APNIC eLearning:
IPv6 Address Planning

Contact: training@apnic.net

APNIC

Overview

- Where to Get IPv6 Addresses
- Addressing Plans – ISP Infrastructure
- Addressing Plans – Customer
- Example Address Plan
- Addressing Tools

Where to get IPv6 addresses

If Your ISP in:

- Africa
  - AfriNIC – http://www.afrinic.net
- Asia and the Pacific
  - APNIC – http://www.apnic.net
- North America
  - ARIN – http://www.arin.net
- Latin America and the Caribbean
  - LACNIC – http://www.lacnic.net
- Europe and Middle East
  - RIPE NCC – http://www.ripe.net/info/ncc

Internet Registry Regions

Getting IPv6 address space

- Become a member of your Regional Internet Registry and get your own allocation
  - Require a plan for a year ahead
  - General allocation policies are outlined in RFC2050, more specific details for IPv6 are on the individual RIR website
  - Receive a /32 (or larger if you will have more than 65k /48 assignments)

or

- Take part of upstream ISP's address space
  - Get one /48 from your upstream ISP
  - More than one /48 if you have more than 65k subnets
- There is plenty of IPv6 address space

Addressing Plans – ISP Infrastructure

- ISPs will receive /32 from APNIC as minimum allocation
- Address block for router loop-back interfaces
  - Generally number all loopbacks out of **one** /64
  - /128 per loopback
- Address block for infrastructure
  - /48 allows 65k subnets
  - /48 per region (for the largest international networks)
  - /48 for whole backbone (for the majority of networks)
  - Summarise between sites if it makes sense

Addressing Plans – ISP Infrastructure

- What about LANs?
  - /64 per LAN
- What about Point-to-Point links?
  - Protocol design expectation is that /64 is used
  - /127 now recommended/standardised
    - http://www.rfc-editor.org/rfc/rfc6164.txt
    - (reserve /64 for the link, but address it as a /127)
  - Other options:
    - /126s are being used (mirrors IPv4 /30)
    - /112s are being used
      - Leaves final 16 bits free for node IDs
    - Some discussion about /80s, /96s and /120s too

Addressing Plans – Customer

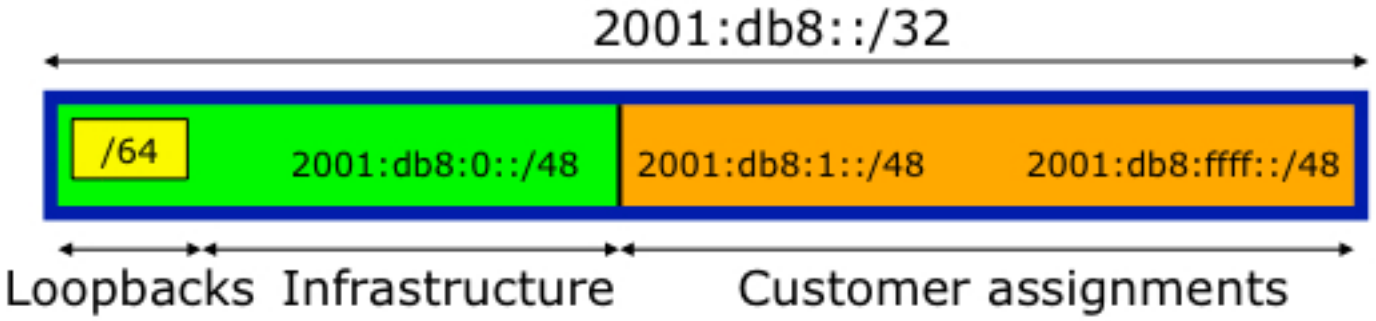
- Customers get one /48
  - Unless they have more than 65k subnets in which case they get a second /48 (and so on)
- In typical deployments today:
  - Several ISPs give small customers a /56 and single LAN end-sites a /64, e.g.:
  - /64 if end-site will only ever be a LAN (or only one VLAN)
  - /56 for medium end-sites (e.g. small business)
  - /48 for large end-sites
  - (This is another very active discussion area)

Addressing Plans – Advice

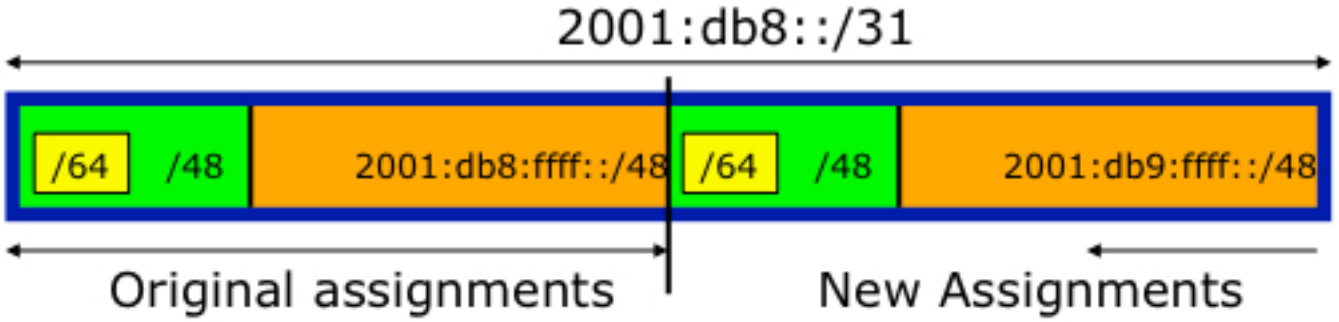
- Customer address assignments should not be reserved or assigned on a per PoP basis
  - Same principle as for IPv4
  - ISP iBGP carries customer nets
  - Aggregation within the iBGP not required and usually not desirable
  - Aggregation in eBGP is very necessary
- Backbone infrastructure assignments:
  - Number out of a single /48
    - Operational simplicity and security
  - Aggregate to minimise size of the IGP

Addressing Plans – ISP Infrastructure

- Phase One



- Phase Two – Second /32



Addressing Plans
Planning

- Registries will usually allocate the next block to be contiguous with the first allocation
  - Minimum allocation is /32
  - Very likely that subsequent allocation will make this up to a /31
  - So plan accordingly

Example Address Plan

- IPv6 Allocation Form Registry is
  - 2406:6400::/32

Example Address Plan

This example is for reference only. You need to plan according to you network requirement

- Option 1
  - For ISP growing on Internet access customer
- Option 2
  - For ISP growing on both data centre hosting & Internet access customer

Example Address Plan

- **Option 1**
  - **For ISP growing on Internet access customer**
- Option 2
  - For ISP growing on both data centre hosting & Internet access customer

Training ISP IPV6 Addressing Plan

Table 1: 1st Level Distribution Infrastructure & Customer

Block#	Prefix	Description	Reverse Domain	SOR	Registration
1	**2406:6400::/32**	**Parent Block**	**0.0.4.6.6.0.4.2.ip6.arpa.**	**N/A**	**APNIC**
2	2406:6400:0000:0000::/33	Infrastructure + DC + CS P2P + Cust net	7~0.0.0.4.6.6.0.4.2.ip6.arpa.[x8]	No	Optional
3	2406:6400:8000:0000::/33	Customer network	f~8.0.0.4.6.6.0.4.2.ip6.arpa. [x8]	Not yet	Optional

Training ISP IPV6 Addressing Plan

Table 2: 2nd Level Distribution Infrastructure					
Block#	**Prefix**	**Description**	**Reverse Domain**	**SOR**	**Registration**
2	**2406:6400:0000:0000::/33**	**Infrastructure + DC + CS P2P + Cust**	**7~0.0.0.4.6.6.0.4.2.ip6.arpa**	**N/A**	**Optional**
4	2406:6400:0000:0000::/48	Loopback, Transport & P2P [Infra]			
5	2406:6400:0001:0000::/48	CS P2P			
6	2406:6400:0002:0000::/48	CS P2P			
7	2406:6400:0003:0000::/48	CS P2P			
8	2406:6400:0004:0000::/48	CS P2P			
9	2406:6400:0005:0000::/48	DC (DNS, Mail, WWW, Hosting Cust)			
10	2406:6400:0006:0000::/48	DC (DNS, Mail, WWW, Hosting Cust)			
11	2406:6400:0007:0000::/48	DC (DNS, Mail, WWW, Hosting Cust)			
12	2406:6400:0008:0000::/48	DC (DNS, Mail, WWW, Hosting Cust)			
13	2406:6400:0009:0000::/48				
14	2406:6400:000A:0000::/48	Customer network			
15	2406:6400:000B:0000::/48	Customer network			
16	2406:6400:000C:0000::/48	Customer network			
17	2406:6400:000D:0000::/48	Customer network			
18	2406:6400:000E:0000::/48	Customer network			
19	2406:6400:000F:0000::/48	Customer network			
	2406:6400:7FFF:0000::/48	Customer network			

Training ISP IPV6 Addressing Plan

Table 3: Further detail loopback, transport & infrastructure WAN Only					
Block#	**Prefix**	**Description**	**Reverse Domain**	**SOR**	**Registration**
4	**2406:6400:0000:0000::/48**	**Loopback, Trans, Infra WAN**	**0.0.0.0.0.0.4.6.6.0.4.2.ip6.arpa.**		**Optional**
32773	2406:6400:0000:0000::/64	Loopback		No	No
32774	2406:6400:0000:0001::/64				
32775	2406:6400:0000:0002::/64	Transport		No	No
32776	2406:6400:0000:0003::/64			No	No
32777	2406:6400:0000:0004::/64			No	No
32778	2406:6400:0000:0005::/64	Infra WAN		No	No
32779	2406:6400:0000:0006::/64	Infra WAN		No	No
32780	2406:6400:0000:0007::/64	Infra WAN		No	No
32781	2406:6400:0000:0008::/64	Infra WAN		No	No
32782	2406:6400:0000:0009::/64	Infra WAN		No	No
32783	2406:6400:0000:000a::/64	Infra WAN		No	No
32784	2406:6400:0000:000b::/64	Infra WAN		No	No
32785	2406:6400:0000:000c::/64	Infra WAN		No	No
32786	2406:6400:0000:000d::/64	Infra WAN		No	No
32787	2406:6400:0000:000e::/64	Infra WAN		No	No
32788	2406:6400:0000:000f::/64	Infra WAN		No	No
	2406:6400:0000:ffff::/64	Infra WAN		No	No

Training ISP IPV6 Addressing Plan

Table 4: Further detail Customer Assignment

Block#	Prefix	Description	Reverse Domain	SOR	Registration
3	2406:6400:8000:0000::/33				
	2406:6400:8000:0000::/48	Customer 1	0.0.0.8.0.0.4.6.6.0.4.2.ip6.arpa.	Yes	Yes
	2406:6400:8001:0000::/48	Customer2	1.0.0.8.0.0.4.6.6.0.4.2.ip6.arpa.	Yes	Yes
	2406:6400:8002:0000::/48				
	2406:6400:8003:0000::/48				
	2406:6400:8004:0000::/48				
	2406:6400:8005:0000::/48				
	2406:6400:8006:0000::/48				
	2406:6400:8007:0000::/48				
	2406:6400:8008:0000::/48				
	2406:6400:8009:0000::/48				
	2406:6400:800A:0000::/48				
	2406:6400:800B:0000::/48				
	2406:6400:800C:0000::/48				
	2406:6400:800D:0000::/48				
	2406:6400:800E:0000::/48				
	2406:6400:800F:0000::/48				
	2406:6400:FFFF:0000::/48				

Example Address Plan

- Option 1
  - For ISP growing on Internet access customer
- **Option 2**
  - **For ISP growing on both data centre hosting & Internet access customer**

Training ISP IPV6 Addressing Plan

Table 1: Top level distribution infrastructure & customer

Block#	Prefix	Description	Reverse Domain	SOR	Registration
1	**2406:6400::/32**	***Parent Block***	0.0.4.6.6.0.4.2.ip6.arpa.	N/A	APNIC
2	2406:6400:0000:0000::/36	Infrastructure + DC	0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Optional
3	2406:6400:1000:0000::/36	Customer network	1.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
4	2406:6400:2000:0000::/36	Customer network	2.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
5	2406:6400:3000:0000::/36	Customer network	3.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
6	2406:6400:4000:0000::/36	Customer network	4.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
7	2406:6400:5000:0000::/36	Customer network	5.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
8	2406:6400:6000:0000::/36	Customer network	6.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
9	2406:6400:7000:0000::/36	Customer network	7.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
10	2406:6400:8000:0000::/36	Customer network	8.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
11	2406:6400:9000:0000::/36	Customer network	9.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
12	2406:6400:a000:0000::/36	Customer network	a.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
13	2406:6400:b000:0000::/36	Customer network	b.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
14	2406:6400:c000:0000::/36	Customer network	c.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
15	2406:6400:d000:0000::/36	Customer network	d.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
16	2406:6400:e000:0000::/36	Customer network	e.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
17	2406:6400:f000:0000::/36	Customer network	f.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional

Training ISP IPV6 Addressing Plan

Table 2: Detail distribution infrastructure

Block#	Prefix	Description	Reverse Domain	SOR	Registration
2	***2406:6400:0000:0000::/36***	***Infrastructure***	0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Optional
18	2406:6400:0000:0000::/40	Loopback, Transport & WAN [Infra+CS]	0.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Optional
19	2406:6400:0100:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	1.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
20	2406:6400:0200:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	2.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
21	2406:6400:0300:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	3.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
22	2406:6400:0400:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	4.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
23	2406:6400:0500:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	5.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
24	2406:6400:0600:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	6.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
25	2406:6400:0700:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	7.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
26	2406:6400:0800:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	8.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
27	2406:6400:0900:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	9.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
28	2406:6400:0a00:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	a.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
29	2406:6400:0b00:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	b.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
30	2406:6400:0c00:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	c.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
31	2406:6400:0d00:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	d.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
32	2406:6400:0e00:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	e.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
33	2406:6400:0f00:0000::/40	DC (DNS, Mail, WWW, Hosting Cust)	f.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended

Training ISP IPV6 Addressing Plan

Table 3: Further detail loopback, transport & WAN [Infra+CS]

Block#	Prefix	Description	Reverse Domain	SOR	Registration
18	***2406:6400:0000:0000::/40***	***Loopback, Transport & Infra WAN***	*0.0.0.0.4.6.6.0.4.2.ip6.arpa.*		
19	2406:6400:0000:0000::/48	Loopback, Transport, Infra WAN		No	Recommended
20	2406:6400:0001:0000::/48	Customet poing-to-point Link		No	Recommended
21	2406:6400:0002:0000::/48	Customet poing-to-point Link		No	Recommended
22	2406:6400:0003:0000::/48	Customet poing-to-point Link		No	Recommended
23	2406:6400:0004:0000::/48	Customet poing-to-point Link		No	Recommended
24	2406:6400:0005:0000::/48	Customet poing-to-point Link		No	Recommended
25	2406:6400:0006:0000::/48	Customet poing-to-point Link		No	Recommended
26	2406:6400:0007:0000::/48	Customet poing-to-point Link		No	Recommended
27	2406:6400:0008:0000::/48	Customet poing-to-point Link		No	Recommended
28	2406:6400:0009:0000::/48	Customet poing-to-point Link		No	Recommended
29	2406:6400:000A:0000::/48	Customet poing-to-point Link		No	Recommended
30	2406:6400:000B:0000::/48	Customet poing-to-point Link		No	Recommended
31	2406:6400:000C:0000::/48	Customet poing-to-point Link		No	Recommended
32	2406:6400:000D:0000::/48	Customet poing-to-point Link		No	Recommended
33	2406:6400:000E:0000::/48	Customet poing-to-point Link		No	Recommended
34	2406:6400:000F:0000::/48	Customet poing-to-point Link		No	Recommended
275	2406:6400:00FF:0000::/48	Customet poing-to-point Link		No	Recommended

Training ISP IPV6 Addressing Plan

Table 4: Further detail loopback, transport & infrastructure WAN Only					
Block#	**Prefix**	**Description**	**Reverse Domain**	**SOR**	**Registration**
19	***2406:6400:0000:0000::/48***	***Loopback, Transport & Infra WAN***	*0.0.0.0.4.6.6.0.4.2.ip6.arpa.*		Optional
276	2406:6400:0000:0000::/64	Loopback		No	No
277	2406:6400:0000:0001::/64				
278	2406:6400:0000:0002::/64	Transport		No	No
279	2406:6400:0000:0003::/64			No	No
280	2406:6400:0000:0004::/64			No	No
281	2406:6400:0000:0005::/64	Infra WAN		No	No
282	2406:6400:0000:0006::/64	Infra WAN		No	No
283	2406:6400:0000:0007::/64	Infra WAN		No	No
284	2406:6400:0000:0008::/64	Infra WAN		No	No
285	2406:6400:0000:0009::/64	Infra WAN		No	No
286	2406:6400:0000:000a::/64	Infra WAN		No	No
287	2406:6400:0000:000b::/64	Infra WAN		No	No
288	2406:6400:0000:000c::/64	Infra WAN		No	No
289	2406:6400:0000:000d::/64	Infra WAN		No	No
290	2406:6400:0000:000e::/64	Infra WAN		No	No
291	2406:6400:0000:000f::/64	Infra WAN		No	No
65811	2406:6400:0000:ffff::/64	Infra WAN		No	No

Training ISP IPV6 Addressing Plan

Table 5: Detail Customer Block

Block#	Prefix	Description	Reverse DNS	SOR	Registration
3	2406:6400:1000:0000::/36	Customer network			
	2406:6400:1000:0000::/48	Customer 1		Yes	Yes
	2406:6400:1001:0000::/48	Customer 2		Yes	Yes
	2406:6400:1002:0000::/48				
	2406:6400:1003:0000::/48				
	2406:6400:1004:0000::/48				
	2406:6400:1005:0000::/48				
	2406:6400:1006:0000::/48				
	2406:6400:1007:0000::/48				
	2406:6400:1008:0000::/48				
	2406:6400:1009:0000::/48				
	2406:6400:100a:0000::/48				
	2406:6400:100b:0000::/48				
	2406:6400:100c:0000::/48				
	2406:6400:100d:0000::/48				
	2406:6400:100e:0000::/48				
	2406:6400:100f:0000::/48				
	2406:6400:1fff:0000::/48				

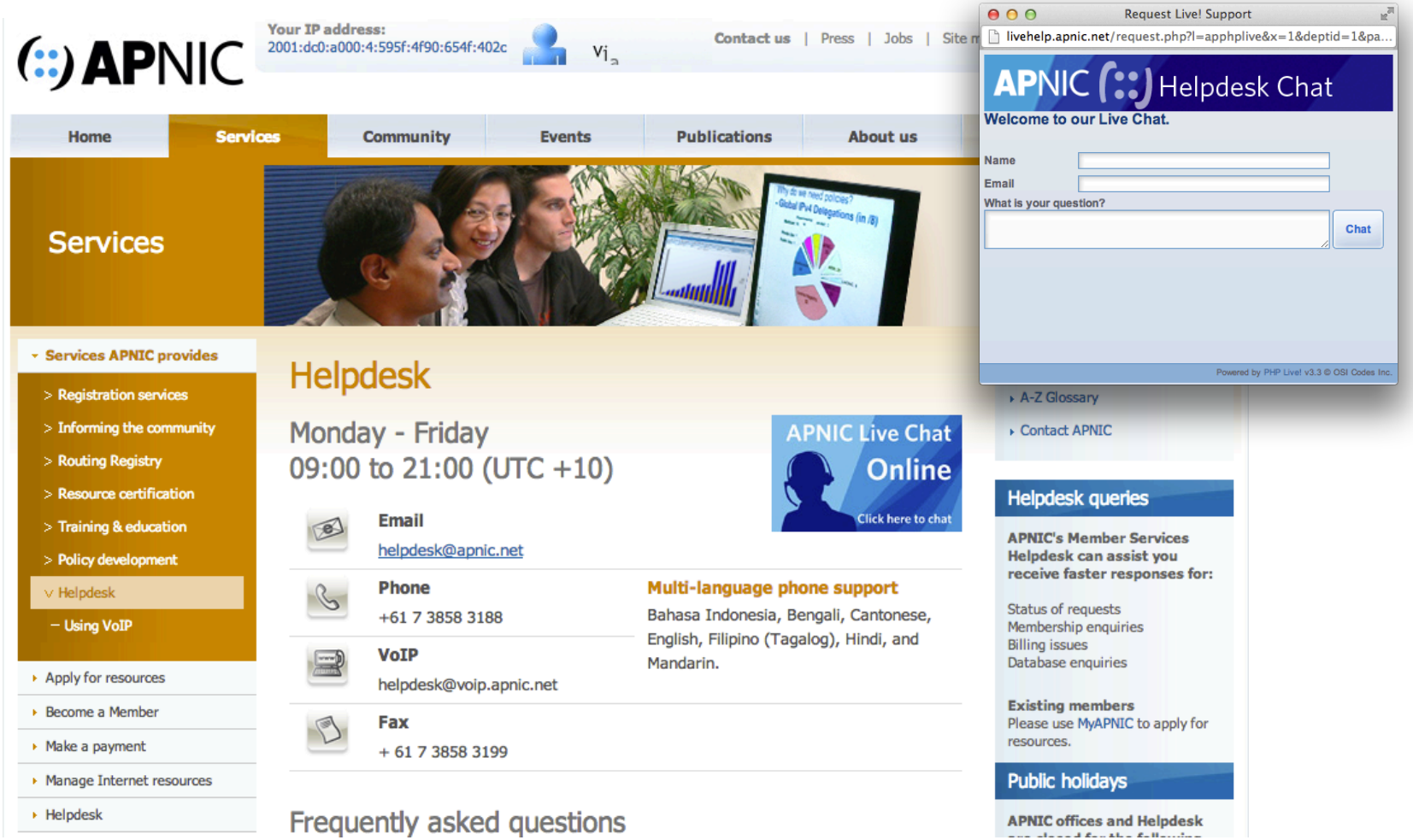
Addressing Tools

- Examples of IP address tools (which support IPv6 too):
  - NetDot netdot.uoregon.edu
  - HaCi sourceforge.net/projects/haci
  - IPAT nethead.de/index.php/ipat
  - ipv6gen techie.devnull.cz/ipv6/ipv6gen/
  - sipcalc www.routemeister.net/projects/sipcalc/
  - freeipdb home.globalcrossing.net/~freeipdb/

Questions

- Please remember to fill out the feedback form
  - <survey-link>
- Slide handouts will be available after completing the survey

APNIC Helpdesk Chat



Thank You!

End of Session

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