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SixXS – Getting IPv6 to the end-user

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SixXS

- **Service for providing ISPs with a quick way of enabling their user base with IPv6.**
- **Tunnel Broker PoPs, provided by various ISPs around Europe (be,ch,ee,fi,de,ie,it,lu,nl,no,pl,pt,si,se,uk), New Zealand and the United States.**
Thanks to all the ISPs who are providing these PoPs, without them it would not be possible.
- **FAQ, Wiki and Forum.**
- **15.000++ *active* users and tunnels.**
- **7000++ *active* subnets (/48's).**
- **Only two people running it: Pim & Jeroen**
- **With the help of all the people at the ISPs who make sure the IPv4+IPv6 routing works to their PoPs, thanks to them for providing this service**

IPng.nl

Overview:

- Started in 1999 by Pim van Pelt
- 1 PoP: p200, 64mb memory @ AMS-IX
- Static 6bone /127 Tunnels & /60 subnets
- Mostly shell scripts (read: bash)
- MySQL database
- Monitoring using customized fping & rrdtool
- About 200 users



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Introduction

IPng stands for *IP Next Generation*, and it is a different name for the global IPv6 network that is currently being deployed.

Ever since 1997, students of the University of Technology in Eindhoven (TU/e) have been active on the 6bone. One of these students, Pim van Pelt, started collaborating with [Intouch](#) in late 1999. At Intouch, he has been building a production network with usage of the IPv6 protocol.

In early 2000, Intouch joined the Group of Six, six large network operators at the Amsterdam Internet Exchange (AMS-IX) in a unique project, which involves native IPv6 transit over an IX.

Basically, the AMS-IX board have granted us a dedicated vlan on the shared medium which we use to interconnect our routers without the usage of intermediate tunnels. We are:

- [Intouch](#), Organising through Communicating
- [SurfNet](#), The educational backbone in The Netherlands
- [AMS-IX](#), The Amsterdam Internet Exchange
- [UUNet](#), UUNet Europe, The Netherlands
- [Cistron](#), Cistron Internet Services
- [RIPE NCC](#), The RIPE hq in The Netherlands
- [AT&T](#), An American Telco

Basically, Intouch provides IPv6 connectivity and services to those of you interested in connecting to and working with the 6bone.

IPng.nl

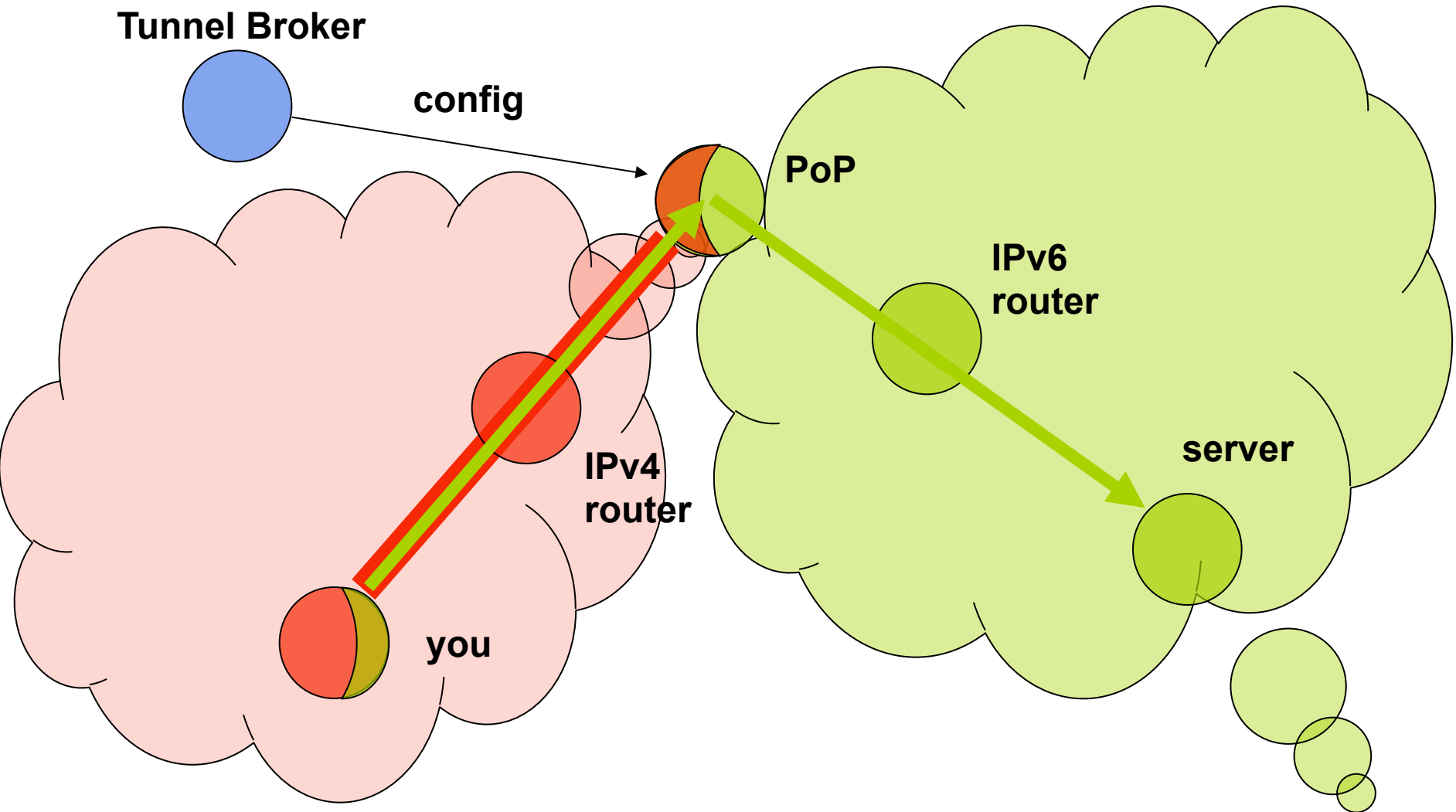
Problems:

- **Scalability problems (management, stats)**
- **Only static tunnels, thus not useful for dialup/cable**
- **Too difficult for non-technical users**
- **Messy code (according to Pim ;)**
- **Again: too much work to maintain in general**

Protocol 41

- **Protocol 41 = IPv6**
- **It specifies how to put an IPv6 packet directly inside an IPv4 packet.**
- **Protocol 41 is static only.**
- **Protocol 41 doesn't cross NATs.**
- **Protocol 41 is 'hacker' according to some:**
 - **Firewalls see this, user gets an alert of 'weird' traffic, user yells abuse.**
 - **This can happen when a 'static' endpoint is not so static, eg cable links, dialup, etc.**

RFC3053 – IPv6 Tunnel Broker



SixXS v1

- **New idea: a distributed Tunnel Broker**
 - 1 IPv6 prefix (eg a 6bone /32)
 - 1 IPv4 address per PoP
 - **Allow users to connect to multiple PoPs**
 - **Do routing**
 - **We called it: Six Access -> SixXS**
(thanks to XS4all.nl for the 'XS' part)

SixXS v1

- **Several problems with that though:**
 - **ISP's reluctant to carry traffic for others**
 - **Requires cross-tunnelling between PoPs**
 - **Different OS's on different PoPs, synchronisation of statistics and management in general becomes quite hard**
 - **Introduces new places where things can break**
 - **More difficult for the user in the end and most likely doesn't give them any advantage (except when a PoP goes down)**
- **Additionally time issues caused this idea to be aborted... thus...**

SixXS v2

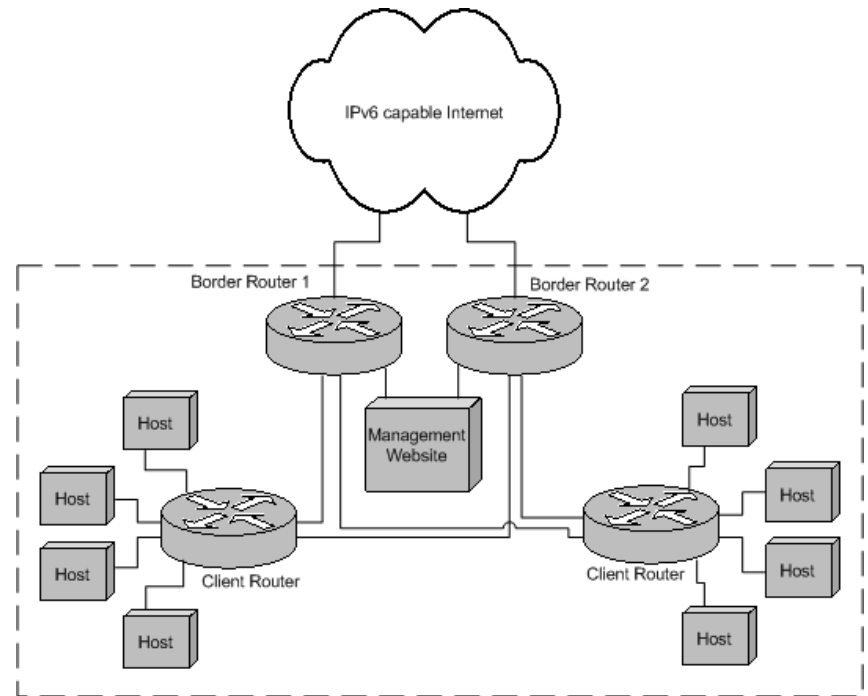
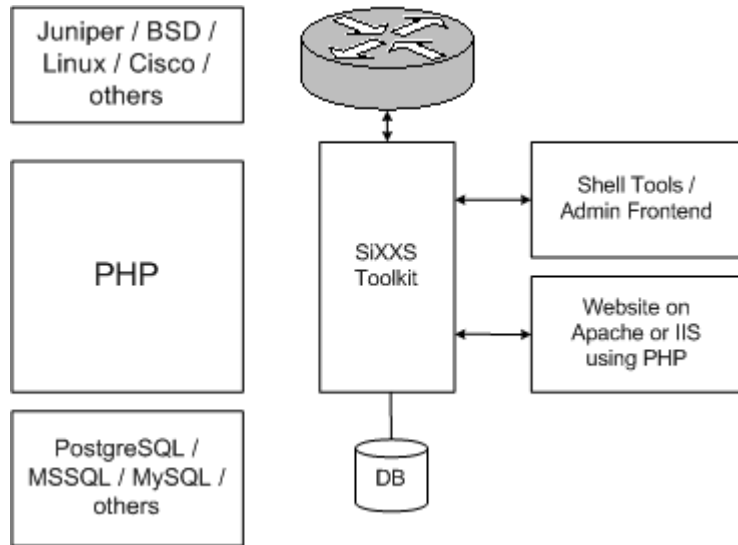
- Pim and Jeroen as core team.
- Second go at it, thus v2.
- Design a TB from the ground up.
- White label, so we could ‘brand’ it.
- Central control site & Multiple PoPs
- Shell & Web interface for the backend
- PHP as the common language
- Credit system to limit abuse
- Launched at AMS-IX Awareness Day (AIAD)



← Jeroen

← For people wondering who this
“Pim van Pelt” actually is...

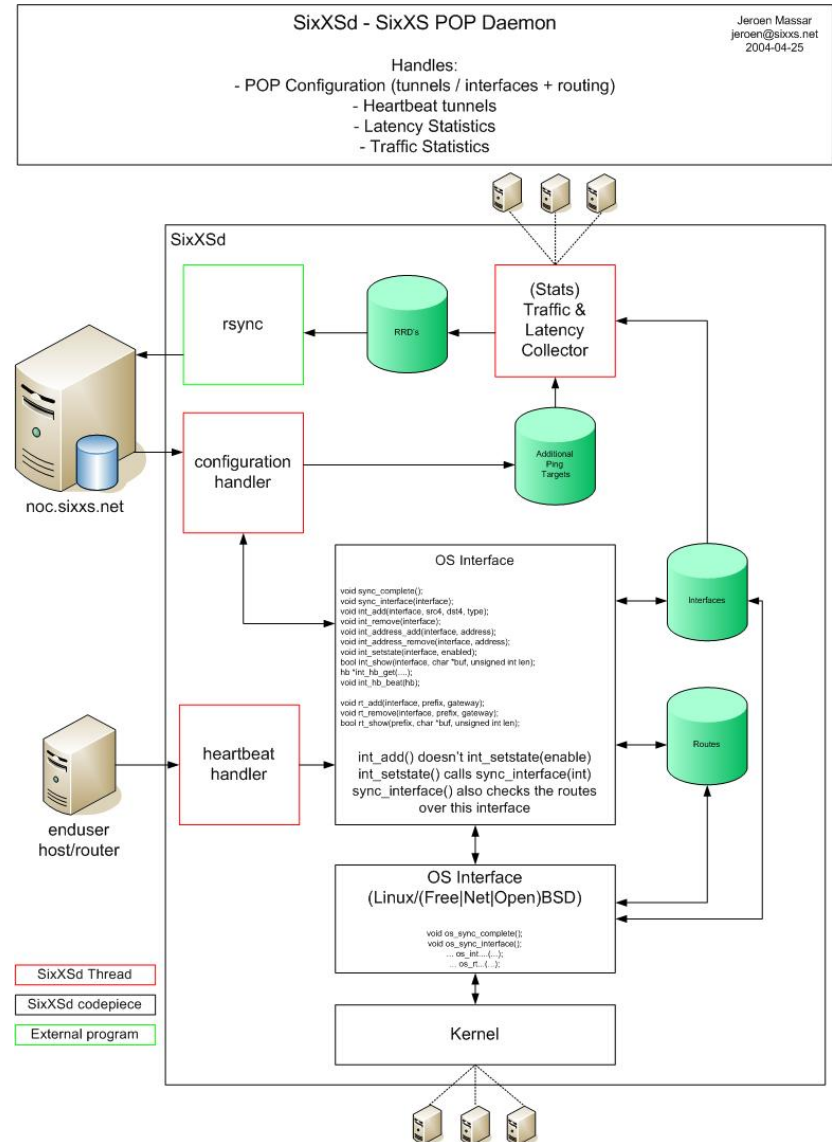
SixXS v2 Toolkit



SixXS v3

v2 was still not 'automatic' enough:

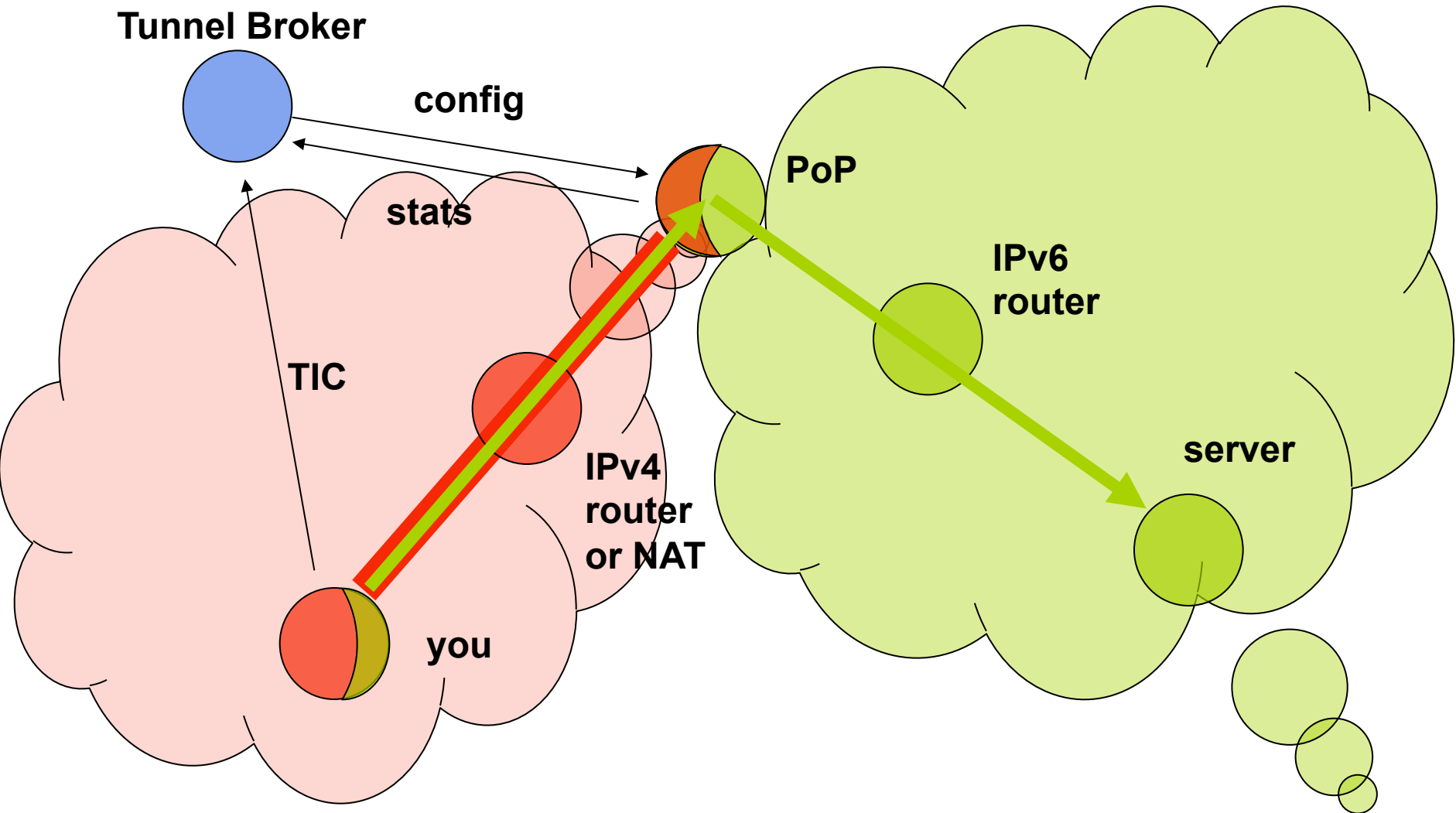
- No direct updates
- Sometimes synchronizations where missed, manual changes or other routing daemons on the PoP would cause changes which the scripts didn't handle.



SixXS v3

- **Thus v3: C-based daemons on the PoPs**
- **Kept using our sync/configuration architecture which was designed with such a change in mind**
- **Act as a routing daemon and “counteract” changes where needed**
- **TIC support, AICCU to use it**
- **AYIYA support**
- **Better logging, notification and tracking**

SixXS Tunnel Broker



Heartbeat

- **Dynamic/non-24/7 IPv4 endpoints.**
- **Proto-41 is static. The moment the user unplugs, another user can get that IPv4 address. That user then gets proto-41 packets and the firewall tool beeps with warnings, which sometimes results in abuse reports because we are attacking them.**
- **Allows one to move around proto-41 tunnels automatically or enable/disable them on the fly.**

AYIYA – Anything in Anything

- **Proto-41 tunnels can't cross NATs.**
- **Proto-41 tunnels are not authenticated.**
(read: one can spoof them easily)
- **Heartbeat runs next-to the proto-41 tunnel.**
Heartbeat might work, proto-41 might not.

AYIYA solves these issues by tunneling IPv6 inside IPv4/UDP and signing these packets.

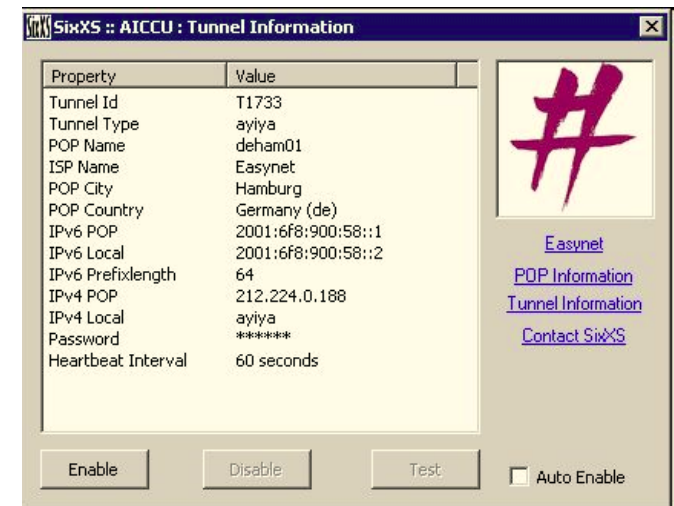
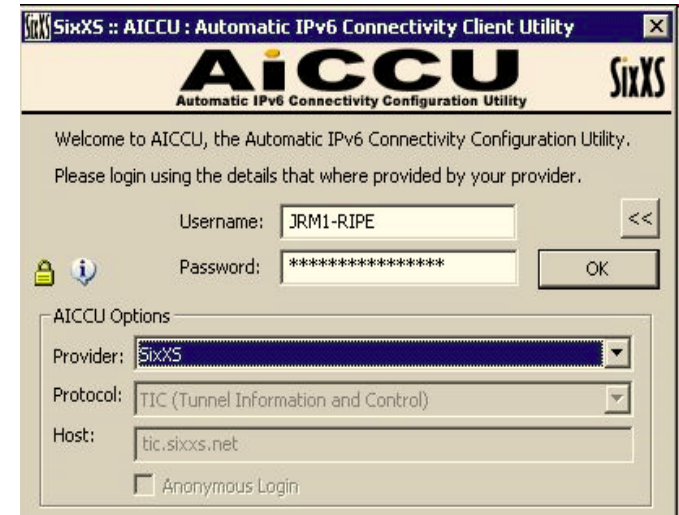
Tunnel Information & Control

- **Short: TIC**
- **Simple SMTP-like command/answer protocol**
- **Authentication**
- **Tunnel Configuration Information**
- **Tunnel Modification**
- **Route/Subnet Information**

AICCU

“Automatic IPv6 Connectivity Client Utility”

- Proto-41, heartbeat and AYIYA tunnels.
- Windows GUI, Debian Debconf, CLI.
- More-or-less click-and-have-IPv6



Fritz!Box IPv6

- http://www.avm.de/en/news/artikel/IPv6_Lab.html

“ **New: FRITZ! IPv6 Lab**

**For FRITZ!Box Fon WLAN 7270 or 7570 VDSL
Features at a glance**

....

IPv6 – SixXS Tunnel Broker support”

Does TIC + heartbeat + subnet delegation

Configurable from the webinterface,

Just enter the user login/password



Abuse handling

- **Lots of people seem to just want to abuse IPv6: ability to 'hide' on IRC and then annoy people, inviting an DoS which ends up at the PoP.**
- **We thus require proper details at signup, and verify these. Non-free email addresses solves already a large portion of this as getting a new ISP address is difficult, and very hard when your ISP knows about ones misbehavior.**
- **Good contacts with various IRC network where the abuse generally comes from**

Common Issues

- **AICCU takes quite a few setup problems away, but it is far from perfect as it can't solve broken systems.**
- **DNS issues (AAAA being dropped)**
- **Firewalling tools just dropping and thus breaking IPv6.**
- **Misconfigured Firewalls**
- **Mis-understanding**

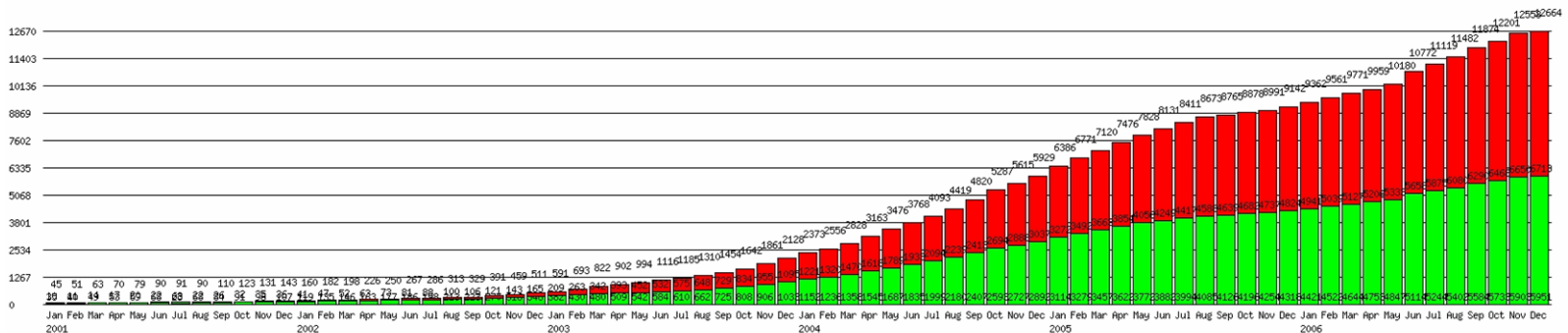
Management

```
noc.sixxs.net - PuTTY
jeroen@noc:~$ sadmin
Usage: sadmin {user|tunnel|route|pop|mail|dns|review} {help|args}
jeroen@noc:~$ sadmin user
Usage: user {create|update|delete|verify|approve} NICHDL
user checkwhois NICHDL {report}
user show|view NICHDL [full]
user {showlog|viewlog|viewdata}[ip] [[@]NICHDL[%DATE] [LINES|all]
user list [{name|email|state|address|country|maintainer|ip} QUERY [exact]]
user {allowmodify|allowrequest|usecredit|allowforum} NICHDL {yes|no}
user setstate NICHDL {enabled|disabled|deleted}
user setadmin NICHDL {yes|no}
user setcountry NICHDL COUNTRYID
user setpass NICHDL <password>
user credit NICHDL <integer> [reason]
user log NICHDL MESSAGE
user popright NICHDL POPNAME {A[llow]|D[eny]|R[emove]}
user getemail NICHDL
user rename OLDHDL NEWHDL
user forum posts NICHDL
jeroen@noc:~$ sadmin tunnel
Usage: tunnel request NICHDL POPNAME IPV4THEM CITY COUNTRYID
tunnel {delete|show} TUNID
tunnel list [{pop|user|ipv4|ipv6|...} [exact]]
tunnel move TUNID {NEWIPV4THEM|heartbeat|ayiya}
tunnel setstate TUNID admin {enabled|disabled|requested}
tunnel setstate TUNID user {enabled|disabled|deleted}
tunnel approve TUNID [POPNAME [POPPREFIXNAME]]
tunnel {showlatency} TUNID
tunnel set TUNID {country|city|heartbeatpassword|private|mtu} VALUE
tunnel chown TUNID <NICHDL>
jeroen@noc:~$ sadmin route
Usage: route request TUNID DESCRIPTION
route {delete|show|free} ROUTEID
route list [{pop|user|prefix|tunnel} QUERY exact]
route setstate ROUTEID {admin|user} {enabled|disabled|deleted|requested}
route settype TUNID {static|bgp}
route approve ROUTEID [POPPREFIXNAME] [PREFIX]
route {delegate|undelegate} ROUTEID NAMESERVER
jeroen@noc:~$ █
```

Reviewing

As most faulty requests have similar things wrong we have a standard list of rejections, thus don't be offended when you get rejected, it is not only you...

```
noc.sixxs.net - PuTTY
Approve this user [n/y/d/r/o/c/f/a/i/s/?] ? ?
n : Skip
y : Approve
d : Mark as deleted in silence
r : Reject: custom reason
o : Disable: Only one account/signup per user
c : Disable: IPv6 is not only for IRC
f : Reject: Freemail / Non-ISP mail / Not enough MX's
a : Reject: Address incomplete
i : Reject: Illegal/fake user
s : Disable: We don't provide IPv6 connectivity to shell providers
Approve this user [?] ? r
Custom reason: Bought us a six pack of heineken while he promised us two bottles of Jameson
```



IPv6Gate

Allows access to any IPv4 website over IPv6 from IPv6-only hosts.

<http://www.google.com.sixxs.org>

(or get in their approved DNS list ;)

Also allows the reverse: IPv6-only site from IPv4-only host:

<http://ipv6.google.com.ipv4.sixxs.org>

GRH – Ghost Route Hunter

- Peers actively with over 150 ISPs around the world.
 - A tool for detecting and hunting down Ghost Routes in the IPv6 routing tables and displaying DFP availability.
 - Distributed Looking Glass
 - Missing Prefixes
 - Prefix Comparison
 - <http://www.sixxs.net/tools/grh/>
- (See also possible lightning talk about this)

RFC4193 - ULA

IPv6 ULA (Unique Local Address)

RFC4193 Registration

- **fd00::/8 ULA Locally Assigned.**
It is Unique, but maybe not Unique enough as it has a chance that it is not.
- **fc00::/8 ULA “Registered” – not specified and thus can’t be used.**
- **Nearly 200 registrations**
- **Of course not guaranteed, when people don’t check this list it can’t be.**

Future / Wish list

- **New signup mechanics**
- **Multicast**
 - **Most PoPs already in the SixXS Multicast cloud, but need more testing/experiments**
- **AYIYA/DNS and AYIYA/HTTP(S)**
- **New AICCU client**
- **BGP Support / Multi-PoP Tunnels**
- **Community Edition**
- **More and more and more PoPs!**

<http://www.sixxs.net/about/technology/>

SixXS for ISPs

First the ISP contacts popmaster@sixxs.net and discuss the possible PoP with us.

The ISP provides:

- A policy describing who can use their PoP
- A (virtual) host
- 1 IPv4 + 2 IPv6 addresses (management .
- Routes IPv6 /40 or more to it
- Installs our root SSH key
- Delegate the reverse for the prefix to us.
- Register the prefix in RIPE

ISP gets

- **A PoP for their users (eg their paying customers, or users in country/region X etc) providing all these folks with IPv6**
- **We handle signups, tunnel and subnet requests. Optionally this can be automated with a backend to the ISP, eg POP/IMAP-based authentication, ACL or other methods.**
- **Experience in IPv6 in the core**
- **For free, as SixXS is a project for the community, getting IPv6 to the world is the ultimate goal (along with having to shutdown the IPv6 tunnel broker because everybody has IPv6).**

Questions?

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