Welcome!
APNIC Tutorial

Internet Resource Management Essentials

26 February 2007, Bali, Indonesia

In conjunction with APRICOT 2007

Introduction

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Assumptions & Objectives

Assumptions

- Are current or prospective APNIC member
- Have not submitted many requests
- Are not familiar / up-to-date with policies
- Are not familiar with procedures

Objectives

- Teach members how to request resources from APNIC
- Keep membership up-to-date with latest policies
- Liaise with members
  - ☺ Faces behind the e-mails

Overview

- Introduction to APNIC
- APNIC community & policy development
- APNIC policies – allocation and assignment
- ISP request evaluation
- Assignment and sub-allocation procedures
- The whois database
- Privacy of customer assignments
- MyAPNIC
- AS Number
- IPv6

Introduction to APNIC

Asia Pacific Network Information Centre

What is APNIC?

- Regional Internet Registry (RIR) for the Asia Pacific region
  - One of five RIRs currently operating around the world
  - Non-profit, membership organisation
    - Open participation, democratic, bottom-up processes
  - Responsible for distributing Internet resources throughout the AP region
- Industry self-regulatory body
  - Consensus-based, open, and transparent decision-making and policy development
- Meetings and mailing lists
  - Open to anyone
  - http://www.apnic.net/meetings/23/index.html
  - http://www.apnic.net/community/lists/index.html

What does APNIC do?

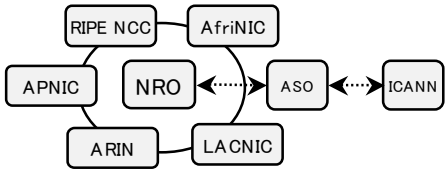
Resource service	Policy development

• IPv4, IPv6, ASNs
• Reverse DNS delegation
• Resource registration
  • Authoritative registration server
  • whois
  • IRR
	• Facilitating the policy development process
	• Implementing policy changes

Information dissemination	**Training & Outreach**

• APNIC meetings
• Web and ftp site
• Publications, mailing lists
• Outreach seminars
 	
http://www.apnic.net/community/lists/
	• Training
	  • Internet Resource management
	  • DNS workshops
	
	- Subsidised for members
	
	Schedule:
	http://www.apnic.net/training

Global policy coordination



The main function of ASO:

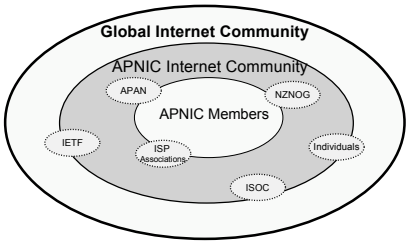
- ASO receives global policies and policy process details from the NRO
- ASO forwards global policies and policy process details to ICANN board

Questions ?

APNIC Community & Policy Development

You are part of APNIC community!

- **Open** forum in the Asia Pacific
  - Open to any interested parties

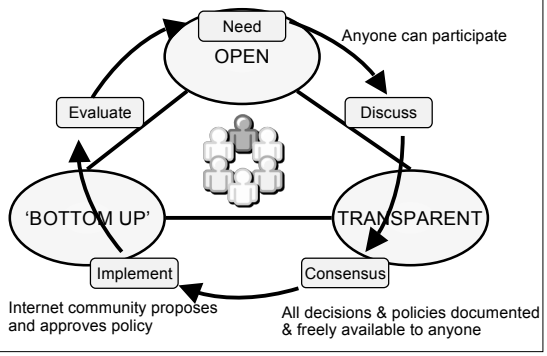


– A voice in regional Internet operations through participation in APNIC

Participation in policy development

- Why should I bother?
  - Responsibility as an APNIC member
    - To be aware of the current policies for managing address space allocated to you
  - Business reasons
    - Policies affect your business operating environment and are constantly changing
    - Ensure your 'needs' are met
  - Educational
    - Learn and share experiences
    - Stay abreast with 'best practices' in the Internet

Policy Development Process



The policy development process

Need Discuss Consensus Implement

You can participate!
More information about policy development can be found at:
http://www.apnic.net/docs/policy/dev

How to make your voice heard

- Contribute on the public mailing lists
  - http://www.apnic.net/community/lists/index.html
- Attend meetings
  - Or send a representative
  - Watch webcast (video streaming) from the meeting web site
  - Read live transcripts from the meeting web site
  - And express your opinion via Jabber chat
- Give feedback
  - Training or seminar events

Next APNIC meetings

- 23rd APNIC Open Policy Meeting
  - –In conjunction with APRICOT 2007, Bali, Indonesia
    - 27 Feb - 2 Mar 2007
- 24th APNIC Open Policy Meeting
  - –New Delhi, India
    - 29 Aug - 7 Sep 2007
- Sponsorships available
  - Please talk to any APNIC staff

Questions ?

APNIC policies

Allocation and assignment

Allocation

"A block of address space held by an IR (or downstream ISP) for subsequent allocation or assignment"

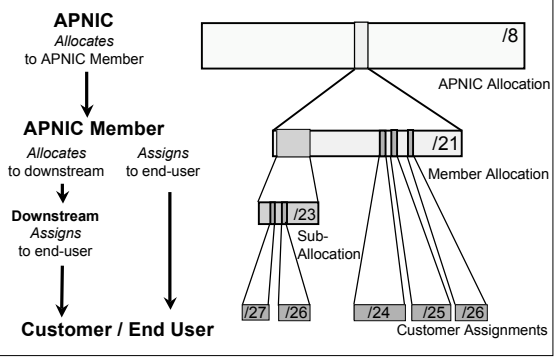
- Not yet used to address any networks

Assignment

"A block of address space used to address an operational network"

- May be provided to LIR customers, or used for an LIR's infrastructure ('self-assignment')

Allocation and assignment



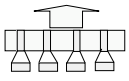
Portable & non-portable

Portable Assignments

- Customer addresses independent from ISP
  - Keeps addresses when changing ISP
- Bad for size of routing tables
- Bad for QoS: routes may be filtered, flap-dampened

Non-portable Assignments

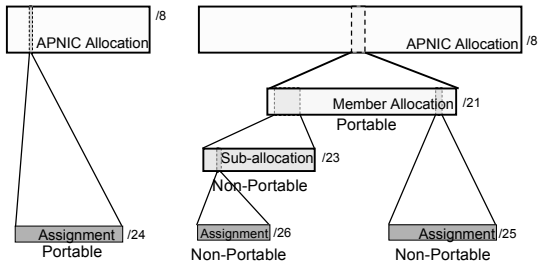
- Customer uses ISP's address space
  - Must renumber if changing ISP
- Only way to effectively scale the Internet



Portable allocations

- Allocations made by APNIC/NIRs"

Address management hierarchy



•Describes "portability" of the address space

Internet resource management objectives

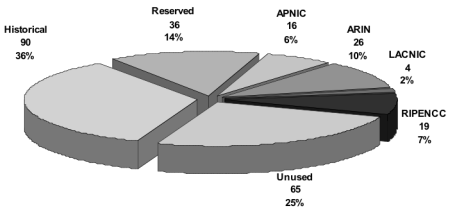
Conservation
- Efficient use of resources
- Based on demonstrated need

Aggregation
- Limit routing table growth
- Support provider-based routing

Registration
- Ensure uniqueness
- Facilitate trouble shooting

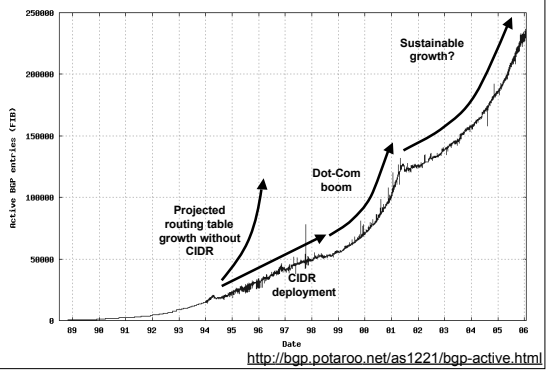
Uniqueness, fairness and consistency

Why do we need policies?
- Global IPv4 Delegations



Last update: Mar 2006

Growth of global routing table



http://bgp.potaroo.net/as1221/bgp-active.html

APNIC policy environment

"*IP addresses not freehold property*"

- Assignments & allocations on license basis
  - Addresses *cannot* be bought or sold
  - Internet resources are public resources
  - 'Ownership' is contrary to management goals

"Confidentiality & security"

- APNIC to observe and protect trust relationship
  - Non-disclosure agreement signed by staff

APNIC allocation policies

- Aggregation of allocation
  - Provider responsible for aggregation
  - Customer assignments /sub-allocations must be non-portable
- Allocations based on demonstrated need
  - Detailed documentation required
    - All address space held to be declared
  - Address space to be obtained from one source
    - routing considerations may apply
  - Stockpiling not permitted

Initial IPv4 allocation

- Initial (portable) allocation: /21 (4096 addresses).
  - The allocation can be used for further assignments to customers or your own infrastructure.
  - Lowered from /20 as APNIC 17 consensus (Aug 2004)

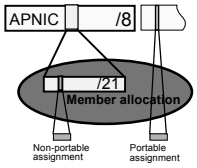
Criteria

1a. Have used a /23 from upstream provider
Demonstrated efficient address usage

OR

1b. Show immediate need for /23
Can include customer projections & infrastructure equipment

2. Detailed plan for use of /22 within 1 year
3. Renumber to new space within 1 year



APNIC allocation policies

- Transfer of address space
  - Not automatically recognised
    - Return unused address space to appropriate IR
- Effects of mergers, acquisitions & take-overs
  - Will require contact with IR (APNIC)
    - contact details may change
    - new agreement may be required
  - May require re-examination of allocations
    - requirement depends on new network structure

Portable assignments

- Small multihoming assignment policy
  - *For (small) organisations who require a portable assignment for multi-homing purposes*

Criteria

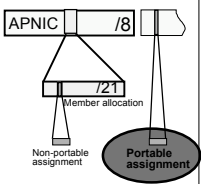
1a. Applicants currently multihomed

OR

1b. Demonstrate a plan to multihome within 1 month

2. Agree to renumber out of previously assigned space

Demonstrate need to use 25% of requested space immediately and 50% within 1 year



Policy for IXP assignments

- Criteria
  - 3 or more peers
  - Demonstrate “open peering policy”
- APNIC has a reserved block of space from which to make IXP assignments

Sub-allocation guidelines

- Sub-allocate cautiously
  - Seek APNIC advice if in doubt
  - If customer requirements meet min allocation criteria:
    - Customers should approach APNIC for portable allocation
- Efficient assignments
  - LIRs responsible for overall utilisation
    - Sub-allocation holders need to make efficient assignments
- Database registration
  - Sub-allocations & assignments to be registered in the db

Portable critical infrastructure assignments

- What is Critical Internet Infrastructure?
  - Domain registry infrastructure
    - Root DNS operators, gTLD operators, ccTLD operators
  - Address Registry Infrastructure
    - RIRs & NIRs
    - IANA
- Why a specific policy ?
  - Protect stability of core Internet function
- Assignment sizes:
  - IPv4: /24
  - IPv6: /32

Supporting historical resource transfer

- Bring historical resource registrations into the current policy framework
  - Allow transfers of historical resources to APNIC members
    - the recipient of the transfer must be an APNIC members
    - no technical review or approval
    - historical resource holder must be verified
    - resources will then be considered "current"
- Address space subject to current policy framewor

Questions ?

Material available at: www.apnic.net/training/recent/

ISP request and evaluation

ISP address request

members only

- Hostmaster Administrivia
  - <hostmaster@apnic.net> mailbox filtered
    - Requires member account name
      - Subject: IP Address Request [CONNECT-AU]
- Ticketing system
  - Every request is assigned a ticket
    - Please keep # in subject line of email eg.
      - [APNIC #14122] [CHINANET-CN]
- New staff at ISP
  - Require an 'introduction' to APNIC
    - To ensure confidentiality

ISP address request - Overview

- Contact Details
- Network Information
- Existing Customer Network Information
- Existing Infrastructure Network Information
- Future Network Plan
- Additional Information

ISP address request instructions

- Complete the documentation
  - ISP Address Request Form

    - Web Form:
      - http://www.apnic.net/services/ipv4/
    - Plain text
      - http://ftp.apnic.net/apnic/docs/isp-address-request
- The more detailed and precise
  - Fewer iterations with APNIC
    - Quicker resolution time
- *Read the quick tips!*
  http://www.apnic.net/faq/isp-request-tips.html

ISP request evaluation

- 'Infrastructure' & 'network-plan'
  - Policy
    - Technical descriptions are detailed enough so APNIC can understand why subnet size was chosen
    - Do customer projections match infrastructure plans?
    - Efficient subnet assignments
  - 'Best current practice'
    - Name based virtual web hosting
    - Dynamic dial up

Additional Information - Topology & deployment

- POP topology
  - Diagrams showing network design
  - Diagrams showing POP design
    - does network/POP topology description correlate with addressing plan and current infrastructure?
    - larger requests will require additional documentation
- Deployment plan
  - Give details of phases of deploying equipment
    - does deployment plan match information in network-plan fields?

Additional Information - Equipment and services

- Equipment and services
  - Specifications, number of ports
    - information that cannot fit onto fields of form
  - Details of how implement services
    - explain acronyms or special services
- Miscellaneous
  - Anything not covered by the form, anything unusual also can be declared
    - Supplementary information very useful to the hostmaster when evaluating your request

Additional information - Renumbering & return policy

- Renumbering?
  - one-for-one exchange to assist renumbering
  - needs confirmation from upstream ISP to confirm renumbering will take place
- 'No Questions Asked' return prefix policy
  - swap 3 or more discontiguous prefixes (ISP or customers) for single prefix, no charge
    - ftp://ftp.apnic.net/apnic/docs/no-questions-policy
  - Form for returning addresses
    - ftp://ftp.apnic.net/apnic/docs/address-return-request

Virtual web hosting

- Name based hosting
  - '*Strongly recommended*'
    - Use 'infrastructure' field to describe web servers
- IP based hosting
  - Permitted on technical grounds
    - SSL, virtual ftp..
    - Use 'infrastructure' field to describe web servers
  - Special verification for IP based
    - If more than /22 used for this purpose
    - Requestor must send list of URLs of virtual domain and corresponding IP address

Cable, DSL services

- 1:1 contention ratio
  - Can be either statically or dynamically assigned
  - Means 1 IP address per customer
- Greater than 1:1 contention ratio
  - Preferred because conserves address space
- Choice of addressing is optional for members
  - dynamic addressing is encouraged
- Verification for DSL Services
  - Equipment details
    - Ex: BRAS, Number of ports
  - Purchase receipts

Evaluation by APNIC

- All address space held should be documented
  - Check other RIR, NIR databases for historical allocations
- 'No reservations' policy
  - Reservations may never be claimed
  - Fragments address space
  - Customers may need more or less address space than is actually reserved

First allocation

- Must meet criteria
  - (discussed in policy section)
- Requires clear detailed and accurate request
- Implementation of 'Best Current Practice'
- Efficient assignments planned
- Always a /21 'slow start'
  - Exceptions made for very large networks but not common

Subsequent allocations

- 80% overall utilisation
  - Unless large assignment pending
- Demonstrated conservative assignments
- Correct customer registrations in db
  - Need to fix inconsistencies before next allocation
- Allocation size to cover 1 year need
  - Based on previous utilisation rate
- Contiguous allocation not guaranteed
  - But every effort made

Questions ?

Assignment and sub-allocation procedures

Assignment Window &
2nd Opinion process

Second opinion request

- Assignment Window
- Second Opinion Request Form
- Evaluation

What is an Assignment Window?

"The amount of address space a member may assign without a 'second opinion'"

- All members have an AW
  - Starts at zero, increases as member gains experience in address management
- Second opinion process
  - Customer assignments require a 'second-opinion' when proposed assignment size is larger than members AW

Assignment Window

- Size of assignment window
  - Evaluated after about five 2nd-opinion requests
  - Increased as member gains experience and demonstrates understanding of policies
    - Prefix length normally reduced by 1 bit at a time
    - Assignment window may be reduced, in rare cases
- Why an assignment window?
  - Monitoring ongoing progress and adherence to policies
  - Mechanism for member education

Second opinion request form

2nd Opinion

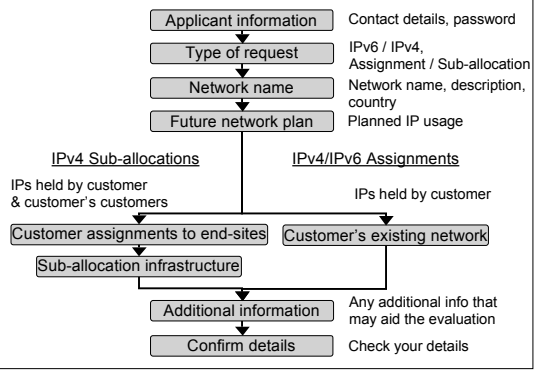
Used to seek approval for:

- IPv4 assignments & sub-allocations
- Multiple/additional IPv6 /48s to a single customer

Before you start:

- Separate form for each request
- Help buttons available
- Form can be saved by use of password

Overview of 2nd opinion form



2nd opinion evaluation (policy)

- Efficiency
  - More than 50% used in any one subnet?
  - Can different subnet sizes be used?
  - More than 80% used for previous assignment?
- Stockpiling
  - Is all address space held declared on form?
  - Has organisation obtained address space from more than one member/ISP?
- Registration
  - Is previous assignment in APNIC database and are they correct and up to date?

2nd opinion evaluation

- APNIC & Member evaluation
  - Should be the same
    - If NO, APNIC will ask member to obtain more information
      - iterative process
    - If YES, APNIC approves 2nd opinion request

2nd opinion request approval

```
Dear XXXXXXX,

APNIC has approved your "second opinion" request to make
  the following assignment:

     [netname]

     [address/prefix]

* Please ensure that you update the APNIC whois database
  to register this assignment before informing your
  customer or requesting reverse DNS delegation. Do this
  using the form at:

     http://www.apnic.net/apnic-bin/inetnum.pl

Important:

  Unregistered assignments are considered as "unused"
```


Customer assignment

- Member updates internal records
  - Select address range to be assigned
  - Archive original documents sent to APNIC
  - Update APNIC database
- Clarify status of address space
  - APNIC requirement is 'Non portable'
  - 'Portable' assignments are made by APNIC only with the end-user request form
    - Organisation must have technical requirement

Questions ?

The APNIC Whois Database

Introduction and usage

What is the APNIC database?

- Public network management database
  - Operated by IRs
    - Public data only
    - For private data: Please see “Privacy of customer assignment” module
- Tracks network resources
  - IP addresses, ASNs, Reverse Domains, Routing policies
- Records administrative information
  - Contact information (persons/roles)
  - Authorisation

Object types

OBJECT	PURPOSE
person	contact persons
role	contact groups/roles
inetnum	IPv4 addresses
inet6num	IPv6 addresses
aut-num	Autonomous System number
domain	reverse domains
route	prefixes being announced
mntner	(maintainer) data protection

http://www.apnic.net/db/

Object templates

To obtain template structure*, use :
whois -t <object type>

```
% whois -h whois.apnic.net -t person

person:   [mandatory]  [single]     [primary/look-up key]
address:  [mandatory]  [multiple]   [ ]
country:  [mandatory]  [single]     [ ]
phone:    [mandatory]  [multiple]   [ ]
fax-no:   [optional]   [multiple]   [ ]
e-mail:   [mandatory]  [multiple]   [look-up key]
nic-hdl:  [mandatory]  [single]     [primary/look-up key]
remarks:  [optional]   [multiple]   [ ]
notify:   [optional]   [multiple]   [inverse key]
mnt-by:   [mandatory]  [multiple]   [inverse key]
changed:  [mandatory]  [multiple]   [ ]
source:   [mandatory]  [single]     [ ]
```

*Recognised by the RIPE whois client/server

Person object example

– Person objects contain contact information

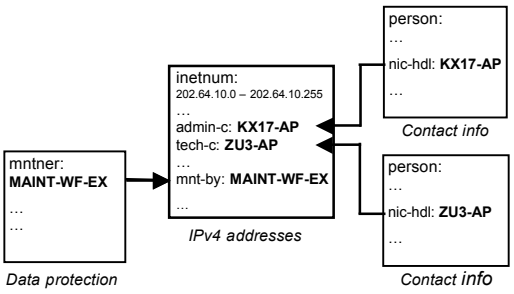
Attributes	Values
person:	Ky Xander
address:	ExampleNet Service Provider
address:	2 Pandora St Boxville
address:	Wallis and Futuna Islands
country:	WF
phone:	+680-368-0844
fax-no:	+680-367-1797
e-mail:	kxander@example.com
nic-hdl:	KX17-AP
mnt-by:	MAINT-WF-EX
changed:	kxander@example.com 20020731
source:	APNIC

Inetnum object example

– Contain IP address allocations / assignments

Attributes	Values
inetnum:	202.51.64.0 - 202.51.95.255
netname:	CCNEP-NP-AP
descr:	Communication & Communicate Nepal Ltd
descr:	VSAT Service Provider, Kathmandu
country:	NP
admin-c:	AS75-AP
tech-c:	AS75-AP
mnt-by:	APNIC-HM
mnt-lower:	MAINT-NP-ARUN
changed:	hostmaster@apnic.net 20010205
status:	ALLOCATED PORTABLE
source:	APNIC

Inter-related objects



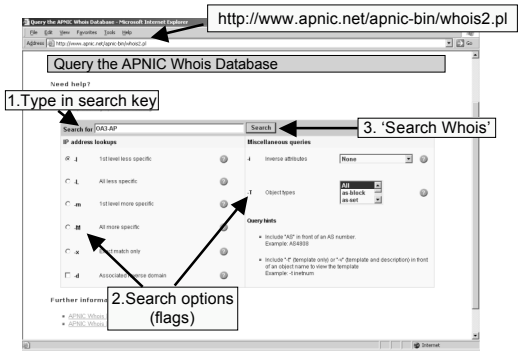
Whois database query - clients

- Standard whois client
  - Included with many Unix distributions
  - RIPE extended whois client
    - http://ftp.apnic.net/apnic/dbase/tools/ripe-dbase-client.tar.gz
- Query via the APNIC website
  - http://www.apnic.net/apnic-bin/whois2.pl
- Query clients - MS-Windows etc
  - Many available

Why use the whois database?

- Register use of Internet Resources
  - Reverse DNS, IP assignments (public data), etc.
  - Ascertain custodianship of a resource
  - Fulfill responsibilities as resource holder
- Obtain details of technical contacts for a network
  - Investigate security incidents
  - Track source of network abuse or “spam” email

Whois database query - web



Creating a person object

Whois Database Guide:
http://www.apnic.net/services/whois_guide.html

1. Fill out person object form on web
   - Name, e-mail, phone, address etc
   - Tick 'MNT-NEW' for temporary protection

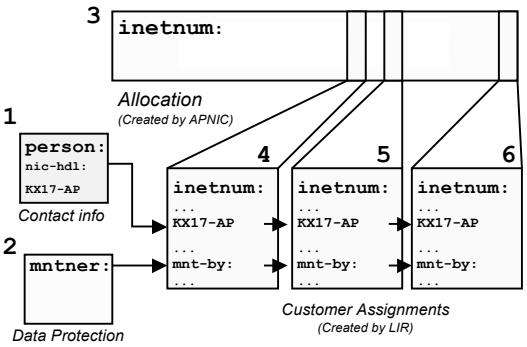
2. Completed template is sent to you
3. Forward template to <auto-dbm@apnic.net>
4. Person object created and nic-hdl is generated

LIR registration responsibilities

1. Create person objects for contacts
   - To provide contact info in other objects
2. Create mntner object
   - To provide protection of objects
     - (To be discussed later)

3. Create inetnum objects for all customer address assignments as private data
   - But you may change to be public data if you wish
   - Allocation object created by APNIC

Using the db – step by step



Whois database auto-responses

- Successful update SUCCEEDED
  - Objects accepted
- Warnings
  - Objects accepted but ambiguous
  - Objects corrected and accepted
- Errors FAILED
  - Objects NOT accepted

Don't understand the error message?

1. Help documentation
   - http://www.apnic.net/docs/database-update-info.html
2. Contact <helpdesk@apnic.net>
   - Include the error message

Role object

- Represents a *group* of contact persons for an organisation
  - Eases administration
  - Can be referenced in other objects instead of the person objects for individuals
- Also has a nic-hdl
  - Eg. HM20-AP

http://www.apnic.net/db/role.html

Creating a role object

- Email
  - Whois –t role
    - Gives role object template
  - Complete all fields
    - With the nic-hdls of all contacts in your organisation
  - Send to <auto-dbm@apnic.net>

Replacing contacts in the db
– using a role object

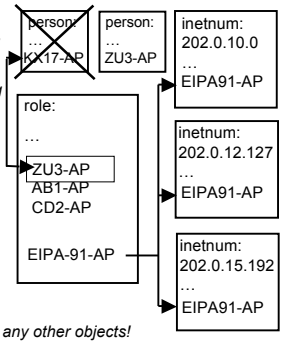
K. Xander is leaving my organisation. Z. Ulrich is replacing him.

I am using a role object containing all contact persons, which is referenced in all my objects.

1. Create a person object for new contact (Z. Ulrich).

2. Replace old contact (KX17-AP) with new contact (ZU3-AP) in role object

3. Delete old contact's person object.



No need to update any other objects!

The Whois database

Protection and updating

Database protection - maintainer object

mntner:	MAINT-WF-EX
descr:	Maintainer for ExampleNet Service Provider
country:	WF
admin-c:	ZU3-AP
tech-c:	KX17-AP
upd-to:	kxander@example.com
mnt-nfy:	kxander@example.com
auth:	CRYPT-PW apHJ9zF3o
mnt-by:	MAINT-WF-EX
referral-by:	MAINT-APNIC-AP
changed:	kxander@example.com 20020731
source:	APNIC

- protects other objects in the APNIC database

Creating a maintainer object

1. Fill out webform
   - Provide:
     - Admin-c & tech-c
     - password
     - email address etc

2. Completed form will be sent to you
3. Forward request to maint-request@apnic.net
4. Maintainer will be created *manually*
   - Manual verification by APNIC Hostmasters
5. Update your person object with mntner

http://www.apnic.net/services/whois_guide.html

Mnt-by & mnt-lower

- 'mnt-by' attribute
  - Can be used to protect any object
  - Changes to protected object must satisfy authentication rules of 'mntner' object.
- 'mnt-lower' attribute
  - Also references mntner object
  - Hierarchical authorisation for inetnum & domain objects
  - The creation of child objects must satisfy this mntner
  - Protects against unauthorised updates to an allocated range - highly recommended!

Authentication/authorisation

– APNIC allocation to member

• Created and maintained by APNIC

```
Inetnum:     203.146.96.0 - 203.146.127.255
netname:     LOXINFO-TH
descr:       Loxley Information Company Ltd.
Descr:       304 Suapah Rd, Promprab,Bangkok
country:     TH
admin-c:     KS32-AP
tech-c:      CT2-AP
mnt-by:      APNIC-HM
mnt-lower:   LOXINFO-IS
changed:     hostmaster@apnic.net 19990714
source:      APNIC
```

① ②

1. Only APNIC can change this object
2. Only Loxinfo can create assignments within this allocation

Authentication/authorisation

– Member assignment to customer

• Created and maintained by APNIC member

```
Inetnum:     203.146.113.64 - 203.146.113.127
netname:     SCC-TH
descr:       Sukhothai Commercial College
Country:     TH
admin-c:     SI10-AP
tech-c:      VP5-AP
mnt-by:      LOXINFO-IS
changed:     voraluck@loxinfo.co.th 19990930
source:      APNIC
```

Only LOXINFO-IS can change this object

APNIC Whois Database update process

- Update transactions
  - Create a new object
  - Change an object
  - Delete an object

- Updates are submitted by email
  - Applies to public data only
    - E-mail to: <auto-dbm@apnic.net>
- Email message contains template representing new or updated object

APNIC Whois database update process

- Successful update
  - If Parse and Auth. steps succeed, database is updated
  - Confirmation by email to requestor

- Mirror to public server
  - Updates mirrored to “whois.apnic.net”
    - may take up to 5 minutes

Deleting a public object

- Copy object as-is in database into email
- Add your maintainer password
- Leave the changed attribute

```
inetnum:     202.182.224.0 - 202.182.225.255
netname:     SONY-HK
...
mnt-by:      MAINT-CNS-AP
changed:     ph@macroview.com 19990617
source:      APNIC
password:    x34zky
delete:      no longer required me@company.com
```

Note: Referenced objects cannot be deleted (02/99)

Forgotten the password?

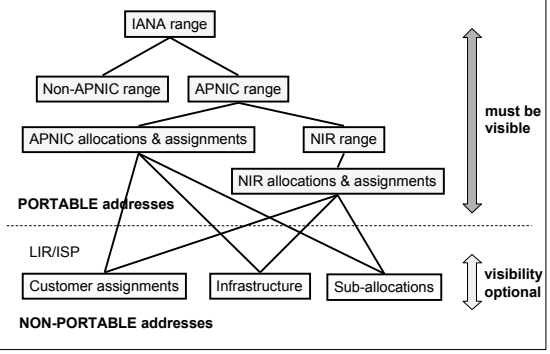
- If you are an APNIC member
  - Are you an APNIC’s authorised contact?
  - If yes,
    - send a request for password reset to helpdesk@apnic.net
  - If no,
    - become an authorised contact first
    - http://www.apnic.net/info/faq/isp-request-tips.html#2
- If you are not an APNIC member and you are holding legacy space
  - Send your request for password reset to helpdesk@apnic.net
  - Go through necessary procedures to confirm your custodianship before resetting password

Privacy of customer assignments

Customer privacy

- Privacy issues
  - Concerns about publication of customer information
  - Increasing government concern
- APNIC legal risk
  - Legal responsibility for accuracy and advice
  - Damages incurred by maintaining inaccurate personal data
- Customer data is hard to maintain
  - APNIC has no direct control over accuracy of data
- Customer assignment registration is still mandatory

What needs to be visible?

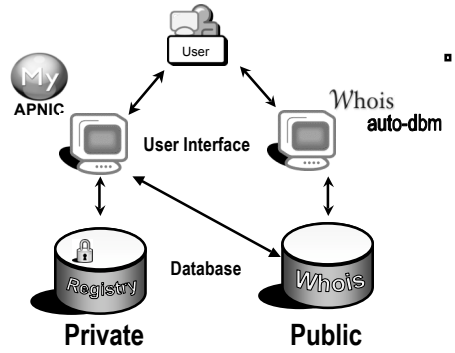


MyAPNIC

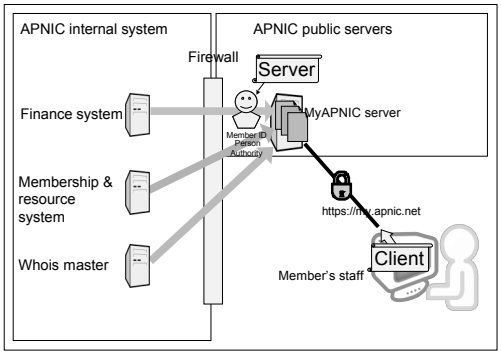
MyAPNIC

A day-to-day tool to manage your APNIC account and resources

Database tools



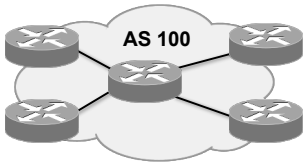
How it works



MyAPNIC demo

Autonomous System Numbers

What is an Autonomous System?



- Collection of networks with same routing policy
- Usually under single ownership, trust and administrative control

When do I need an ASN?

- When do I need an AS?
  - Multi-homed network to different providers and
  - Routing policy different to external peers
  - RFC1930: Guidelines for creation, selection and registration of an Autonomous System

When don't I need an ASN?

- Factors that don't count
  - Transition and 'future proofing'
  - Multi-homing to the same upstream
    - RFC2270: A dedicated AS for sites homed to a single provider
  - Service differentiation
    - RFC1997: BGP Communities attribute

Requesting an ASN

- Complete the request form
  - web form available:
    - http://www.apnic.net/db/aut-num.html
- Request form is parsed - real time
  - Must include routing policy
    - multiple import and export lines
  - Is checked for syntactical accuracy
    - based on RPSL (rfc2622)
  - Peers verified by querying routing table
  - [NO-PARSE] will not send request to parser

Requesting an ASN - Customers

1. Requested directly from APNIC
   - AS number is “portable”
2. Requested via member
   - ASN is “non-portable”
   - ASN returned if customer changes provider

- Transfers of ASNs
  - Need legal documentation (mergers etc)
  - Should be returned if no longer required

4 byte AS number

Updated Jan 2007

This modules is developed based on several articles written by Geoff Huston, APNIC Chief Scientist and George Michaelson, APNIC Senior R&D Officer

Background

- Current 2 byte ASN (16 bits)
  - Possibly run into the exhaustion by 2010
  - 4 byte ASN (32 bits) is developed by IETF
- 4 byte ASN distribution policy
  - Reached consensus in APNIC in 2006
- Timeline
  - APNIC started allocating 4 byte ASN upon specific request Jan 2007, default 2 byte ASN
  - Jan 2009: Default 4 byte ASN, 2 byte ASN on request
  - Jan 2010: 4 byte ANS only

Canonical textual form of 4 byte ASN

- 4 byte only ASN
  - MUST be represented as two pairs of 16 bit decimal values with no leading zeros, separated by the "." character.
  - <high order 16 bit value in decimal> . <low order 16 bit value in decimal>
    - E.g., a 4 byte ASN of decimal value 65546
    - 1.10
- 4byte ASN
  - If their value lies in the range 0 – 65535
    - 4 byte ASN may be represented identically as 2 byte only ASN.
  - Otherwise, they MUST be represented identically as for 4 byte only ASN.
    - For values in the range 0 – 65535 the canonical 4 byte ANS representation
    - 0. <16 bit decimal value>
- 2 byte only ANS
  - May be represented as a 16 bit value decimal number, with no leading zeros, or "." character.
  - They may be represented as 4 byte ASN.
- APNIC resource range: 2.0 ~ 2.1023

Ref: Canonical Textual Representation of 4 byte AS Numbers, draft-michaelson-4byte-as-repsentation-02

4 byte ASN approach

- Change as little as possible in the BGP spec
- Be 'backward compatible' with 2 byte BGP implementations
- Preserve AS semantics
  - Preserve loop detection capability
  - Preserve AS path length metric
- No 'flag day'
  - Allow 2 byte implementations to continue to operate indefinitely in a mixed 2 / 4 byte AS world

AS path semantics

- AS Path services' two purposes
  - Path length metric
    - The length is used as in path selection
  - Loop detector
    - Presence of your own AS in a path is an indicator of distant vector to stop a loop
- An entirely accurate AS path is not a mandatory
  - But at a minimum you have to preserve
    - Routing path metric
    - Routing loop detecting property

4 byte AS transition

- Think about this space as a set of New / Old boundaries
- Define the New / Old and the Old / New transitions
  - New BGP speakers will have to set up sessions with Old BGP speakers
  - Old BGP speakers will have to set up sessions with New BGP speakers
- Preserve all BGP information at the transition interfaces
  - Translate 4 byte AS path information into a 2 byte representation
  - Tunnel 4 byte AS path information through 2 byte AS domain as an update attribute

4 byte AS transition

- In the 2 byte world we 'lie' about the 4 byte path
  - 4 byte ASes appear as AS23456 in the 2 byte world
    - AS23456 is reserved for use in AS number pool transition.
  - As long as you preserve the integrity of path length and don't change 2 byte values in the 2 byte world
    - BGP works in terms of path metric and loop detection
- In the 4 byte world we preserve 4 byte values of the entire AS path

IPv6 policy and procedures

IPv6 address policy goals

- Efficient address usage
  - Avoid wasteful practices
- Aggregation
  - Hierarchical distribution
  - Aggregation of routing information
  - Limiting number of routing entries advertised
- Minimise overhead
  - Associated with obtaining address space
- Registration, Uniqueness, Fairness & consistency
- Balance conflict of interests

IPv6 initial allocation

- Initial allocation criteria
  - Plan to connect 200 end sites within 2 years
    - Default allocation (“slow start”)
- Initial allocation size is /32
  - Larger initial allocations can be made if justified according to:
    - IPv6 network infrastructure plan
    - Existing IPv4 infrastructure and customer base
- License model of allocation
  - Allocations are not considered permanent, but always subject to review and reclamation

End site assignment policy for IPv6

- The current end site assignment a uniformed size of /48
  - Concerns raised regarding address utilisation efficiency
    - Expecting diversified IPv6 deployment scenarios
- This will be soon changed (March 2007): any size longer than /48
  - Decision is up to LIRs or ISPs
    - Implication: any size between /64 - /48
  - Global coordination is required
  - Assuming the HD ratio changes to a larger value
    - HD ratio measurement unit: /48 => /56
      - Implication: Register all assignments shorter than /56?
    - HD ratio: 0.8 => 0.94
  - Achieve more efficient address utilisation
    - useful lifetime of IPv6 to encompass a period in excess of 100 years
- Current status
  - To be implemented on 09/03/2007

IPv6 utilisation

- Utilisation determined from end site assignments
  - LIR responsible for registration of all /48 assignments
  - Intermediate allocation hierarchy not considered
- Utilisation of IPv6 address space is measured differently from IPv4
  - Use HD ratio to measure
- Subsequent allocation may be requested when IPv6 utilisation requirement is met

Amend IPv6 assignment and utilisation requirement

- IPv6 assignment and utilisation requirement policy
  - HD ratio: 0.8 => 0.94
  - Measurement unit: /48 => /56
- The HD ratio threshold is
  - HD=log(/56 units assigned) / log (16,777,216)
  - 0.94 = 6,183,533 x /56 units
- Calculation of the HD ratio
  - Convert the assignment size into equivalent /56 units
    - Each /48 end site = 256 x /56 units
    - Each /52 end site = 16 x /56 units
    - Each /56 end site = 1 x /56 units
    - Each /60 end site = 1/16 x /56 units
    - Each /64 end site = 1/256 x /56 units
- Current status
  - To be implemented on 09/03/2007 in conjunction with change of end site assignment size

IPv6 utilisation (HD = 0.94)

- The ratio 0.94 will be implemented soon (March 2007)
- Percentage utilisation calculation

IPv6 Prefix	Site Address Bits	Total site address in /56s	Threshold (HD ratio 0.94)	Utilisation %
/42	14	16,384	9,153	55.9%
/36	20	1,048,576	456,419	43.5%
/35	21	2,097,152	875,653	41.8 %
/32	24	16,777,216	6,185,533	36.9%
/29	27	134,217,728	43,665,787	32.5 %
/24	32	4,294,967,296	1,134,964,479	26.4 %
/16	40	1,099,511,627,776	208,318,498,661	18.9 %

RFC 3194

"In a hierarchical address plan, as the size of the allocation increases, the density of assignments will decrease."

Subsequent allocation

- Must meet HD = 0.94 utilisation requirement of previous allocation (subject to change)
  - From March 2007
- Other criteria to be met
  - Correct registrations (all /48s registered)
  - Correct assignment practices etc
- Subsequent allocation results in a doubling of the address space allocated to it
  - Resulting in total IPv6 prefix is 1 bit shorter
  - Or sufficient for 2 years requirement

IXP IPv6 assignment policy

- Criteria
  - Demonstrate 'open peering policy'
  - 3 or more peers
- Portable assignment size: /48
  - All other needs should be met through normal processes
  - /64 holders can "upgrade" to /48
    - Through NIRs/ APNIC
    - Need to return /64

IPv6 portable assignment for multihoming

- The current policy does not allow IPv6 portable assignment to end-sites
  - Obstructs setting redundancy connectivity for stable network operation
  - Size: /48, or a shorter prefix if the end site can justify it
  - To be multihomed within 3 months
  - Assignment from a specified block separately from portable allocations address space
- Current status
  - To be implemented on 09/03/2007

IPv6 policy – have your say!

- Limited experience of policy in action
  - Your feedback very important
  - Policy always subject to change and refinement
- Open discussion list
  - global-v6@lists.apnic.net (all regions)
  - SIG Policy mailing list (APNIC region)
- Documentation
  - FAQ information and more!
    - http://www.apnic.net/services/ipv6_guide.html
  - Guidelines document under development
    - To assist new requestors with policy

How do I apply for IPv6 addresses?

Check your eligibility for IPv6 addresses

Read IPv6 policies

http://www.apnic.net/docs/policy/ipv6-address-policy.html

Read IPv6 guideline

http://www.apnic.net/docs/policy/ipv6-guidelines.html

Do you have an APNIC account?

If not, become an APNIC member or open a non-member account

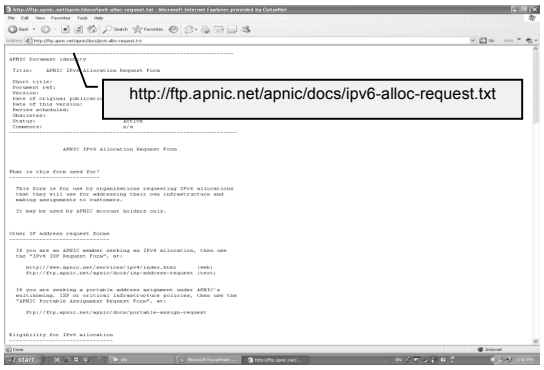
Complete an IPv6 address request form

Submit the form hostmaster@apnic.net

Questions:
email: helpdesk@apnic.net

Helpdesk chat: http://www.apnic.net/helpdesk

IPv6 address request form



IPv6 address request form

- Requester template
  - Name, email, acct-name, org-relationship:
- Network template
  - Netname, descr, country, admin-c, tech-c, remarks, changed, mnt-lower
- IPv6 usage template
  - Services, cust-types, cust-network, infrastructure, network-plan
- Additional information

Member Services Helpdesk

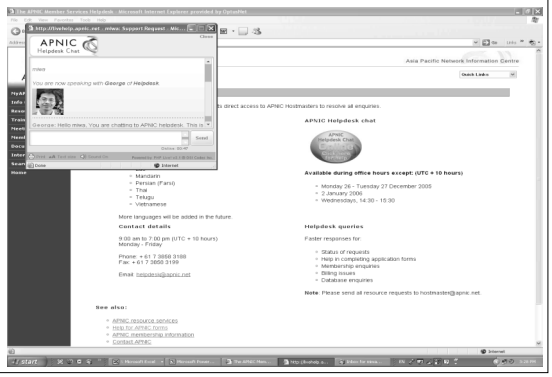
-One point of contact for all member enquiries
-Online chat services

Helpdesk hours
9:00 am – 7:00 pm (AU EST, UTC + 10 hrs)

ph: +61 7 3858 3188 fax: 61 7 3858 3199

- *More personalised service*
  - Range of languages:
    Cantonese, Filipino, Mandarin, Thai, Vietnamese etc.
- *Faster response and resolution of queries*
  - IP resource applications, status of requests, obtaining help in completing application forms, membership enquiries, billing issues & database enquiries

APNIC Helpdesk chat



Thank you !!

Your feedback is appreciated

Material available at:
http://www.apnic.net/training/recent/