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IPv6: is it working?

practical experiences from an ISP network

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what is this all about?

- report about *our* practical experience with IPv6

- plus configuration examples for typical uses

- backbone stuff, and customer access

- external services

- in-house office usage

IPv6 on backbone routers

- very much straightforward on recent Cisco gear

  – Cisco 7200 with 12.2S, 12.3, and 7600/Sup720 with 12.2SXF

- all backbone links are configured dual-stacked

```
interface GigabitEthernet2/8
    ip address 195.30.3.85 255.255.255.252
    ipv6 address 2001:608:0:E03::85/64
    ipv6 ospf 42 area 0
```

- routing is done with BGP4 and OSPFv3, "standard stuff"

  – BGP policies (mostly) identical for IPv4 and IPv6

  – tunnel peerings are only used if unavoidable & beneficial

- addressing and DNS maintenance is a minor nuisance

Caveats and funnies on the backbone routers

- Control Plane Policing - *needs* IPv6 clause!

```
class-map match-all cpp-ipv6
  match protocol ipv6

policy-map cpp
  class cpp-ipv6
    police cir 100000 conform-action transmit exceed-action drop
```

- watch out for management access, e.g. vty access-lists

```
ipv6 access-list VTY
  permit ipv6 2001:608:0:1::/64 any

line vty 0 4
  access-class 9 in
  ipv6 access-class VTY in
```

- if you run IS-IS for v4+v6, watch out for non-v6-capable routers (or use multi-topology IS-IS)

IPv6 towards the customer

- very easy for leased line customers:

```
interface Serial1/0:0
    ipv6 unnumbered Loopback0
ipv6 route 2001:608:B000::/48 Serial1/0:0
```

- also quite easy for hosted customer servers

  - /64 per customer LAN

  - VLAN id encoded in IPv6 network address

```
ipv6 router ospf 42
    redustribute connected
interface Vlan508
    ip address ...
    ipv6 address 2001:608:0:508::1/64
```

- for customers with /48 behind ethernet links, a transit network is needed (taken from /48, or from separate address block)
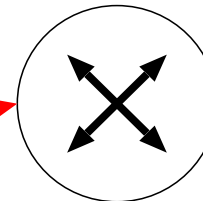
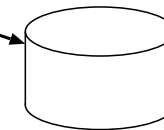# IPv6 towards the customer - Dial-In/PPPoE

Client machine
Linux OS
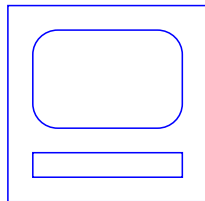
PPPoE based
DSL Connection

ISP Router (LNS)
Cisco 7200

IPv4+IPv6 Internet

Radius-Server

/usr/sbin/pppoed \
   name user@dsl.space.net \
   ipv6 ipv6cp-use-ipaddr

/etc/ppp/chap-secrets
   user@dsl.space.net * secret

(Google for "PPPoE Linux" for
more details about PPPoE setup)

Radius-Config
"user@dsl.space.net" User-Password = "secret",
     Cisco-AVPair = "lcp:interface-config#1=
         ipv6 enable",
     Cisco-AVPair = "lcp:interface-config#2=
         ipv6 unnumbered FastEthernet0/0",
     Cisco-AVPair = "lcp:interface-config#3=
         ipv6 mtu 1492",
     Cisco-AVPair = "lcp:interface-config#4=
         no ipv6 nd suppress-ra",
     Cisco-AVPair = "ipv6:prefix=2001:0608:0014::/48",

IPv6 towards the customer (3) - nasties

- re-sale DSL from Telcos that mandate specific CPEs

  - e.G. Netopia, Efficient, ... $\Rightarrow$ no IPv6 support

  - one possible solution: short-haul tunnels to ISP router

- similar problems: "Layer 3 VPN" solutions that only do IPv4

- until today: no big support issues, "early adoptor" customers

- but eventually: troubleshooting will pose some challanges

IPv6 on external services

- a "service" provider usually needs to run lots of stuff for his customers (and the rest of the Internet), like:

    - DNS (authoritative and recursive)

    - HTTP (ISP's own web servers, and hosted customer servers)

    - Web proxy/cache servers

    - E-Mail (to reach the ISP, and as a customer service)

    - NNTP news

    - IRC (*very* important!)

- all services should be IPv4+IPv6 capable

IPv6 external services: DNS

- authoritative zones served by BIND (8.4.6-REL)

```
named.conf:
  options {
     listen-on { 194.97.129.1; 127.0.0.1; };
     listen-on-v6 { 2001:608::4; 2001:608::1000:16; };
  };
```

- recursive DNS served by DJB's dnscache

  - IPv6 patch from `http://www.fefe.de/dns/`

  - patch also makes tinydns work with IPv6

- **new:** ip6.int zone synthesized via Bind9+DNAME setup

```
named.conf:
    zone "8.0.6.0.1.0.0.2.ip6.int" in { type master; file "2001-0608.int"; };
2001-0608.int:
    8.0.6.0.1.0.0.2.ip6.int.    IN DNAME    8.0.6.0.1.0.0.2.ip6.arpa.
```

IPv6 external services: HTTP, Web proxy

- Apache2 IPv6 support is "automatic", works well

- Squid proxy/cache cannot do IPv6, but apache2 can help:

```
httpd.conf:
    ProxyRequests On
    ProxyVia On
    <Proxy>
        Order deny,allow
        Deny from all
        Allow from 195.30.0.0/16
        Allow from 2001:608::/32
    </Proxy>
```

- virtual (shared) web hosting currently IPv4-only, because
  neither BSD jail nor Linux vserver support IPv6 jailing :-(

IPv6 external services: E-Mail + Usenet

- we use the "qmail" MTA, with heavy local modifications

- IPv6 patch available, but doesn't apply to locally patched qmail

- $\Rightarrow$ would require major effort, and there has not been any customer request yet $\Rightarrow$ low priority

- ditto for POP3/IMAP - lack of demand $\Rightarrow$ no invest

- MTAs that work well with IPv6: sendmail, exim, postfix

- Usenet News via NNTP: INN 2.4.x "just works"

```
inn.conf:
    bindaddress:           195.30.0.7
    bindaddress6:          "2001:608::1000:7"
```

In-House IPv6 usage

- office networks are IPv6-enabled and use IPv6 autoconfig

- most internal servers ("Intranet") are IPv6-enabled

- traffic is a mixture of IPv4 and IPv6, depending on client and server OS and application capabilities

- $\Rightarrow$ debugging can be difficult (e.g.: mismatched server ACLs)

- main IPv6 users: (Intranet-)HTTP, ssh, telnet

- most non-HTTP-based internal tools still IPv4-only

- in-house IRC server is "being worked on" (IRC net migration)

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IPv6: where's the pain?

- customer demand (pretty much zero :-( )
  $\Rightarrow$ management decisions regarding priorities

- internal support ("these weird problems are only caused by
  your IPv6 stuff")

- CPE equipment (sometimes mandatory CPE for certain lines)

- firewall and load balancer vendors

- vendor licensing
  - Juniper ERX is worst example

- application programmers
  - bad: applications not v6-capable at all
  - worse: applications with subtly broken v6 support

Questions?

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http://www.space.net/~gert/RIPE/R52-IPv6-operational.pdf