*SpaceNet*

# IPv6 deployment - an ISP view

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# Overview

- Introduction

- ISP network aspects (connectivity)

- ISP address registry services

- ISP technical services (DNS etc.)

# History of IPv6 at SpaceNet

- 1997 - first contact with IPv6 and 6bone

- 1999 - official RIPE IPv6 allocation (/35)

- 1999 - first permanent IPv6 server online

- 2000 - first exchange point with IPv6 (Munich)

- 2002 - office network IPv6 enabled

- 2003 - regular upstreams start providing IPv6

- 2005 - fully integrated IPv4+IPv6 backbone

- 2007 - still waiting for customer inrush. . .

# ISP network - external connectivity

- most important part of an ISP network is "get to the Internet"

- early years: upstream providers and exchange points had no IPv6 connectivity, so IPv6 was provided via tunnels

- today: many major upstream providers (in Europe) provide native IPv6 (in parallel to IPv4, or via separate links)

- most major exchange points (IXPs) support IPv6

- cisco example:

```
interface GigabitEthernet2/5
 description GigE to INXS-Switch, BB-D08, Port 7/8 (sp1)
   ip address 194.59.190.7 255.255.255.0
   ipv6 address 2001:7F8:2C:1000:0:A500:5539:1/64
```

- $\Rightarrow$ OK!

# ISP network - internal connectivity

- with Juniper routers, IPv4 + IPv6 in parallel, with full performance, just works

- with Cisco, it depends on model used
  - CRS-1, 7600/Sup720, GSR with recent line cards: IPv6 in hardware, no performance impact
  - 7200 and slower platforms: IPv4 and IPv6 both in software, no big difference
  - GSR with older line cards, 6500/Sup2: IPv4 in hardware, IPv6 in software, big problem for some networks

- mixed results for other vendors

- ⇒ depends on vendor choice

- but *if* it works, very similar to IPv4 operations

# ISP network - customer access

- very easy for customers with ethernet connectivity (hosted servers, metro ethernet, ...)

- very easy for customers with "traditional" leased line connectivity (T1, T3, OC-3, ...)

```
interface Serial3/4
  ipv6 address 2001:608:0:999::1/64
ipv6 route 2001:608:4::/48 Serial3/4
```

- work in progress for cable (DOCSIS 3.0)

- *hard* for DSL style customers

  - low-end CPEs can't do IPv6, Cisco 8xx series expensive

  - some carriers require their own (v4-only) CPE

  - carrier networks breaking IPv6 (L2TP on Cisco 10k series)
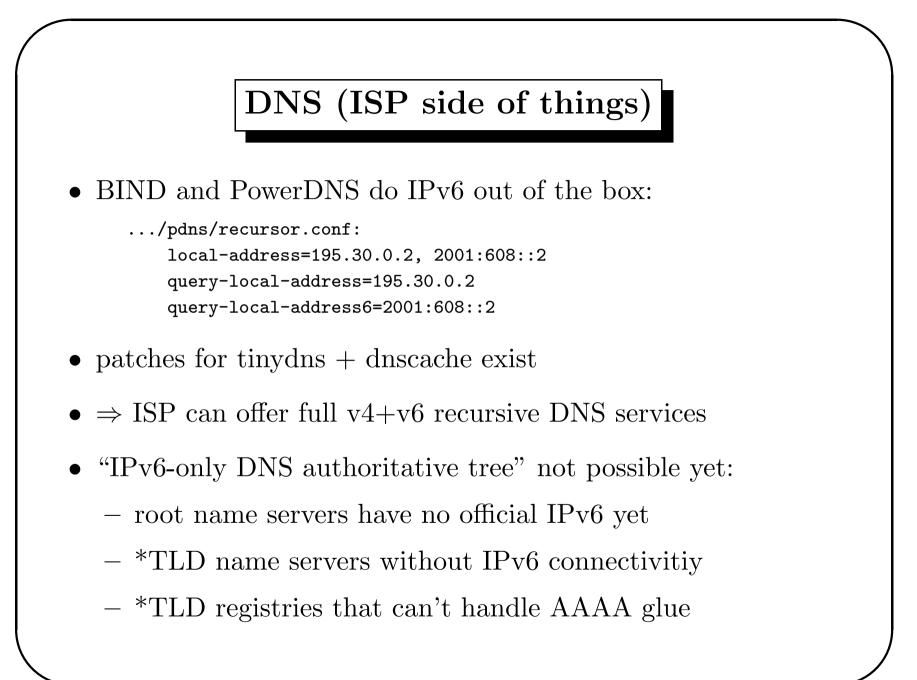
# ISP services - IP addressing

- current addressing policy is nice for ISP and Customer

    - "every customer gets a /48 network prefix"

    - makes planning very easy

    - speeds up automated provisioning

    - customers can easily get static addresses, no discussions

    - internal ISP aggregation layers taken into account

- Geoff Houston math suggests that /48 might be a bit too large if IPv6 is supposed to last for 50 or 100 years

    - Proposal to reduce "standard" customer allocation to /56

    - Proposal to tighten the HD ratio a bit

- some folks claim to need Provider Independent (PI) addresses

# ISP auxiliary services

- to make "The Internet work", ISPs usually provide additional
  services to "bare metal" packet transporting

- customer visible stuff
  - DNS, e-mail relay, www proxy, NTP servers, . . .
  - managed firewalls
  - managed services (virtual web hosting)

- internal stuff
  - ISP office infrastructure
  - network monitoring

# DNS (ISP side of things)

- BIND and PowerDNS do IPv6 out of the box:

```
.../pdns/recursor.conf:
    local-address=195.30.0.2, 2001:608::2
    query-local-address=195.30.0.2
    query-local-address6=2001:608::2
```

- patches for tinydns + dnscache exist

- ⇒ ISP can offer full v4+v6 recursive DNS services

- "IPv6-only DNS authoritative tree" not possible yet:

    – root name servers have no official IPv6 yet

    – *TLD name servers without IPv6 connectivitiy

    – *TLD registries that can't handle AAAA glue

# E-Mail, Web Proxy, . . .

- ISPs can help IPv6 migration by providing dual-stacked *relay* services

  - E-Mail (sendmail, postfix, exim, . . . )

  - WWW-Proxy (Apache2, patches for Squid, . . . )

  - NTP time service

  - . . .

- most of this stuff works quite well today

  - if specific packages cannot do IPv6, alternatives exist

- problem area: closed source appliances, e.g. SPAM filtering

- problem area: virtual e-mail servers (see below)

# ISP (datacenter) hosting services

- dedicated machines ⇒ fairly easy

  – needs routers that do IPv4+IPv6 equally well

  – ideally: one separate L3 VLAN per customer

- virtualized machines ⇒ *hard*

  – for cost control, most small WWW servers do not run on dedicated machines, but on virtual "compartments", that can't see other customer's processes, and are restricted to use only their own IP address (abuse)

  – FreeBSD jail: IPv6 is not isolated

  – Linux vserver: "early" patches for 2.6 kernels only

  – VMware (etc.): heavyweight and costly

- it *could* be done if sufficient demand was there. . .

## ISP VPN / managed firewall services

- growing area of business in recent years

- offload hassles of VPN and firewall managment to ISP staff

- IPv6 could be really beneficial for enterprises with many VPN partners

  - (IPv4) address collisions in RFC1918 space quite frequent

  - with IPv6 (global or ULA), collisions very unlikely

- combined with IPv4/IPv6 dual stacked proxies, internal enterprise network could migrate to "IPv6-mostly"

- Firewall products with IPv6 support exist (Netscreen, Checkpoint, Cisco PIX, *BSD pf(4), Linux, . . . )

## customer demand (?!)

- largest problem to get things done is lack of customer demand

- since 1999 (nearly 8 years):
  - all our office networks have IPv6

  - about half of our (internal and external) servers have IPv6

  - about 40 "access" customers (leased line, DSL, tunneled)

  - 4 "hosting" customers (machines in datacenter)

  - *one* customer inquiry for virtual web hosting with IPv6

  - *no* customer inquiry for managed firewall or VPN with IPv6

  - *no* customer inquiry for e-mail service with IPv6

- $\Rightarrow$ quite hard to justify internal resources for IPv6 work :-(

# Closing Words

- most remaining issues could be solved, given enough demand

- what would be necessary to create *end user* market demand for IPv6?

- what are *enterprises* waiting for?

- should we ditch IPv6, and live with IPv4 + NAT forever?

- . . . or is the Internet doomed anyway?

- feel free to send questions to: gert@space.net