# **APNIC Internet Resource Management (IRM) Tutorial**

APNIC

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# Agenda

## Introduction to APNIC

- Policy Development Process
- Internet Registry Policies
- Requesting IP Addresses
- APNIC Whois Database
- Using MyAPNIC
- Autonomous System Numbers
- Reverse DNS
- Resource Certification (RPKI)

# **AP**NIC



# (:) APNIC

- Asia-Pacific Network Information Centre
- One of five Regional Internet Registry (RIRs) charged with ensuring the fair distribution and responsible management of IP addresses and related resources
- A membership-based, not-for-profit organization
- Industry self-regulatory body
  - Open
  - Consensus-based
  - Transparent





## Where is the APNIC Region?







## What does APNIC do? APNIC services Members

### **Resource distribution**

- IP addresses
- AS numbers

### **Registration services**

- reverse DNS
- Internet routing registry
- resource certification
- whois registry





## What does APNIC do? APNIC supports the Asia Pacific region

#### **Policy development**

#### **Capacity building**

- training
- workshops
- conferences
- fellowships
- grants

#### Infrastructure

- root servers
- IXPs
- engineering assistance





## What does APNIC do? APNIC collaborates with the Internet community

**Original research** 

Data collection and measurements

**Publications** 

Local/regional/global events

**Government outreach** 

Intergovernmental & technical organizations collaboration

**Internet security** 





## **APNIC in the Internet Ecosystem**



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## **Internet Registry Structure**







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## **APNIC – Vision**

# A global, open, stable, and secure Internet that serves the entire Asia Pacific community.

How we achieve this:

- Serving Members
- Supporting the Asia Pacific Region
- Collaborating with the Internet Community





## **APNIC – Mission**

- Function as the Regional Internet Registry for the Asia Pacific, in the service of the community of Members and others
- Provide Internet registry services to the highest possible standards of trust, neutrality, and accuracy
- Provide information, training, and supporting services to assist the community in building and managing the Internet
- Support critical Internet infrastructure to assist in creating and maintaining a robust Internet environment
- Provide leadership and advocacy in support of its vision and the community
- Facilitate regional Internet development as needed throughout the APNIC community





## **APNIC from a Global Perspective**







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## **APNIC** in the Asia Pacific







## **Global Policy Coordination**



The NRO is a coordinating body for the five regional Internet registries (RIRs)

https://www.nro.net





The purpose of the Address Supporting Organization (ASO) is to review and develop recommendations on Internet Protocol (IP) address policy and to advise the ICANN Board.

https://aso.icann.org/



## Where do IP Addresses come from?







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# **AP**NIC



# **Policy Development**

- Creating a policy environment that supports the region's Internet development
- Developed by the membership and broader Internet community





## You are part of the APNIC community!

## **Open** forum in the Asia Pacific



A voice in regional Internet operations through participation in APNIC





Open

Anyone can participate

## **Bottom up**

Internet community proposes and approves policy

## **Transparent**

All decisions & policies documented & freely available to anyone







### **Before the meeting**

- Submit proposed policy to the APNIC Secretariat
- SIG Chair posts the proposal to mailing list
- Community discusses proposal







## **During the meeting**

- Proposed policies are presented at the Open Policy Meeting (OPM)
- Community comments on the proposal
- If it reaches consensus, SIG Chair reports the decision at the APNIC Member Meeting (AMM)







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## After the meeting

- Within a week, proposal is sent back to mailing list
- A comment period between 4-8 weeks is given
- If it reaches consensus, SIG
  Chair asks the Executive Council
  (EC) to endorse the proposal
- APNIC EC endorses proposal
- APNIC Secretariat implements the policy (minimum of 3 months)









# **Policy Discussions**

- Comment
  - Participants are encouraged to comment on the proposal
- Discuss
  - The Chair encourages discussion about the pros and cons of the proposal
- Show of hands
  - to broadly measure opinion not a vote
- Consensus
  - declared if there are no objections





## **How to Participate**

- Read the policy proposals currently under discussion
- Check out discussions on the Policy SIG mailing list
- Join the discussion at APNIC conferences
  - webcast (live streaming)
  - live transcripts
  - comment on Jabber chat
- Provide your feedback
  - Training or community outreach events











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# **AP**NIC



## **How IP Addresses are Delegated**



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# **Portable and Non-Portable**

- Portable Address
  - Provider-Independent (PI)
  - Assigned by RIR to end-user
  - Keeps addresses when changing ISP
  - Increases the size of routing tables
- Non-portable Address
  - Provider-aggregatable (PA)
  - End-user gets address space from LIR
  - Must renumber if changing upstream provider
  - Can be aggregated for improved routing efficiency



**Customer Assignments** 



**Customer Assignments** 



## **IPv6 Address Management Hierarchy**



Describes "portability" of the address space





# **Aggregation and Portability**

#### Aggregation

(non-portable assignments)

No Aggregation



(portable assignments)



## **IRM 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





# **Growth of the Global Routing Table**

#### 534062 prefixes



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http://www.cidr-report.org/as2.0/

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# **APNIC Policy Environment**

- Internet resources are delegated on a license basis
  - Limited duration (usually one year)
  - Renewable on the following conditions:
    - Original basis of delegation remains valid, and
    - Address space is properly registered at the time of renewal
- Security and confidentiality
  - APNIC to maintain systems and practices that protect the confidentiality of Members' information and their customers




#### **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





## **IPv4 Allocation Policies**

- APNIC IPv4 allocation size per account holder
  - Minimum /24

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- Maximum /21/22 from final /8 block/22 from the recovered block
- According to current allocation from the final /8 block
  - Allocation is based on demonstrated need





#### **IPv4 Sub-allocation**



Customer Assignments

- No max or min size
  - Max 1 year requirement
- Assignment Window & 2nd Opinion
  - applies to both sub-allocation & assignments
  - Sub-allocation holders don't need to send in 2nd opinions



Customer Assignments

# What is an Assignment Window?

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

- All members have an Assignment Window
  - 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 member's Assignment Window





### **Assignment Window**

- Size of Assignment Window
  - Evaluated after about three 2nd-opinion requests
  - Increased as member gains experience and demonstrates understanding of policies
    - Assignment Window may be reduced, in rare cases
- Why an Assignment Window?
  - Monitoring ongoing progress and adherence to policies
  - Mechanism for member education







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## **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"





# **IPv6 Allocation Policies**

- Initial allocation criteria
  - Minimum of /32 IPv6 block
  - Larger than /32 may be justified
- For APNIC members with existing IPv4 space
  - One-click Policy (through MyAPNIC)
- Without existing IPv4 space
  - Must meet initial allocation criteria
- Subsequent allocation
  - Based on HD ratio (0.94)
  - Doubles the allocated address space





# **IPv6 Utilisation (HD = 0.94)**

IPv6 Prefix	Site Address Bits	Total site address in /56	Threshold (HD = 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."



# **IPv6 Sub-allocation**



- All /48 assignments to end sites must be registered
- LIR must submit a second opinion request for assignments greater than /48





### **IPv6 Assignment Policies**

- Assignment address space size
  - Minimum of /64 (only 1 subnet)
  - Normal maximum of /48
- Assignment of multiple /48s to a single end site
  - Documentation must be provided
  - Will be reviewed at the RIR/NIR level
- Assignment to operator's infrastructure
  - /48 per Point-of-Presence of an IPv6 service operator





## **Portable Assignments**

- Small multi-homing assignment
  - For (small) organisations who require a portable assignment for multi-homing purposes
- Criteria
  - Currently multi-homed, or demonstrate a plan to multi-home within 1 month
  - Demonstrate need to use 25% of requested space immediately, and 50% within 1 year



### **IXP Assignments**

- APNIC has a reserved block of space from which to make IXP assignments
- To be used exclusively to connect IXP participant devices to the exchange point
- Criteria:
  - 3 or more peers
  - Demonstrate "open peering policy"
- Assignment size:
  - IPv4: /24
  - IPv6: /48 minimum





## **Portable Critical Infrastructure**

- 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?
  - To protect the stability of core Internet functions
- Assignment sizes:
  - IPv4: /24
  - IPv6: /32 (Maximum)





#### **Sub-allocation Guidelines**

- Sub-allocate cautiously
  - Seek APNIC advice if in doubt
  - If customer requirements meet min allocation criteria, customers can approach APNIC for portable allocation
- Efficient assignments
  - ISPs responsible for overall utilisation
- Database registration (WHOIS database)
  - Sub-allocations & assignments to be registered in the database





### **IPv4 Transfer Policies**

- Between APNIC members
  - Minimum transfer size of /24
  - Source entity must be the currently registered holder of the IPv4 resources
  - Recipient entity will be subject to current APNIC policies
- Inter-RIR IPv4 Transfers
  - Minimum transfer size of /24
  - Conditions on the source and recipient RIR will apply





#### **Historical Resources**

- Internet resources registered under early registry policies without formal agreements and include:
  - Registrations transferred to APNIC as part of the AUNIC to APNIC migration
  - Registrations transferred as part of the Early Registration Transfer (ERX) project
  - Historical APNIC resources

https://www.apnic.net/policy/historical-resource-policies





### **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 member
  - No technical review or approval
  - Historical resource holder must be verified
  - Resources will then be considered "current"
- Address space subject to current policy framework











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# **AP**NIC



## How do I get addresses?

- Decide what kind of number resources you need
   IPv4, IPv6
- Check your eligibility
  - On the website <u>www.apnic.net</u>
  - Contact the helpdesk <u>helpdesk@apnic.net</u>
- Become familiar with the policies
  - www.apnic.net/policy
- Apply for membership and resources





#### **IPv4 Address Space**

#### STATUS OF 256 /8s IPv4 ADDRESS SPACE





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#### Available IPv4 /8s in Each RIR



Source: NRO Q3 2014



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# **Check for Eligibility – IPv4**

- Initial LIR delegation:
  - Have used a /24 from their upstream provider or demonstrate an immediate need for a /24,
  - Have complied with applicable policies in managing all address space previously delegated to it (including historical delegations), and
  - Demonstrate a detailed plan for use of a /23 within a year
- Small multihoming delegation:
  - Currently multihomed with provider-based addresses, or demonstrates a plan to multihome within one month
  - Demonstrate that they are able to use 25% of the requested addresses immediately and 50% within one year





# **Check for Eligibility – IPv4**

- Internet Exchange Points:
  - Eligible to receive a delegation from APNIC to be used exclusively to connect the IXP participant devices to the Exchange Point.
- Critical Infrastructure:
  - If operating in the Asia Pacific region, are eligible to receive a delegation
  - Available only to the actual operators of the network infrastructure performing such functions





# **Check for Eligibility – IPv6**

- APNIC members with IPv4 but no IPv6 automatically qualify for an appropriately sized block of IPv6 addresses.
  - Members with an IPv4 allocation are eligible for a /32 of IPv6
  - Members with an IPv4 assignment are eligible for a /48 of IPv6
- Minimum initial allocation
  - Must be an LIR
  - Not be an end site
  - Plan to announce IPv6 within two years
  - Must meet one of these:
    - Have a plan for making at least 200 assignments to other organizations within two years
    - Be an existing LIR with IPv4 allocations from an APNIC or an NIR, which will make IPv6 assignments or sub-allocations within two years.





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#### **Initial IP Address Request**

- You are required to be an APNIC member in order to initiate your IP address request.
- However, you can apply for membership and request an initial address allocation at the same time.
- <u>http://www.apnic.net/services/become-a-member</u>





#### **New Member Application Form**



Confirmation

#### Applicant **Contact Details**

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#### Clear form and restart

#### **Privacy Collection Statement**

APNIC is collecting personal information from you in order to process your application for APNIC membership. Without this information, APNIC may not be able to process your application.

APNIC may publish your organisation name, phone number and Abuse Contact email address in the public APNIC Whois database.

APNIC has a privacy policy that contains information about:

- · How you may complain about a breach of the Australian Privacy Principles by APNIC, and how APNIC will deal with such a complaint;
- How you may access and seek the correction of the personal information held by APNIC about you.

Please note, while it is unlikely your personal information will be disclosed to any overseas recipient, some of your personal information may be stored by APNIC using computer servers located outside Australia.

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#### Name: \*

Your name

#### Position: \*

Your job position title

#### Email: \*

Your email address

#### Confirm Email: \*

Your email address

#### I am the Corporate Contact: What's this?

No Yes

#### The billing contact is the same as the Corporate Contact:

Yes No

#### Where did you hear about APNIC? \*







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### **New Member Application Form**

- More user-friendly, interactive, and informative
- Member receives quote after application. Invoice issued after approval
- Contacts Management
- Kickstart IPv6 integration
- Essential Whois objects will be created automatically





#### **Applying for Resources - IP**

#### **AP**NIC **New Member Application Form** 2 - 4 3 Applicant Organization IP / ASN Confirmation Do you have any approved resource transfer under the merger/acquisition IP / ASN or historical resource claim policies that will be transferred into this APNIC member account? The information you provide will be No Yes evaluated by APNIC to determine if this request meets the relevant policy Do you want to apply for IP resources or ASN? criteria. No Yes Clear form and restart IP? What type of IP? IPv6 /32 Only My organization is located in the Asia-Pacific region, or I plan to deploy this network in the Asia-Pacific region. No • Yes My organization meets the initial IPv6 allocation criteria. No • Yes ASN? No Yes What are you using the internet resources for? Select all that apply. Access services - fixed line Access services - fixed wireless Access services - mobile Building/Campus/Enterprise Network Communication services (text, voice, video etc.) Consumer services (ATM, kiosk, vending, consumer equipment etc.) Data Center/Hosting/Cloud Services/Content Delivery Network Internet Exchange Point IP transit services (local, national, international) Online services (web portal, gaming, mobile apps etc.) Remote operation, monitoring and measurement Other

Select IPv4 or IPv6 and the block size. Make sure you meet the criteria.





# **Applying for Resources - ASN**

#### ASN?

ASN implementation date: \*

2012-01-01

Please provide details of at least two peering networks.

Peering Network #1	Peering Network #2		
ASN: *	ASN: *		
ASN of peer network	Contact AS		
Contact name: *	Contact name: *		
Contact name	Contact name		
Email: *	Email: *		
Contact email	Contact email		
Phone: *	Phone: *		
+12 1234 5678	+12 1234 5678		

Provide details of two peering networks, and whether you require 2-byte or 4-byte ASN





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### **First Allocation**

- APNIC IPv4 allocation size per account holder
  - Minimum of /24
  - Maximum of /21

/22 from final /8 block/22 from the recovered block

- Initial IPv6 allocation criteria
  - Minimum of /32 IPv6 block
  - Larger than /32 may be justified





#### **Requesting for Additional Resources**

Home	Res	ources	Administration	Training	Tools		
IPv4	IPv6	ASN	Whois updates	Certification	Maintainers	IRTs	
Home / Resource management							

#### Resource management

#### **Internet resources**

· View and manage resources

#### Whois database updates

Add/Update/Delete Whois objects

#### Resource request forms

- IPv4 addresses
- IPv6 addresses
- AS numbers

#### Resource transfer/return

- Transfer resources into another account
- Receive resources into my account
- Transfer pre-approval
- Return resources to APNIC

#### **Resource certification**

Manage certification

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More on how to use MyAPNIC in later sections








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**AP**NIC

Resource Certification (RPKI)

### Resource Registration



## What is the APNIC Database?

- Public network management database
  - Operated by Internet Registries
  - APNIC maintains the database of resources for the AP region
- Tracks network resources
  - IP addresses, ASNs, Reverse DNS delegations, Routing policies
- Records administrative information
  - Contact information (persons/roles) of relevant resource holders
  - Authorization for updating these info
  - Network abuse handling (IRT)





## **Resource Registration**

As part of the membership agreement with APNIC, all members are required to register their resources in the APNIC database.

- Members must keep records up to date
  - $\checkmark$  When ever there is a change in <u>contacts</u>
  - ✓ When <u>new resources</u> are received
  - ✓ When resources are <u>sub-allocated or assigned</u>



# **Whois Object Types**

OBJECT	PURPOSE		
person	Technical or administrative contacts responsible for an object		
role	Technical or administrative contacts represented by a role, performed by one or more people		
inetnum	Allocation or assignment of IPv4 address space		
inet6num	Allocation or assignment of IPv6 address space		
aut-num	Registered holder of an AS number and corresponding routing policy		
domain	<ul> <li>in-addr.arpa (IPv4) or ip6.arpa (IPv6) reverse DNS delegations</li> <li>Single IPv4/IPv6 route injected into the Internet routing mesh</li> </ul>		
route / route6			
mntner	Authorized agent to make changes to an object		
irt	Dedicated abuse handling team		
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## **Objects for New Members**

- If you are receiving your first allocation or assignment, APNIC will create the following objects for you:
  - role object
  - inetnum or inet6num object
  - maintainer object (to protect your data)
  - aut-num object (if you received an ASN)
  - irt object
- Information is taken from your application for resources and membership





## **How to Use APNIC Whois**

- Using a web browser
  - <u>http://www.apnic.net/whois</u>
- Whois client or query tool
  - whois.apnic.net
- Identify network contacts from the registration records
  - IRT (Incident Response Team) if present
  - Contact persons: "tech-c" or "admin-c"





# What if Whois information is invalid?

- Members (LIRs) are responsible for reporting changes to APNIC
  - Under formal membership agreement
- Report invalid ISP contacts to APNIC
  - http://www.apnic.net/invalidcontact
  - APNIC will contact member and update registration details





# What if Whois information is invalid?

- Customer assignment information is the responsibility of the LIR
  - LIR must update their customer network registrations
- Tools such as *traceroute*, *looking glass* and RIS may be used to track the upstream provider if needed





# **Using the Whois – Step by Step**



Data Protection

Customer Assignments (Created by Member)



# Inetnum / Inet6num Objects

- Contains IP delegation information
- APNIC creates an *inetnum* or *inet6num* object for each delegation they make to the Member
- All members must create *inetnum* or *inet6num* objects for each sub-allocation or assignment they make to customers





# **Inet6num Object**

<pre>inet6num: netname: descr: descr: country:</pre>	2406:6400::/32 APNIC-TRAININGIPv6-Lab-AP APNIC TRAINING Lab LEVEL 1, 33 PARK RD AU
admin-c: tech-c: mnt-by: mnt-lower: mnt-routes:	AT480-AP AT480-AP APNIC-HM MAINT-AU-APNICTRAINING MAINT-AU-APNICTRAINING
status: remarks:	ALLOCATED PORTABLE
<pre>remarks: remarks: remarks: remarks: remarks: changed: changed: source:</pre>	This object can only be updated by APNIC hostmasters. To update this object, please contact APNIC hostmasters and include your organisation's account name in the subject line. -+-+-+-+-+-+-+-++-++-++-++-++-++-++-++-





## **Person Object**

- Represents a contact person for an organization
  - Every Member must have at least one contact person registered
  - Large organizations often have several contacts for different purposes
- Is referenced in other objects
- Has a <u>nic-hdl</u> a unique identifier for a person or role object
  - Format: [A-Z][0-9]-AP





## **Person Object**

person:
nic-hdl:

- e-mail:
- address:
- address:
- address:
- phone:
- fax-no:
- country:
- changed:
- mnt-by:
- changed:
- changed:
- source:

Nurul Islam Roman NR97-AP nurul@apnic.net 6 Cordelia Street South Brisbane OLD 4101 +61 7 3858 3100 +61 7 3858 3199 AU nurul@apnic.net 20061128 MAINT-AU-APNICTRAINING hm-changed@apnic.net 20100818 hm-changed@apnic.net 20110624 APNTC





# **Role Object**

- Contains details of technical or administrative contacts as represented by a role performed by one or more people within an organization
- Also has a nic-hdl
- Preferred over *person* object as reference in other objects
  - Eases administration





# **Role Object**

role: address: address: address: country: phone: fax-no: e-mail: admin-c: tech-c: nic-hdl: mnt-by: changed: changed: changed: source:

#### **APNIC Training**

```
6 Cordelia Street
South Brisbane
QLD 4101
AU
+61 7 3858 3100
+61 7 3858 3199
training@apnic.net
NR97-AP
                 Points to a person object
NR97-AP
AT480-AP
MAINT-AU-APNICTRAINING
hm-changed@apnic.net 20080424
hm-changed@apnic.net 20100818
hm-changed@apnic.net 20110624
APNIC
```





# **Replacing Contacts – Person Object**



Customer Assignments (Created by Member)





# **Replacing Contacts – Role Object**

Replace old contact with new contact 3 in Role object role: 2 nic-hdl: AT480-AP person: person: nic-hdl: nic-hdl: . . . tech-c: **KX17-AP BW101-AP BW101-AP** Contact info Contact info Contact info inetnum: inetnum: inetnum: . . . . . . . . . **KX17-AP KX17-AP KX17-AP** . . . . . . . . . mnt-by: mnt-by: mnt-by: . . . . . . • • •

No change in inetnum objects

Customer Assignments (Created by Member)





# **APNIC Whois Web Query**

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Search for Search				
IP addr	ess lookups		Miscellaneous queries	
<b>○</b> -I	1st level less specific	0	-i Inverse attributes None 🗘 🕐	
○ -L	All less specific	0	-T Object types as-block	
○ - <b>m</b>	1st level more specific	2	as-set	
→ -M	All more specific	ې ۱	Query hints	
0			<ul> <li>Include "AS" in front of an AS number. Example: AS4808</li> </ul>	
<b>○ -x</b>	Exact match only	0	<ul> <li>Include "-t" (template only) or "-v" (template and description) in front of an</li> </ul>	
🗆 -d	Associated reverse domain	0	object name to view the template Example: -t inetnum	

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## **Whois Database Queries**



– Flags used for inetnum queries

None one level less specific matches

- L find all less specific matches
- m find first level more specific matches
- M find all More specific matches
- x find exact match (if no match, nothing)
- d enables use of flags for reverse domains
- r turn off recursive lookups





## Whois Database Query - inetnum





### **Recursive Lookups**



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### **Inverse Queries**

- Inverse queries are performed on inverse keys
  - See object template (whois –t)
- Returns all public objects that reference the object with the key specified as a query argument
  - Practical when searching for objects in which a particular value is referenced, such as your nic-hdl
- Syntax: whois -i <attribute> <value>





# **Customer Privacy**

- Public data
  - Includes portable addresses (inetnum objects), and other objects e.g.route objects
  - Public data: must be visible
- Private data
  - Can include non-portable addresses (inetnum objects)
  - Members have the option to make private data visible
- Customer assignments
  - Can be changed to be public data (public data is an optional choice)





### What needs to be visible?







97

## What is a Maintainer?

- Protects objects in the APNIC Whois Database
- Applied to any object created directly below that maintainer object
- Why do we need Maintainer?
  - To prevent unauthorized persons from changing the details in the Whois DB
  - As parts of a block are sub-allocated or assigned, another layer of maintainers is often created to allow the new users to protect their (sub)set of addresses
- Authentication options: CRYPT-PW, MD5, PGPKEY





# **Maintainer Object**

mntner:	MAINT-AU-APNICTRAININ	IG
descr:	APNIC Training	
country:	AU	
admin-c:	NR97-AP	
tech-c:	NR97-AP	
auth:	# Filtered	
mnt-by:	MAINT-AU-APNICTRAININ	1G
upd-to:	nurul@apnic.net	
referral-by:	APNIC-HM	
changed:	hm-changed@apnic.net	20091111
changed:	hm-changed@apnic.net	20091217
changed:	hm-changed@apnic.net	20100528
changed:	hm-changed@apnic.net	20110124
changed:	hm-changed@apnic.net	20131129
source:	APNIC	





# **Mnt-by and Mnt-Lower Attributes**

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





# **Maintainer Hierarchy Diagram**

#### Allocated to APNIC:

Maint-by can only be changed by IANA

#### Allocated to Member:

Maint-by can only be changed by APNIC

#### Sub-allocated to Customer:

Maint-by can only be changed by Member







## **Authentication / Authorization**

```
203.176.189.0 - 203.176.189.255
inetnum:
netname:
               APNIC-TRAINING-IPv4-DATA-CENTRE
descr:
               APNIC Training IPv4 Address for data centre
country:
               AU
admin-c:
               AT480-AP
               AT480-AP
tech-c:
               ASSIGNED PORTABLE
status:
mnt-bv:
               MAINT-AU-APNICTRAINING
mnt-routes:
               MAINT-AU-APNICTRAINING
               remarks:
+ - + - +
remarks:
               This object can only be updated by APNIC
hostmasters.
               To update this object, please contact APNIC
remarks:
               hostmasters and include your organisation's
remarks:
account
               name in the subject line.
remarks:
               remarks:
+-+-+
changed:
               hm-changed@apnic.net 20080424
changed:
               hm-changed@apnic.net 20100818
source:
               APNTC
  Only APNICTRAINING-AU can create assignments within this allocation
```

Only APNIC can change this object

**APNIC** 



## **Whois IRT Contact**

- Incident Response Team (IRT)
  - Dedicated abuse handling teams (not netops)
- IRT objects are mandatory when creating *inetnum*, inet6num and aut-num objects
- Provide an abuse contact email
  - Dedicated team to resolve incidents
  - Efficient and accurate response
  - Stops the tech-c and admin-c from getting abuse reports





# **IRT Object**

irt:

address: address: address: e-mail: e-mail: abuse-mailbox: admin-c: tech-c: auth: mnt-by: changed: changed:

#### IRT-MYAPNIC-TEST-AP

6 Cordelia Street test South Brisbane QLD 4101 helpdesk@apnic.net tamya@apnic.net helpdesk@apnic.net VN61 - APVN61-AP # Filtered MAINT-AU-VIVEK helpdesk@apnic.net 20101108 hm-changed@apnic.net 20110624 APNTC



source:



### **Whois Database Geolocation**

• A latitude/longitude coordinate indicating where users of this network are located. Provides a hint to content and geolocation service providers.





## **Whois Object with Geolocation**

inetnum:	61.45.248.0 - 61.45.255.255
netname:	APNIC-SERVICES-V4
descr:	APNIC Pty Ltd
country:	AU
geoloc:	-27.473057 153.014199
language:	en
admin-c:	AMS11-AP
tech-c:	AH256-AP
status:	ALLOCATED PORTABLE
notify:	helpdesk@apnic.net
mnt-by:	APNIC-HM
mnt-lower:	MAINT-MYAPNIC-AP
mnt-lower:	MAINT-AU-VIVEK
mnt-routes:	MAINT-MYAPNIC-AP
mnt-irt:	IRT-MYAPNIC-TEST-AP
remarks:	$-\!+\!-\!+\!-\!+\!-\!+\!-\!+\!-\!+\!-\!+\!-\!+\!-\!+\!-\!+$
changed:	hm-changed@apnic.net 20140114
changed:	hm-changed@apnic.net 20150106
source:	APNIC











# Agenda

- Introduction to APNIC
- Policy Development Process
- Internet Registry Policies
- Requesting IP Addresses
- Whois Database
- Using MyAPNIC
- Autonomous System Numbers
- Reverse DNS
- Resource Certification (RPKI)

# **AP**NIC


# What is MyAPNIC?

- A secure website that enables Members to manage Internet resources and account interactions with APNIC online
- https://myapnic.net







### **How it Works**







# **Access to MyAPNIC**

- Available to all authorized contacts of APNIC accounts by registering your username and password
- Corporate Contacts can register and get instant access
   <u>www.apnic.net/corporate\_contacts</u>
- Other contacts need their registration approved by their Corporate Contact





# **MyAPNIC Registration**

MyAPNIC / Register

### Registration

APNIC

### **Your details**



https://myapnic.net/register



# **Registration – Corporate Contact**

Login	Register
MyAPNIC	/ Register
Regist	ration
-	
Your	registration
	- gioti di citi
Succe	ss
Succe You ha	ss ve successfully registered for MYAPNIC-TEST-AP.
You ha You wi able to	ss ve successfully registered for MYAPNIC-TEST-AP. Il receive an email shortly containing an activation link that must be clicked for you to b access MyAPNIC.





# **Registration – Corporate Contact**

#### helpdesk@apnic.net to me

Dear Vivek Nigam,

This email confirms your registration to access MyAPNIC for the following account:

MYAPNIC-TEST-AP

Your details are as follows:

Name = Vivek Nigam Username = vn1234 Email address = <u>viveknigam.au@gmail.com</u>

Before you can access MyAPNIC, you will need to click the following link:

https://myapnic.net/auth/ccactivate.html?ctc\_id=314773&uid=vn1234&token=6AF90522-3581-11DF-937C-156A37E08A02

Kind regards,

MyAPNIC





# **Registration – Corporate Contact**



Your access for MYAPNIC-TEST-AP has been activated.





## **Registration – Other Contacts**

Subject: MyAPNIC Registration From: helpdesk@apnic.net v Date: 9:11 AM To: vivek@apnic.net • Dear Vivek Nigam, This email confirms your security code to access MyAPNIC for the following account: MYAPNIC-TEST-AP Your details are as follows: = Vivek Nigam Name Username = viv4 Email address = vivek@apnic.net = wZpmI9iC5P Token Before you can access MyAPNIC, you will need to provide your token to one of the following corporate contact(s) to approve your access. \* Tom H \* George K Kind regards, MyAPNIC





## **Registration – Other Contacts**

Home Resource	es Adminis	tration Train	ing Tools				
Member details	Member details Contact details Access list Billing history Annual fee calculator Correspondence						
Home / Administration / Approve Access							
Approve Acc	ess						
Pending acco	ess						
Date (UTC)	Username	Email address	Authorization code	Billing	Technical	Approve access	Reject access
2012-09-19 06:11:59	NonCorporate	vivek@apnic.net	No9jOwfAec	0	2	Approve	Reject
2011-10-21 05:09:32	Craigtest	george@apnic.net				Approve	Reject
2010-12-21	smarks	smarks@annic.net			-	Approve	Reject

Approve



2010-08-16

23:33:50

flash007

wita@apnic.net



Reject

## **Registration – Other Contacts**

Home	Resources	Administration	Training	Tools				
Member details Contact details Access list Billing history Annual fee calculator Correspondence								
Home / Administration / Approve Access								
Approv	ve Access							

- - Access request successfully approved.

### Pending access

Date (UTC)	Username	Email address	Authorization code	Billing	Technical	Approve access	Reject access
2011-10-21 05:09:32	Graigtest	george@apnic.net				Approve	Reject
2010-12-21 05:38:14	smarks	smarks@apnic.net				Approve	Reject
2010-08-16 23:33:50	flash007	wita@apnic.net				Approve	Reject



# **Multiple Account Access**

Add

lome / My Profile								
My Profile								
Memberships	Password reset	Account permis	sions	Digital certifi	cates			
Active								
Account	Email	address		Position		Corporate	Billing	Technical
APNICTRAINING	-AU vivek@apnic.	net				×	1	×
MYAPNIC-TEST-	AP vivek@apnic.	net				1		1
			Save chan	ges				
Add another	account							
Add anothe	r account							
To access anoth	er account, add the	e account name ar	n <mark>d your</mark> e	email for the ac	ccoun	t below.		
Αссоι	int	Email address		Notifications?				

# **MyAPNIC Digital Certificate**

**Required for:** 

- Online voting
- Resource certification
- Approve other contacts' certificate request







### **Request Certificate**

Home / My Profile

#### My Profile

Memberships Password reset Account permissions Digital certificates

#### **Your certificates**

An APNIC certificate is required to perform certain operations such as Resource Certification and Online Voting. It is also required for a Corporate Contact to approve certificate requests for other account contacts. A certificate is valid for 12 months from the date of issue.

For more information, please see APNIC Digital Certificates.

You have been issued with the following certificate(s):

Serial number	Expiry date
286CB96C96AFC29A	2011-02-25 03:53:37 (expired)
4ED4E607FD85F497	2015-05-11 04:26:24
3F82DE46C7079C50	2015-05-11 04:26:24
777D7A688B77F536	2015-05-11 04:26:24
538E0081E6EC27F5	2015-05-11 04:26:24

If you require an additional certificate, you are advised to use a backup copy of your current valid certificate.

Please only request an additional certificate when you are not able to recover your backup copy.

To request a digital certificate, click on "Request a certificate".

#### Request a certificate

#### **CA certificates**

The APNIC Root CA Certificate is also provided for users that need a trusted authority in their email software, and the email software of correspondents that require secure communication.

Download CA certificate Download root CA certificate

If you have any other queries, please email helpdesk@apnic.net for assistance.



) ()(::**/::/::**)

# **Administration Features**

Vivek   Account: MYAPNIC-TEST-AP									•	<ul> <li>Manage Contag</li> </ul>	cts
	Home	Resour	ces	Administ	ration	Т	raining	Tools	3		
	Member	details	Contac	t details	Access	list	Billing	history		Annual fee calculator	
	Home /	Administra	tion								

### Administration

View your billing history and membership details:

- ->
- Member details
  Contact details
- Access list
- Billing history
- Annual membership fee calculator
- Correspondence





## **Contact Management**

-		
Λ.	2.62	
AI	111	<b>a</b>

anna@apnic.net

[-] anna

Anna's MyAPNIC access privileges

Resource management	View	Update
Resource certification		
ASN, IPv4, IPv6 and AW		
Resource tickets		
Whois database	View	Update
Private objects		$\checkmark$
Domain objects		
Membership administration	View	Update
Membership details (address, phone)		
View billing history, balance and invoice		
Admin tickets		

Voting View Update





### **Resource Management**



#### **Internet resources**

· View and manage resources

#### Whois database updates

Add/Update/Delete Whois objects

#### **Resource request forms**

- IPv4 addresses
- IPv6 addresses
- AS numbers

#### **Resource transfer/return**

- Transfer resources into another account
- Receive resources into my account
- Transfer pre-approval
- Return resources to APNIC

#### **Resource certification**

Manage certification





# **Maintainer Page**

Home / Resource management / Maintainer list

### Maintainer list

When using MyAPNIC to manage your Whois objects, MyAPNIC will retrieve the maintainer and its password from this list. You should ensure that all maintainers referenced by the Whois objects you manage are added to this list. To add a maintainer, please supply the maintainer name and its plain text password in the fields below. If you have reset the password, you must update the password saved in this list. If you do not know your maintainer name or password, please email helpdesk@apnic.net.

Registered maintainers	Auth. method	Password	Delete
MAINT-AU-VIVEK	CRYPT-PW	Valid password	Delete
MAINT-MYAPNIC-AP	CRYPT-PW	Valid password	Delete
MAINT-NEW	CRYPT-PW	Valid password	Delete
Ма	intainer	Password	Add
			Add





## **One-Click IPv6**

- Home
   Resources
   Administration
   Training

   IPv4
   IPv6
   ASN
   Whois updates
   Maintainers

   Home / Resource management
   Home / Resource management
   Maintainers

   IPv6 ASN
   Resource management
   Internet resources
  - View and manage resources

### Whois database updates

Add/Update/Delete Whois objects

### **Resource request forms**

- IPv4 addresses
- IPv6 addresses
- AS numbers

### **Resource transfer/return**

- Transfer resources into another account
- Receive resources into my account
- Return resources to APNIC





## **One-Click IPv6**

Home / Resource management / One-Click IPv6

### One-Click IPv6

Based on your current IPv4 holdings, your membership account is eligible to receive a /32 IPv6 allocation or a /48 IPv6 assignment via this One-click IPv6 feature without having to lodge a separate resource request.

To request a different size of IPv6 resources, please use the IPv6 resource request form located under the "Resources" tab.

By receiving this /32 allocation or /48 assignment, you acknowledge that:

- · you understand the policy implementation; and
- your membership fee will be reviewed at the next renewal as per the Membership fee schedule.

To proceed, please click "Confirm" below to accept this allocation or assignment.







## Manage Resources

Home	Resources	Administration	Training	Tools	
IPv4 I	Pv6 ASN	Whois updates	Certification	Maintainers IRTs	
Home / Re	esource manage	ment			

### Resource management

#### **Internet resources**

View and manage resources

#### Whois database updates

Add/Update/Delete Whois objects

#### **Resource request forms**

- IPv4 addresses
- IPv6 addresses
- AS numbers

#### **Resource transfer/return**

- Transfer resources into another account
- Receive resources into my account
- Transfer pre-approval
- Return resources to APNIC

#### **Resource certification**

Manage certification

Home / Resource management / Summary

### Summary of all resources

1

Pv4 manage		IPv6 manage		ASN manage	
Address range	<u>Length</u>	Address Range	<u>Length</u>	Number	
61.45.248.0	/24	2001:0DF0:000A::	/48	17821	
61.45.249.0	/24	2406:6400::	/32	45192	
61.45.251.0	/24			131107	
61.45.253.0	/24				
203.176.189.0	/24				





## **Sub-allocation**

Home / Resource management / IPv4

### IPv4 resources - all resources

Assignment window

Date last reviewed

Bulk reverse delegations		Add public assignment		Add private assignment	Request more IPv4 addresses		ses
Start IP	Length	Date	Usage	Assignment status	Reverse DNS	Private	Public
61.45.248.0	/24	2010-09-27	100%	-	update		
61.45.249.0	/24	2010-09-27	100%	-	update		
61.45.251.0	/24	2010-04-07	100%	-	update		
61.45.253.0	/24	2010-04-07	100%	-	update		
203.176.189.0	/24	2008-04-24	100%	-	update		
						Select All	Select All
						Downloa	d as .ZIP
Legend:	< 20%	= 20%	= 40%	= 60%	<b>0%</b> ► 80%		



# **Updating Attributes in Parent Object**

Home / Resource management / IPv4 assignments

### IPv4 assignments within/covering 61.45.248.0/24

### **Parent records**

AP

Network name	Start IP	End IP	Maintained by	Changed
APNIC-SERVICES-V4	61.45.248.0	61.45.255.255	APNIC-HM	hm-changed@apnic.net 20150106

### Public records (shown in whois.apnic.net)







## **Requesting Resources**

Home / Resource Management

### Internet number resource request

The current policy for IPv4 address space management in the Asia Pacific region permits each new or existing APNIC account holder to receive delegations totalling a maximum of a /21 since 15 April 2011.

Maximum delegation limit	/21
Received resources	/24
Available resources	7 x /24







## **Whois Updates**

Home / Resource management / Whois update

### MyAPNIC Whois Update

The information you register will be available publicly in the APNIC Whois database, unless the 'Private' option is available and specified.

Add Update Delete Bulk Who	is Updates
Object type	Please select Please select as-set aut-num domain
	filter-set inet-rtr inet6num inetnum irt mntner peering-set
	role route route–set route6 rtr–set





Addir	ng Obje	cts		
	Add Update De	lete Bulk Whois Updates		
		Object type route ‡		
The route object represents a single IPv4 route injected into the Internet mesh. The route attribute is the address prefix of the route and the origin attribute is the AS number of the AS that originates the route.				
	route	Т		
	descr			
	origin			
	mnt-lower	MAINT-MYAPNIC-AP		
	mnt-routes	MAINT-MYAPNIC-AP		
	mnt-by	MAINT-MYAPNIC-AP ‡		
	changed	Т		
	source	APNIC		
		descr   Add field  Submit		





# **Updating Objects**

Add Update Del	elete Bulk Whois Updates						
Object type route ‡							
Search 61.45.252.0/22							
Search							
route	61.45.252.0/22 T						
descr	Test route object – Training in PK						
origin	A\$131211 T						
mnt-lower	MAINT-MYAPNIC-AP						
mnt-routes	MAINT-MYAPNIC-AP						
mnt-by	MAINT-MYAPNIC-AP \$						
changed	vivek@apni.net 20120717						
country	ТХ						
source	APNIC						
	descr   Add field  Submit						





## **Deleting Objects**

Add Update	Delete Bulk Whois Updates
Ľ	Object type route ‡
	Search 61.45.252.0/22
	Search
route descr origin mnt-lower mnt-routes mnt-by changed source	61.45.252.0/22 Test route object - Training in PK AS131211 MAINT-MYAPNIC-AP MAINT-MYAPNIC-AP MAINT-MYAPNIC-AP vivek@apni.net 20120717 APNIC
	Delete message
	Submit





## **Bulk Updates**

Home / Resource management / Bulk update

### Whois bulk update

Bulk update requests

<ul> <li>All objects (text file upload)</li> </ul>
Please attach a plain text file containing the object templates you wish to
register, update, or delete.
Whois type Public \$
Please select file to upload Browse No file selected.
Submit
Single attribute update
Domain objects (zone file upload)





## **Resource Transfer / Return**

Home Resources	Administration	Events	Contact	Tools	
IPv4 IPv6 ASN	Whois updates	Maintainers	IRTs		
Home / Resource manage	ement				
Resource mana	igement				Useful links
Internet resource	ces				Resource management
View and manage	resources				Assignment window
Whois database	updates				10%
Add/Update/Delete	e Whois objects				
Resource reque	st forms				
<ul> <li>IPv4 addresses</li> <li>IPv6 addresses</li> <li>AS numbers</li> </ul>					
Resource transf • <u>Transfer resources</u> • Receive resources • Transfer pre-appro • Return resources to	er/return into another account into my account val o APNIC				





Home Resources Administration Events Contact Tools	e Resources A	Home	
IPv4 IPv6 ASN Whois updates Certification Maintainers IRT	IPv6 ASN Wh	IPv4	

Home / Resource management / Transfer resources

### **Resource management**

### **Transfer resources**

Select the range and/or ASN to transfer and then click 'Add'. This will copy the value into the 'IPv4 block' and AS Number(s) field. If you only want to transfer part of the IP range, then the value can be adjusted at this point.



## **Receiving Resources**

### Receive resources into my account

From account	Resources
MYAPNIC-TEST-AP	202.125.97.0/24
Receive	Reject

Please note that this transfer is subject to APNIC's approval.





Home	Resources	Administration	Events Contac	: Tools	
IPv4 I	Pv6 ASN	Whois updates C	ertification Mainta	ainers IRTs	

Home / Resource management / Transfer pre-approval

### Transfer pre-approval

This form is used by the recipient account before locating the source of the IPv4 transfer and to facilitate a smooth transfer when a source account is ready to relinquish their addresses.

Before you proceed, please read the following terms and conditions carefully.

### Terms and conditions

1. APNIC policy requires that recipients of IPv4 address transfers justify their need for additional addresses. The pre-approval requests must meet the IPv4 transfer policy criteria.

http://www.apnic.net/policy/transfer-policy

2. Pre-approvals are valid for 24 months from the date of approval. If another pre-approval is requested and approved within that period, it will replace the previous pre-approval.

3. The recipient account must remain "open" to receive any transfer.

4. The recipient account will be required to provide additional justification when the size of transfer to receive is larger than what has already been pre-approved.

I agree to the terms and conditions.

Home	Resources	Administration	Events	Contact T	ools
IPv4 I	Pv6 ASN	Whois updates C	Certification	Maintainers	IRTs

Home / Resource management / Transfer pre-approval

### Transfer pre-approval

Resource type

**Resources required** 

\* fields are required

- Select the type of IPv4 resources\* you require:
- IP allocation for service providers for own network infrastructure and further delegations to customer networks
  - IP assignment for own network use







# **Transfer Pre-approval**

Home / Resource management / Transfer pre-approval

### Transfer pre-approval

Your account already has a valid pre-approval:

- Approval date: 2011-11-20
- Expiry date: 2012-11-20
- Prefixes available: /17, /18, /19 and /20

Only complete this form if your IPv4 requirements have changed.







# **MyAPNIC EC Submission**

Home	Resources	Administration	Events	Contact	Tools	
Helpdesk	Resources	Administration	EC Submis	sion		

Home / Contact / EC Submission

### **EC Submission**

Send a new submission or view your submissions that have not yet been resolved.

### New submission

	Search					
Ticket Number		Status 🔶	Subject 🔶	Requestor	Created 🔻	
No submissions found.						





# **Referral Application**

### What can I do?

- Complete a referral application for a customer
- View and update your resource information for IPv4, IPv6, AS numbers and Whois updates
- Manage your resource certificates
- View your Member details and Contact details.
- Use the Events section to view training and events history
- Use the APNIC looking glass or generate a prefix report




#### **Available Utilities**

lome	Resources	Administration	Training	Tools	
Home / 1	Fools				
Tools					
→IPv6	Sparse Assig	gnment			
→IPv6	Subnets				
→IPv6	Reverse Don	nains			
►APNI	C Looking G	lass			
→Prefi	x Report				
→MD5	Hashing				
-Reve	rse domain v	verification			
The bee Thi Rev DN	e Reverse don en configured is includes ver verse domain SSEC verificat	nain verification to correctly, in order rification of the r	ool enables ye er to complete equired record	ou to check that your zone has e your delegation successfully. ds for DNSSEC implementation.	





## **Tools – IPv6 Sparse Assignment**

Home / Tools

#### **Tools**

#### **~IPv6 Sparse Assignment**

The IPv6 Sparse Assignment tool enables you to create assignments that are spaced apart from one another, ensuring assignments can grow as needed while maintaining route aggregation.

Enter an IPv6 address of a block where the assignments will come from (beginning address & prefix length), number of assignments you need to make, and the minimum size of the assignment (optional).

Beginning address *	2406:6400::	
Prefix length *	32	e.g. 32
Number of assignments *	8	e.g. 5
Minimum assignment size		e.g. 35
	Submit	

Prefix entered Block count Required minimum block length Actual minimum block length	=> => => =>	2406:6400::/32 8 128 35
Beginning address		
2406:6400:: 2406:6400:8000:: 2406:6400:4000:: 2406:6400:c000:: 2406:6400:2000:: 2406:6400:a000:: 2406:6400:6000:: 2406:6400:e000::		





#### **Tools – IPv6 Subnet**

#### **•IPv6 Subnets**

The IPv6 subnet calculator allows you to subnet any given IPv6 prefix with a specified subnet length. Enter an IPv6 prefix and click on 'Submit' to view subnets based on the subnet length selected.

Address prefix *	2406:6400::/32	e.g. 2001::/32
Subnet length *	48	e.g. 48
	Submit	

147

#### APNIC

## **Tools – Reverse Domain Verification**

#### **~**Reverse domain verification

The Reverse domain verification tool enables you to check that your zone has been configured correctly, in order to complete your delegation successfully. This includes verification of the required records for DNSSEC implementation.

**Reverse domain** 

APN

42.119.203.in-addr.arpa.

DNSSEC verification

IP address	Name	Accessible	SOA found	AA bit set	Zones match	SOA serial
202.12.29.59	cumin.apnic.net	Yes	Yes	Yes	Yes	2014051168
2001:dc0:2001:a:4608::59	cumin.apnic.net	Yes	Yes	Yes	Yes	2014051168
202.12.28.140	sec3.apnic.net	Yes	Yes	Yes	Yes	2014051168
2001:dc0:1:0:4777::140	sec3.apnic.net	Yes	Yes	Yes	Yes	2014051168
202.12.29.60	tinnie.apnic.net	Yes	Yes	Yes	Yes	2014051168
2001:dc0:2001:a:4608::64	tinnie.apnic.net	Yes	Yes	Yes	Yes	2014051168









# Agenda

- Introduction to APNIC
- Policy Development Process
- Internet Registry Policies
- Requesting IP Addresses
- Whois Database
- Using MyAPNIC
- Autonomous System
  Numbers
- Reverse DNS
- Resource Certification

## **AP**NIC



## What is an AS Number?

- Autonomous System Number (ASN)
- Globally unique identifiers for IP networks
   uniquely identifies each network on the Internet
- Allocated to each Autonomous System (AS) for use in BGP routing
- Used in the exchange of exterior routing information (between neighboring AS) and as an identifier of the AS itself





#### **AS and AS numbers**

• Autonomous System (AS) - group of IP-based networks with the same routing policy, usually under single ownership, trust or administrative control

 Autonomous System Number (ASN) - globally unique identifiers for IP networks, used in the exchange of exterior routing information (BGP)





#### How do Autonomous Systems work?







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### When do I need an ASN?

- ASN is needed if you have a
  - Multi-homed network to different providers, and
  - Routing policy different to external peers
- RFC1930: Guidelines for creation, selection and registration of an Autonomous System





## **ASN Representation**

ASN Range	Usage
0 - 65535	16-bit AS number
0 and 65535	Reserved
1 - 64495	Public Internet
64496 - 64511	Documentation and sample code (RFC5398)
64512 - 65534	Reserved for private use (RFC6996)
23456	AS_TRANS (RFC6793)
65536 - 4294967295	32-bit AS number
65536 - 65551	Documentation and sample code (RFC5398)
65552 – 131071	Reserved (RFC5398)
131072 - 4199999999	Public Internet
420000000 - 4294967294	Reserved for private use (RFC6996)
4294967295	Reserved (RFC7300) http://www.iana.org/assignments/as-numbers/as-numbers.x





## 16-bit and 32-bit ASN

- With the introduction of the "new" 32-bit AS Numbers, and the continuation of use of "old" 16-bit AS Numbers, a method was needed to get them to work together
- The solution is known as AS23456, which allows BGP to either convert or truncate the AS number if it detects an "old" 16-bit number as part of the exchange





# **Requesting an ASN**

- Eligibility
  - Should be multihomed
  - Has a single, clearly defined routing policy that is different from its providers' routing policies
- Request Process: Complete the request form
  - Check with peers if they can handle 4-byte ASN
  - Existing members send the request from MyAPNIC
  - New Members can send AS request along with membership application





## **Requesting an ASN**

- If a member requests an ASN for their own network
  - AS number is portable
  - Member responsible for registration
- If a member requests an ASN for its customer
  - AS number is **non-portable**
  - Customer must meet criteria
  - Member responsible for registration
  - AS number is returned if customer changes provider





# From 2-byte to 4-byte Delegation

- January 2007
  - 2-byte ASN by default, process 4-byte ASN as requested
- January 2009
  - 4-byte ASN by default, process 2-byte ASN as requested
- July 2009
  - 4-byte ASN by default, process requests for 2-byte through demonstrated need
- January 2010
  - No distinction between two-byte and four-byte only AS numbers
  - Will operate AS number assignments from an undifferentiated fourbyte AS number pool





## **ASN Transfers**

- Transfers of ASNs
  - Within the APNIC region and
  - Between regions with compatible inter-regional ASN transfer policies





## **Aut-num Object Example**

aut-num:	AS4777
as-name:	APNIC-NSPIXP2-AS
Descr:	Asia Pacific Network Information Centre
descr:	AS for NSPIXP2, remote facilities site
import:	from AS2500 action pref=100; accept ANY
import:	from AS2524 action pref=100; accept ANY
import:	from AS2514 action pref=100; accept ANY
export:	to AS2500 announce AS4777
export:	to AS2524 announce AS4777 POLICY
export:	to AS2514 announce AS4777 RPSL
default:	to AS2500 action pref=100; networks ANY
admin-c:	PW35-AP
tech-c:	NO4-AP
remarks:	Filtering prefixes longer than /24
mnt-by:	MAINT-APNIC-AP
changed:	paulg@apnic.net 19981028
source:	APNIC
	1.1 ( • • A ( f ( )

VOOY

#### **Four-byte ASN Global Distribution**









# Agenda

- Introduction to APNIC
- Policy Development Process
- Internet Registry Policies
- Requesting IP Addresses
- Whois Database
- Using MyAPNIC
- Autonomous System Numbers
- Reverse DNS
- Resource Certification (RPKI)

## **AP**NIC



#### What is Reverse DNS?

 Forward DNS maps names to numbers svc00.apnic.net →202.12.28.131

Reverse DNS maps numbers to names
 202.12.28.131 → svc00.apnic.net





## **Uses of Reverse DNS**

- Service denial
  - That only allow access when fully reverse delegated eg. anonymous ftp
- Diagnostics
  - Assisting in network troubleshooting (ex: traceroute)
- Spam identifications
  - Reverse lookup to confirm the source of the email
  - Failed lookup adds to an email's spam score





#### **Reverse DNS Tree**







#### **Reverse DNS Tree – with IPv6**







#### **Reverse Zone Example**

- NS ns.company.org.
- NS ns2.company.org.
- 1 PTR gw.company.org. router.company.org.
- 2 PTR ns.company.org.

;auto generate: 65 PTR host65.company.org \$GENERATE 65-127 \$ PTR host\$.company.org.



### **Managing Reverse DNS**

- APNIC manages reverse delegation for both IPv4 and IPv6
- Before you register your domain objects, you need to ensure that your reverse zones have been configured and loaded in your DNS name servers.
- APNIC does not host your DNS name servers or configure your reverse zone files.
- APNIC only delegates the authority of your reverse zones to the DNS name servers you provide through your domain objects.





## **Reverse Delegation Requirements**

- /24 Delegations
  - Address blocks should be delegated
  - At least one name server
- /16 Delegations
  - Same as /24 delegations
  - APNIC delegates entire zone to member
- </24 Delegations</li>
  - Read "classless in-addr.arpa delegation"
  - Not supported







# **APNIC & LIR Responsibilities**

- APNIC
  - Manage reverse delegations of address block distributed by APNIC
  - Process organisations requests for reverse delegations of network allocations
- Organisations
  - Be familiar with APNIC procedures
  - Ensure that addresses are reverse-mapped
  - Maintain nameserver(s) for allocations
  - Keep accurate records in the database
  - Keep reverse DNS current with the Whois DB





#### **Reverse Delegation Procedures**

- Standard APNIC database object
  - Can be updated through myAPNIC
- Nameserver/domain set up verified before being submitting to the database.
- Protection by maintainer object
  - Current authentication options: CRYPT-PW, MD5





#### **Reverse Delegation Procedures**

Home / Resource management / Reverse DNS

#### Add reverse DNS delegation

Important: The information you provide in the form below will be used to create your domain object in the APNIC Whois Database. Please make sure that your name servers are running and are authoritative for the zone, or your reverse DNS delegation might not function correctly.

Address range:

Use CIDR address prefix notation. Multiple range allowed, one range per line.

Example:

2001:dc0:2001::/48 2001:a130::/31

Name servers:

List fully qualified domain name of at least one server.

Important: Do not list IP addresses or reverse DNS names.

Example:

ns1.example.com ns2.example.com

**Maintainer:** 

APNIC

Example:

MAINT-AU-EXAMPLE



#### Input your IP address block here

At least one DNS server (FQDN)

#### **Maintainer password**



## **Whois Domain Object**



#### **AP**NIC









# Agenda

- Introduction to APNIC
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- APNIC Whois Database
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- Autonomous System Numbers
- Reverse DNS
- Resource Certification (RPKI)

## **AP**NIC



## What is **RPKI**?

- <u>Resource Public Key Infrastructure (RPKI)</u>
- A robust security framework for verifying the association between resource holder and their Internet resources
- Created to address the issues in RFC 4593 "Generic Threats to Routing Protocols"
- Helps to secure Internet routing by validating routes
  - Proof that prefix announcements are coming from the legitimate holder of the resource

**RFC 6480** – An Infrastructure to Support Secure Internet Routing (Feb 2012)





## "Right" to Resources

- LIR gets their resources from the RIR
- LIR notifies its upstream of the prefixes to be announced
- Upstream <u>must</u> check the WHOIS database if resource has been delegated to customer LIR

We need to be able to <u>authoritatively</u> prove who owns an IP Prefix and what AS(s) may announce it.





## **APNIC Resource Certification**

- A robust security framework for verifying the association between **resource holders** and **their Internet resources** 
  - Collaborative effort by all RIRs
- Initiative from APNIC aimed at
  - Improving the security of inter-domain routing
  - Augmenting the information published in the Whois database
- Verifies a holder's current "right-of-use" over an Internet resource




# **Route Origin Authorization (ROA)**

- A digital object that contains a list of address prefixes and one ASN
- It is an authority created by a prefix holder to authorize an ASN to originate one or more specific route advertisements
- Publish an ROA using MyAPNIC





#### **APNIC RPKI Service**

- Enhancement to the RIRs
  - Offers verifiable proof of resource holdings
- Resource certification is an opt-in service
  - Resource holders choose to request a certificate and provide their public key to be certified
- APNIC has integrated the RPKI management service into MyAPNIC for APNIC Member use
- Public repository at rpki.apnic.net





#### **How it Works**

#### **RPKI Component elements and interactions**







## **Activate RPKI Engine**

Home	Resources	Administration	Training	Tools			
IPv4 I	Pv6 ASN	Whois updates	Certification	Maintainers	IRTs	Correspondence	

Select if you want to operate in the MyAPNIC RPKI portal or if you want to host your own certificate authority.

Home / Resources / RPKI

RPKI

#### **Enable Resource Certification**

Currently, you have not enabled resource certification for your registry.

I want to operate in the MyAPNIC RPKI portal.

I want to host my own certification authority and run an RPKI engine myself.

Next





### **Create ROA Objects**

Home / Resources / RPKI

#### **RPKI**

#### **ROA Configuration**

Origin ASN AS12345	Prefix	61.45.248.	м	ax Length 24	Add	Add & clone Clear
		61.45.248.0/2	3			
All Changes Items per page 10 Search by AS or IP					Certified	
Origin AS	Prefix	د <mark>^</mark> ا	Aax Length		÷	Resources
No data available in table						
Showing 0 to 0 of 0 entries						61.45.248.0/23
Commit						61.45.252.0/22





### **Ready to ROA**

- ROA sessions conducted at different events to help
  Members explore resource certification
- Join the ROA sessions
- Check out the APNIC page
  - http://www.apnic.net/roa











# **Thank You!**

End of Session



