT -j ACCEPT --proto 41
```

Solaris configuration/1

- Supported since Solaris 8
  - autoconfiguration, IPv4 tunnel, 6to4, IPSec, applications

Solaris configuration/2

- Autoconfiguration
  existing "`/etc/hostname6.<intf>`"
- Static address configuration:
  "`/etc/hostname6.<intf>`" :
  `addif 2001:db8:1:2::100 up`
- Static name ↔IPv6 address resolution:
  `in /etc/inet/ipnodes`
- DNS resolution should be enabled
  /etc/nsswitch.conf
  ipnodes: files dns

MacOSX configuration/1

- Supported since MacOSX 10.2 (since Darwin kernel version 6)
  - autoconfiguration, IPv4 tunnel, 6to4, IPSec, applications, Apple Filing Protocol (since AFP version 3.1)
  - Rendez-vous point supports IPv6
  - Basically – what you can expect from *BSD.

MacOSX configuration/2

- Enabled by ip6config command

  `ip6config command interface`

  - commands:
    - start-v6 –enable IPv6 on given (all) interface
    - stop-v6 –disable IPv6 on given (all) interface
    - start-stf – enable IPv6 as defined in /etc/6to4.conf
    - start-rtadvd – start router advertisement daemon and enable IPv6 packet forwarding between interfaces
  - ip6 – enable disable per interface
- Autoconfiguration

  enabled by default