APNIC Training

*Internet Resource Management Essentials*

01 July 2008, Port Vila, Vanuatu

In conjunction with

PacNOC

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**Introduction**

**Presenters**

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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
• IRMe
  – Introduction to APNIC
  – APNIC community & policy development
  – APNIC policies – allocation and assignment
  – ISP request evaluation
  – APNIC Whois database
  – MyAPNIC
  – Autonomous System Numbers
  – IPv4 unallocated address space exhaustion
  – IPv6 policy and procedures
  – Reverse DNS delegations – registry procedures
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
Where is APNIC region?

What does APNIC do?

<table>
<thead>
<tr>
<th>Resource service</th>
<th>Policy development</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPv4, IPv6, ASNs</td>
<td>Facilitating the policy development process</td>
</tr>
<tr>
<td>Reverse DNS delegation</td>
<td>Implementing policy changes</td>
</tr>
<tr>
<td>Resource registration</td>
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<tr>
<td>Authoritative registration server</td>
<td></td>
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<tr>
<td>whois</td>
<td></td>
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<tr>
<td>IRR</td>
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<table>
<thead>
<tr>
<th>Information dissemination</th>
<th>Training &amp; Outreach</th>
</tr>
</thead>
<tbody>
<tr>
<td>APNIC meetings</td>
<td>Training</td>
</tr>
<tr>
<td>Web and ftp site</td>
<td>Internet Resource management</td>
</tr>
<tr>
<td>Publications, mailing lists</td>
<td>DNS workshops</td>
</tr>
<tr>
<td>Outreach seminars</td>
<td>Subsidised for members</td>
</tr>
</tbody>
</table>

http://www.apnic.net/community/lists/  
Schedule: http://www.apnic.net/training
APNIC is NOT

- A network operator
  - Does not provide networking services
    - Works closely with APRICOT forum

- A standards body
  - Does not develop technical standards
    - Works within IETF in relevant areas (IPv6 etc)

- A domain name registry or registrar
  - Will refer queries to relevant parties

Internet Registry structure

ICANN (IANA)

APNIC

ARIN LACNIC RIPE NCC AfriNIC

NIR LIR LIR NIR LIR ISP ISP ISP
The main aims of the NRO:

• To protect the unallocated number resource pool
• To promote and protect the bottom-up policy development process
• To facilitate the joint coordination of activities e.g., engineering projects
• To act as a focal point for Internet community input into the RIR system

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
APNIC membership

Source: APNIC statistic data - Last update March 2008

AU, 27%
IN, 12%
HK, 9%
NZ, 6%
BD, 5%
PH, 5%
SG, 4%
AP, 4%
TH, 4%
JP, 4%
MY, 3%
PK, 3%
ID, 2%
AF, 1%
Others, 5%

APNIC IPv4 address distribution

Source: APNIC statistic data - Last update March 2008

CN, 32%
JP, 29%
KR, 14%
TH, 11%
MY, 10%
ID, 10%
PH, 1%
Others, 1%
IN, 3%
AU, 8%
HK, 2%
Questions?

APNIC Community & Policy Development
What is the APNIC community?

- **Open** forum in the Asia Pacific
  - Open to any interested parties
- Voluntary participation
- Decisions made based on consensus
- Public meetings
- Mailing lists
  - web archived

- A voice in regional Internet operations through participation in APNIC activities

You are part of APNIC community!

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

• Industry self-regulatory process
  – Policy is developed by the AP Internet community to suit needs of region
  – Facilitated by RIR staff

• Policy implementation
  – APNIC shares with its members and their customers a collective responsibility
    • RIR process
    • ISPs and other affected parties

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
The policy development process

Need Discuss Consensus Implement

Proposal (4 w before meeting) ML discussion Meeting discussion Consensus Report to AMM Consensus Comment period (8 weeks) Consensus EC endorsement Implementation (3 months)

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
- 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 meetings

- **APNIC 26**
  - Christchurch, New Zealand
  - 25 - 29 August 2008
- **APNIC 27**
  - Held in conjunction with APRICOT 2009
  - Manila, Philippines
  - 18 - 27 February 2009
- **APNIC 28**
  - The call for proposal
    - Will open soon for organisations interested in hosting APNIC 28
    - http://www.apnic.net/meetings/upcoming/index.html
APNIC meetings

• Participate remotely
  – Video streaming
    • Selected sessions are video streamed live via unicast and multicast
  – Audio streaming
    • For users with lower bandwidth follow live audio streamed in MP3 format
  – Live transcripts
    • Live transcripts of selected sessions available via Jabber and web browsers
  – Jabber chat
    • Jabber chat rooms give people around the world the chance to participate in meeting sessions in near real time

APNIC policies
Internet registry allocation and assignment

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

APNIC Allocates to APNIC Member
APNIC Member Allocates to downstream Assigns to end-user
Downstream Assigns to end-user
Customer / End User

APNIC Allocates
APNIC Allocation
Member Allocation
Customer Assignments

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 (in /8)

Growth of global routing table

Sustainable growth?

Projected routing table growth without CIDR

Dot-Com boom

CIDR deployment

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 (2048 addresses)
  - The allocation can be used for further assignments to customers or your own infrastructure.
  - Lowered from /20 to /21 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
Address assignment policies

• Assignments based on requirements
  • Demonstrated through detailed documentation
  • Assignment should maximise utilisation
    - minimise wastage
• Classless assignments
  • showing use of VLSM
• Size of allocation
  – Sufficient for up to 12 months requirement

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

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Sub-allocations

- No max or min size
  - Max 1 year requirement

- Assignment Window & 2\textsuperscript{nd} Opinion applies
  - to both sub-allocation & assignments
    - Sub-allocation holders don’t need to send in 2\textsuperscript{nd} opinions
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 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
- We will talk this topic in more details later

Internet Registry Procedures

Addressing Plan
Addressing plan

• To complete documentation
  – First need a technical PLAN
    • Documenting the architecture of the present and eventual goal
  – IP addressing is fundamental part of network design
  – IP addressing ‘planning’ example to follow..

Some icons

- Router (layer 3, IP datagram forwarding)
- Network Access Server (layer 3, IP datagram forwarding)
- Ethernet switch (layer 2, packet forwarding)
Addressing plan

- Identify components of network
  - Customer services
  - ISP internal infrastructure

- Identify phases of deployment
  - Starting off, 6 months, 12 months

- Identify equipment and topology changes
  - Need for redundancy
  - Need for increased scale

Network plan

- Starting off

- Interconnected resilience
- Leased line services 5-8 customers
- Customer services
- Dialup services 16 modems
- 15 hosts NOC operations
- 10 hosts Internal DNS, Web Mail servers
- ISP Infrastructure
- 5 hosts Virtual web (name based)
- 16 modems
- 5 hosts Internal DNS, Web Mail servers

Network Plan Diagram:
- Upstream ISP
- Interconnected resilience
- Leased line services 5-8 customers
- Customer services
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Network Diagram:
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- Interconnected resilience
- Upstream ISP

Network plan

- WAN point to point /30

- 5 hosts
- 10 hosts
- 15 hosts

Upstream ISP

- 16 dialup modems
- 5-8 leased line customers

One loopback interface per assigned router /32

‘ip unnumbered’ to upstream ISP

‘ip unnumbered’ to customers

Addressing plan

• Initial addressing plan

- numbers of host addresses (interfaces)

<table>
<thead>
<tr>
<th>network-plan:</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>network-plan:</td>
<td>5</td>
</tr>
<tr>
<td>network-plan:</td>
<td>128</td>
</tr>
<tr>
<td>network-plan:</td>
<td>15</td>
</tr>
<tr>
<td>network-plan:</td>
<td>10</td>
</tr>
<tr>
<td>network-plan:</td>
<td>4</td>
</tr>
<tr>
<td>network-plan:</td>
<td>2</td>
</tr>
</tbody>
</table>

- analogue dialup modems, vendor ‘x’
- LAN -web hosting (Name-based hosting)

5-8 leased line customers (/28)

- LAN -NOC and Ops management
- LAN -mail,DNS, web servers internal

- loopback router interfaces
- router WAN ports (x 5 lines)
Network plan

- 6 months later
  - scale increased
  - redundancy

  - increased number of leased line customers
  - increased number of hosts on all LANs
  - added new dial up equipment
  - added new router and LAN for redundancy

Addressing plan

- Network plan at 6 months
  - increases in hosts (interfaces)

<table>
<thead>
<tr>
<th>network-plan:</th>
<th>16/60</th>
<th>2 PRI dialup modems, vendor 'y'</th>
</tr>
</thead>
<tbody>
<tr>
<td>network-plan:</td>
<td>5/11</td>
<td>LAN-web hosting (Name-based hosting)</td>
</tr>
<tr>
<td>network-plan:</td>
<td>128/512</td>
<td>30 leased line customers (pool)</td>
</tr>
<tr>
<td>network-plan:</td>
<td>15/25</td>
<td>LAN-NOC and Ops management</td>
</tr>
<tr>
<td>network-plan:</td>
<td>10/16</td>
<td>LAN-mail,DNS, web servers internal</td>
</tr>
<tr>
<td>network-plan:</td>
<td>4/6</td>
<td>loopback router interfaces</td>
</tr>
<tr>
<td>network-plan:</td>
<td>2/2</td>
<td>router WAN ports (x 8 lines)</td>
</tr>
<tr>
<td>network-plan:</td>
<td>0/60</td>
<td>2 PRI dialup modems</td>
</tr>
<tr>
<td>network-plan:</td>
<td>0/8</td>
<td>LAN-secondary servers</td>
</tr>
</tbody>
</table>

Changed description

New hardware
Network plan

- 12 months total
  - site redundancy
  - greater complexity
  - efficiency

Addressing plan

- Network plan at 12 months
  - increases in hosts (interfaces)
  - one year total

<table>
<thead>
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<tbody>
<tr>
<td>16/60/</td>
<td>0/60/</td>
<td>5/11/</td>
<td>128/512/</td>
<td>15/25/</td>
<td>10/16/</td>
<td>0/8/</td>
<td>2/2/</td>
<td>4/6/</td>
</tr>
<tr>
<td>240</td>
<td>240</td>
<td>11</td>
<td>1020</td>
<td>40</td>
<td>35</td>
<td>8</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>8 PRI dialup modems, vendor x</td>
<td>8 PRI dialup modems, vendor y</td>
<td>LAN -web hosting (Name-based hosting)</td>
<td>60 leased line customers (pool)</td>
<td>LAN -NOC and Ops management</td>
<td>LAN -mail, DNS, web servers internal</td>
<td>LAN-secondary servers</td>
<td>router WAN ports (x 8 lines)</td>
<td>loopback router interfaces</td>
</tr>
</tbody>
</table>
Addressing plan

- Can now determine subnet sizes

<table>
<thead>
<tr>
<th>Network Plan</th>
<th>Prefix Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0.0.0</td>
<td>1024</td>
<td>60 leased line customers (pool)</td>
</tr>
<tr>
<td>0.0.4.0</td>
<td>256</td>
<td>8 PRI dialup modems, vendor x</td>
</tr>
<tr>
<td>0.0.5.0</td>
<td>256</td>
<td>8 PRI dialup modems, vendor y</td>
</tr>
<tr>
<td>0.0.6.0</td>
<td>64</td>
<td>LAN -mail,DNS, web internal</td>
</tr>
<tr>
<td>0.0.6.64</td>
<td>64</td>
<td>LAN -NOC and Ops management</td>
</tr>
<tr>
<td>0.0.6.128</td>
<td>16</td>
<td>LAN -web hosting (Name-based hosting)</td>
</tr>
<tr>
<td>0.0.6.144</td>
<td>16</td>
<td>LAN-secondary servers</td>
</tr>
<tr>
<td>0.0.6.160</td>
<td>16</td>
<td>loopback router interfaces</td>
</tr>
<tr>
<td>0.0.6.176</td>
<td>16</td>
<td>router WAN ports (x8)</td>
</tr>
</tbody>
</table>

- Addressing plan for network-plan
  - Re-ordered large to small according to relative subnet size
  - Determination of relative subnet addresses

- Cumulative total 0.0.6.208
### Addressing plan

#### Addressing plan for network-plan

- **connect to the Internet (full-time, part-time)?**

<table>
<thead>
<tr>
<th>Network-plan</th>
<th>Address</th>
<th>Mask</th>
<th>Yes/No</th>
<th>/22</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0.0.0</td>
<td>255.255.252.0</td>
<td>YES</td>
<td>1024</td>
<td>128/512/1020</td>
</tr>
<tr>
<td>0.0.4.0</td>
<td>255.255.255.0</td>
<td>PART</td>
<td>256</td>
<td>16/60/240</td>
</tr>
<tr>
<td>0.0.5.0</td>
<td>255.255.255.0</td>
<td>PART</td>
<td>256</td>
<td>0/60/240</td>
</tr>
<tr>
<td>0.0.6.0</td>
<td>255.255.255.192</td>
<td>YES</td>
<td>64</td>
<td>10/16/35</td>
</tr>
<tr>
<td>0.0.6.64</td>
<td>255.255.255.192</td>
<td>YES</td>
<td>64</td>
<td>15/25/40</td>
</tr>
<tr>
<td>0.0.6.128</td>
<td>255.255.255.240</td>
<td>YES</td>
<td>16</td>
<td>5/11/11</td>
</tr>
<tr>
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<td>YES</td>
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<td>0/8/8</td>
</tr>
<tr>
<td>0.0.6.160</td>
<td>255.255.255.240</td>
<td>YES</td>
<td>16</td>
<td>4/6/12</td>
</tr>
<tr>
<td>0.0.6.176</td>
<td>255.255.255.252</td>
<td>YES</td>
<td>16</td>
<td>2/2/2</td>
</tr>
</tbody>
</table>

- **leased line customers**: 60
- **8 PRI dial up modems**
- **LAN -mail,DNS, web internal**
- **LAN -NOC & Ops mgnt**
- **LAN -web hosting (Name-based)**
- **LAN -secondary servers**
- **loopback router interfaces**
- **router WAN ports (x 8 lines)**

### Addressing plan

#### Addressing plan complete

- **total planned for customer assignments /22**
- **total planned for ISP infrastructure /24 + /23**

<table>
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- **loopback router interfaces**
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- **detailed, efficient and accurate**
Questions?

ISP request and evaluation
ISP address request

• 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 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

Why Assignment Window?

• Motivation
  – Support the LIR during start up
  – Standardise criteria for request evaluation
  – Familiarise the LIR with APNIC policies
  – Ensure accurate data is being kept
  – Treat everyone fairly

FAQ

• http://www.apnic.net/faq/awfaq.html
Second opinion request form

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

Applicant information
Type of request
Network name
Future network plan
IPv4 Sub-allocations
IPv4/IPv6 Assignments
Customer assignments to end-sites
Sub-allocation infrastructure
Additional information
Confirm details

Contact details, password
IPv6 / IPv4, Assignment / Sub-allocation
Network name, description, country
Planned IP usage
IPs held by customer & customer’s customers
IPs held by customer
Any additional info that may aid the evaluation
Check your details

Customer’s existing network
APNIC 2nd opinion request 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?

Material available at: www.apnic.net/training/recent
Database Objects and Usage

The APNIC Whois Database

Introduction and usage
Overview

• What is the APNIC Whois Database?

• Why use it?

• Database query

• Database updating process

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

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

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

### Object templates

To obtain template structure*, use:

```bash
whois -t <object type>
```

```bash
% 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

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>person:</td>
<td>Ky Xander</td>
</tr>
<tr>
<td>address:</td>
<td>ExampleNet Service Provider</td>
</tr>
<tr>
<td>address:</td>
<td>2 Pandora St Boxville</td>
</tr>
<tr>
<td>address:</td>
<td>Wallis and Futuna Islands</td>
</tr>
<tr>
<td>country:</td>
<td>WF</td>
</tr>
<tr>
<td>phone:</td>
<td>+680-368-0844</td>
</tr>
<tr>
<td>fax-no:</td>
<td>+680-367-1797</td>
</tr>
<tr>
<td>e-mail:</td>
<td><a href="mailto:kxander@example.com">kxander@example.com</a></td>
</tr>
<tr>
<td>nic-hdl:</td>
<td>KX17-AP</td>
</tr>
<tr>
<td>mnt-by:</td>
<td>MAINT-WF-EX</td>
</tr>
<tr>
<td>changed:</td>
<td><a href="mailto:kxander@example.com">kxander@example.com</a> 20020731</td>
</tr>
<tr>
<td>source:</td>
<td>APNIC</td>
</tr>
</tbody>
</table>

What is a nic-hdl?

• Unique identifier for a person
• Represents a person object
  – Referenced in objects for contact details
    • (inetnum, aut-num, domain…)
  – format: <XXXX-AP>
    • Eg: KX17-AP
Tip – Choosing your nic-hdl

- Automatic generation of nic-hdls

```
person: Ky Xander
...nic-hdl: KX17-AP
```

- Specifying initials in your nic-hdl

```
role: SparkyNet Staff
...nic-hdl:SN123-AP
```

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
Inetnum object example

Contain IP address allocations / assignments

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>inetnum:</td>
<td>202.51.64.0 - 202.51.95.255</td>
</tr>
<tr>
<td>netname:</td>
<td>CCNEP-NP-AP</td>
</tr>
<tr>
<td>descr:</td>
<td>Communication &amp; Communicate Nepal Ltd</td>
</tr>
<tr>
<td>descr:</td>
<td>VSAT Service Provider, Kathmandu</td>
</tr>
<tr>
<td>country:</td>
<td>NP</td>
</tr>
<tr>
<td>admin-c:</td>
<td>AS75-AP</td>
</tr>
<tr>
<td>tech-c:</td>
<td>AS75-AP</td>
</tr>
<tr>
<td>mnt-by:</td>
<td>APNIC-HM</td>
</tr>
<tr>
<td>mnt-lower:</td>
<td>MAINT-NP-ARUN</td>
</tr>
<tr>
<td>changed:</td>
<td><a href="mailto:hostmaster@apnic.net">hostmaster@apnic.net</a> 20010205</td>
</tr>
<tr>
<td>status:</td>
<td>ALLOCATED PORTABLE</td>
</tr>
<tr>
<td>source:</td>
<td>APNIC</td>
</tr>
</tbody>
</table>

Inter-related objects

IPv4 addresses

Data protection

Contact info

person: ...

nic-hdl: KX17-AP ...

admin-c: KX17-AP ...

tech-c: ZU3-AP ...

mnt-by: MAINT-WF-EX ...

person: ...

nic-hdl: ZU3-AP ...

mntner: MAINT-WF-EX ...
...
 ...

Contact info

APNIC
Asia Pacific Network Information Centre
Admin-c and tech-c

- **Responsibility – ‘admin’ contacts**
  - Legal authority
  - Technical management
  - Network planning, backbone design
  - Deployment, capacity, and upgrade planning

- **Expertise - ‘tech’ contacts**
  - Routing, aggregation, BGP, etc
  - Addressing, subnetting, CIDR, etc

Whois database query - clients

- **Standard whois client**
  - Included with many Unix distributions
- **RIPE extended whois client**

- **Query via the APNIC website**
  - [http://www.apnic.net/apnic-bin/whois2.pl](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

Basic whois database queries

• Unix
  – whois –h whois.apnic.net <lookup key>
• Web interface
  – http://www.apnic.net/apnic-bin/whois2.pl

• Look-up keys
  – usually the object name
  – Check template for look-up keys
Database query – look-up keys

<table>
<thead>
<tr>
<th>OBJECT TYPE</th>
<th>ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>person</td>
<td>name, nic-hdl, e-mail</td>
</tr>
<tr>
<td>role</td>
<td>name, nic-hdl, e-mail</td>
</tr>
<tr>
<td>mntner</td>
<td>maintainer name</td>
</tr>
<tr>
<td>inetnum</td>
<td>network number, name</td>
</tr>
<tr>
<td>domain</td>
<td>domain name</td>
</tr>
<tr>
<td>aut-num</td>
<td>as number</td>
</tr>
<tr>
<td>as-macro</td>
<td>as-macro name</td>
</tr>
<tr>
<td>route</td>
<td>route value</td>
</tr>
<tr>
<td>inet6num</td>
<td>network number, name</td>
</tr>
</tbody>
</table>

* whois supports queries on any of these objects/keys

Whois database query - UNIX

% whois zulrich@example.com
% whois zu3-ap
% whois "zane ulrich"

person: Zane Ulrich
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: zulrich@example.com
nic-hdl: ZU3-AP
mnt-by: MAINT-WF-EX
changed: zulrich@example.com 20020731
source: APNIC
Whois database query - web

http://www.apnic.net/apnic-bin/whois2.pl

Query the APNIC Whois Database

1. Type in search key

2. Search options (flags)

3. 'Search Whois'

Result of search on nic-hdl "OA3-AP" ('Optus IP administrators’ role object)
APNIC Whois web query - example

APNIC Whois command line query - example
APNIC Whois command line query - example

APNIC Whois command line query - example

APNIC Whois command line query - example
APNIC Whois command line query - example

APNIC Whois database objects
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

1. person:
   nic-hdl: KX17-AP
   Contact info

2. mntner:
   Data Protection

3. Allocation
   (Created by APNIC)

4. 4
   Inetnum:
   ... KX17-AP
   ... mnt-by:
   ... mnt-by:
   ... mnt-by:

5. 5
   Inetnum:
   ... KX17-AP
   ... mnt-by:
   ... mnt-by:
   ... mnt-by:

6. 6
   Inetnum:
   ... KX17-AP
   ... mnt-by:
   ... mnt-by:
   ... mnt-by:

Customer Assignments
   (Created by LIR)
Whois database auto-responses

- **Successful update**
  - Objects accepted
  - SUCCEEDED

- **Warnings**
  - Objects accepted but ambiguous
  - Objects corrected and accepted

- **Errors**
  - Objects NOT accepted
  - FAILED

Don’t understand the error message?

1. Help documentation
   - [http://www.apnic.net/docs/database-update-info.html](http://www.apnic.net/docs/database-update-info.html)

2. Contact
   - 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](http://www.apnic.net/db/role.html)
Role object - example

– Contains contact info for several contacts

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>role:</td>
<td>OPTUS IP ADMINISTRATORS</td>
</tr>
<tr>
<td>address:</td>
<td>101 Miller Street North Sydney</td>
</tr>
<tr>
<td>country:</td>
<td>AU</td>
</tr>
<tr>
<td>phone:</td>
<td>+61-2-93427681</td>
</tr>
<tr>
<td>phone:</td>
<td>+61-2-93420813</td>
</tr>
<tr>
<td>fax-no:</td>
<td>+61-2-9342-0998</td>
</tr>
<tr>
<td>fax-no:</td>
<td>+61-2-9342-6122</td>
</tr>
<tr>
<td>e-mail:</td>
<td><a href="mailto:noc@optus.net.au">noc@optus.net.au</a></td>
</tr>
<tr>
<td>admin-c:</td>
<td>NC8-AP</td>
</tr>
<tr>
<td>tech-c:</td>
<td>NC8-AP</td>
</tr>
<tr>
<td>tech-c:</td>
<td>SC120-AP</td>
</tr>
<tr>
<td>nic-hdl:</td>
<td>QA3-AP</td>
</tr>
<tr>
<td>mnt-by:</td>
<td>MAINT-OPTUSCOM-AP</td>
</tr>
<tr>
<td>source:</td>
<td>APNIC</td>
</tr>
</tbody>
</table>

Replacing contacts in the db
- using person objects

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

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

2. Find all objects containing old contact (K. Xander).

3. Update all objects, replacing old contact (KX17-AP) with new contact (ZU3-AP).

4. Delete old contact’s (KX17-AP) person object.
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!

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
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

Database protection

• Authorisation
  – “mnt-by” references a mntner object
    • Can be found in all database objects
    • “mnt-by” should be used with every object!

• Authentication
  – Updates to an object must pass authentication
    rule specified by its maintainer object
Authorisation mechanism

<table>
<thead>
<tr>
<th>inetnum</th>
<th>202.137.181.0 – 202.137.185.255</th>
</tr>
</thead>
<tbody>
<tr>
<td>netname</td>
<td>EXAMPLENET-WF</td>
</tr>
<tr>
<td>descr</td>
<td>ExampleNet Service Provider</td>
</tr>
<tr>
<td>mnt-by</td>
<td>MAINT-WF-EX</td>
</tr>
</tbody>
</table>

mntner:

<table>
<thead>
<tr>
<th>descr</th>
<th>Maintainer for ExampleNet Service Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>country</td>
<td>WF</td>
</tr>
<tr>
<td>admin-c</td>
<td>ZU3-AP</td>
</tr>
<tr>
<td>tech-c</td>
<td>KX17-AP</td>
</tr>
<tr>
<td>upd-to</td>
<td><a href="mailto:kxander@example.com">kxander@example.com</a></td>
</tr>
<tr>
<td>mnt-nfy</td>
<td><a href="mailto:kxander@example.com">kxander@example.com</a></td>
</tr>
<tr>
<td>auth</td>
<td>CRYPT-PW apHJ9zF3o</td>
</tr>
<tr>
<td>mnt-by</td>
<td>MAINT-WF-EX</td>
</tr>
<tr>
<td>changed</td>
<td><a href="mailto:kxander@example.com">kxander@example.com</a> 20020731</td>
</tr>
<tr>
<td>source</td>
<td>APNIC</td>
</tr>
</tbody>
</table>

Maintainer specific attributes

- **mnt-nfy:**
  - Sends notification of any changes to maintained objects to email address specified

- **mnt-by:**
  - Maintainers must also be protected!
    (Normally by themselves)

- **auth:**
  - Authentication method for this maintainer
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. 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

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 - web

- Creates a template through the web form
  - Template will be sent to you by email
  - This should be forwarded to: <auto-dbm@apnic.net>

- Common mistake
  - Replying directly to the email (Adds extra character in front of each line)

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

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
Updating an existing public object

- Change relevant fields
- Add your maintainer password
- Update the changed attribute
- Email updated object to:
  <auto-dbm@apnic.net>

• Note
  - Primary keys cannot be modified

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](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

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?

IANA range

Non-APNIC range  APNIC range

APNIC allocations & assignments  NIR range

NIR allocations & assignments

PORTABLE addresses

LIR/ISP

Customer assignments  Infrastructure  Sub-allocations

NON-PORTABLE addresses

must be visible

visibility optional

MyAPNIC
MyAPNIC

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

Database tools

My APNIC

User Interface

Private

Database

Public

Whois

auto-dbms
How it works

APNIC internal system
- Firewall
- Finance system
- Membership & resource system
- Whois master

APNIC public servers
- MyAPNIC server
- https://my.apnic.net
- Member’s staff

MyAPNIC menus
- Resource information
  - IPv4, IPv6, ASN
- Administration
  - Membership detail
  - Contact persons
  - Billing history
- Training
  - Training history
- Technical
  - Looking glass
- Tools
How can I obtain an APNIC digital certificate? (part A)

1. Fill in the online form: https://www.apnic.net/ca
2. Submit the form
3. For faster processing, scan the form and your photo ID, attach the images to an e-mail, and send it to: ramanager@apnic.net
   • Without the form, APNIC will not process your request

How to use an APNIC digital certificate? (part B)

1. Load client certificate
   • Once a new certificate is issued to you, load it into your browser
     • You can export your certificate to a different computer or to a different browser
2. Verify client certificate
3. Go to https://my.apnic.net to make sure everything is working fine
Common issues

• Issues in getting a certificate
  – Forgetting to send the photo ID
  – Downloading the certificate to the wrong computer

• Accessing MyAPNIC
  – Using a computer without a digital certificate
  – Expired certificate
    • It’s easy to renew! Just send a new request via https://www.apnic.net/ca (renewals do not require photo ID)

My APNIC screen capture
IPv4 address management

IPv6 address management
APNIC Whois DB “add”

APNIC Whois DB “delete”
Questions?
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
Help completing this form
See the Guide to the APNIC AS Number Request Form.
(*) indicates mandatory field.)

Create Aut-num Object

What is this form to be used for?
This form is used in the creation and maintenance of aut-num objects. The aut-num describes the details of the registered owner of an Autonomous System and their routing policy for that AS. See RFC 2422 for details.

Help completing this form
See the Guide to the APNIC AS Number Request Form.

Request form – routing policy

MORE INFORMATION REGARDING RPSL SYNTAX CAN BE FOUND IN RFC 2422.
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
export: to AS2514 announce AS4777
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

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 is developed by IETF
- 4 byte ASN distribution policy (32 bits)
  - 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 ASN only

Canonical textual form of 4 byte ASN

- 2 byte only ASN
  - May be represented as a 16 bit value decimal number, with no leading zeros, or "." character.
  - They may be represented as 4 byte ASN.
- 4 byte 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 ASN representation
    - 0. <16 bit decimal value>
- 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 value 65546 (decimal)
      - 1.10
- APNIC resource range: 2.0 ~ 2.1023

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

IPv4 unallocated address space exhaustion
Acknowledgements

The material used in this course was created in collaboration with Randy Bush (IIJ) and Geoff Huston (APNIC) and includes material provided by them.

APNIC acknowledges with thanks and appreciation the contribution and support of the above.

IPv4 address exhaustion and IPv6 implementation

• Discussion
  – Does your company have a plan for coping with IPv4 unallocated address space exhaustion?
  – Are your staff educated about IPv6 technical knowledge?
  – Is your network equipment ready to deploy IPv6?
  – What other thought do you have?

• JPNIC community’s effort
Current status of IPv4

- IPv4 Address Pool Status
  - IETF Reserved: 36,078
  - IRAP Pool: 44
  - Allocated: 175,922

Advertised and unadvertised addresses

- Time Series of Advertised and Unadvertised Addresses

Graph showing trends over time.
IPv6 allocation and announcements

• Prefix allocation distribution

[Diagram showing the number of prefixes allocated over time for different organizations, such as AfrIC, LACNIC, ARIN, RIPE, and APNIC.]

IPv6 allocation and announcements

• Prefix announcement distribution

[Diagram showing the number of prefixes announced over time for different organizations, such as AfrIC, LACNIC, ARIN, RIPE, and APNIC.]
APNIC 24 community resolution

- Endorsed at APNIC 24
  - Community resolution on IPv4 and IPv6 issues, 7 September 2007
- The APNIC community recognises that the remaining free pool of IPv4 address space is likely to be consumed within 2 to 4 years
  - Requires a concerted effort by the community
    - Responsible measures in managing remaining IPv4 addresses
    - Promote the adoption of IPv6
    - Call upon leading senior and expert members to provide strong leadership in the search of solutions to these issues

Where are we heading?

- IPv4 address consumption is speeding up
  - But remember “number of advertised address block” is about 1/3 of actually assigned/allocated address space
    - Gradually “Advertised addresses” will increase
  - Where is rapid consumption happening?
    - APNIC region
      - Possibly such address space will be traded in the market
- IPv4 UNALLOCATED address space exhaustion
  - According to Geoff’s model (dated: 22 Oct 2007), IANA will allocate its last IPv4 /8 to an RIR on 22 May 2010
    - Tomorrow’s prediction will be different!
Where are we heading?

- Some possible scenarios (but may need to implement all):
  - Persist in IPv4 networks using more NATs
    - NAT’s deployment cost can be internalised by ISPs
    - NATs on steroid
    - Standardise its specification?
  - Address markets emerging for IPv4
    - Remember so much “unadvertised address space”
  - Routing fragmentation
  - IPv6 transition
    - But IPv6 is not backward compatible with IPv4 on the wire
    - So dual stack is mandatory
      - Dual stack requires IPv4 addresses
      - So we need to stretch IPv4

Where are we heading?

- We should preserve the functionality and integrity of the Internet as a service platform
  - Functionality of applications
  - Viability of routing
  - Capability to sustain continued growth
  - Integrity of the network infrastructure
IPv6 policy and procedures

IPv6 address management hierarchy
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

- 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

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(\text{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
  - Implemented

IPv6 utilisation (HD = 0.94)

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

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

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 did 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
  - Implemented

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

- http://ftp.apnic.net/apnic/docs/ipv6-alloc-request.txt
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

http://ftp.apnic.net/apnic/docs/ipv6-alloc-request.txt
Reverse DNS Delegation

Registry Procedures

Reverse DNS - why bother?

- Service denial
  - That only allow access when fully reverse delegated eg. anonymous ftp
- Diagnostics
  - Assisting in trace routes etc
- Spam identification
- Registration
  - Responsibility as a member and Local IR
APNIC & Member responsibilities

- **APNIC**
  - Manage reverse delegations of address block distributed by APNIC
  - Process members requests for reverse delegations of network allocations

- **Members**
  - Be familiar with APNIC procedures
  - Ensure that addresses are reverse-mapped
  - Maintain nameservers for allocations
    - Minimise pollution of DNS

Reverse delegation requirements

- **/24 Delegations**
  - Address blocks should be assigned/allocated
  - At least two name servers
  - Can ask APNIC to be the secondary zone

- **/16 Delegations**
  - Same as /24 delegations
  - APNIC delegates entire zone to member
  - Recommend APNIC secondary zone

- **< /24 Delegations**
  - Read “classless in-addr.arpa delegation”
Delegation procedures

• Upon allocation, member is asked if they want /24 place holder domain objects with member maintainer
  – Gives member direct control

• Standard APNIC database object,
  – can be updated through online form or via email.

• Nameserver/domain set up verified before being submitted to the database.

• Protection by maintainer object
  – (auths: CRYPT-PW, PGP).

• Zone file updated 2-hourly

Example ‘domain’ object

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>domain</td>
<td>124.54.202.in-addr.arpa</td>
</tr>
<tr>
<td>descr</td>
<td>co-located server at mumbai</td>
</tr>
<tr>
<td>country</td>
<td>IN</td>
</tr>
<tr>
<td>admin-c</td>
<td>VT43-AP</td>
</tr>
<tr>
<td>tech-c</td>
<td>IA15-AP</td>
</tr>
<tr>
<td>zone-c</td>
<td>IA15-AP</td>
</tr>
<tr>
<td>nserver</td>
<td>dns.vsnl.net.in</td>
</tr>
<tr>
<td>mnt-by</td>
<td>MAINT-IN-VSNL</td>
</tr>
<tr>
<td>changed</td>
<td><a href="mailto:gpsingh@vsnl.net.in">gpsingh@vsnl.net.in</a> 20010612</td>
</tr>
<tr>
<td>source</td>
<td>APNIC</td>
</tr>
</tbody>
</table>
Delegation procedures – request form

- Complete the documentation
  - [http://www.apnic.net/db/domain.html](http://www.apnic.net/db/domain.html)

- On-line form interface
  - Real time feedback
  - Gives errors, warnings in zone configuration
    - serial number of zone consistent across nameservers
    - nameservers listed in zone consistent
  - Uses database ‘domain’ object
    - examples of form to follow.

Reverse DNS request form

Create Domain Object

**Domain Object**

What is this form to be used for?
This form assists in the creation and maintenance of domain objects. The domain class:

(*) indicates mandatory field

- **Domain:**
- **Descr:** 
  - Please change this field – This is added by [http://www.apnic.net/db/domain.html](http://www.apnic.net/db/domain.html)
  - The reverse delegation zone for this
- **Country:**
- **Admin:**
  - Use the ACN code for administrative contacts
  - Other text: DNSA
  - Admin - must be someone physically located at the site of the network.
Request form

- server
- Remarks:
- Notify:
  - This email address will be notified by the APNIC database when this object changes.
- Mntby:
- *Password
  - You must supply a password for one of the maintainers listed in this field
- Mntower:
  - This step adds -host additions beneath this zone

Evaluation

- Parser checks for
  - 'whois' database
    - IP address range is assigned or allocated
    - Must be in APNIC database
  - Maintainer object
    - Mandatory field of domain object
  - Nic-handles
    - zone-c, tech-c, admin-c
Creation of domain objects

• APNIC highly recommend you to use MyAPNIC when creating domain objects
  – MyAPNIC parser will check the maintainer of ‘inetnum’ object
  – If the password matches no errors will be returned

• Can use MyAPNIC to create multiple domain objects at once
  – ex: If you are allocated a /19, you can provide the full IP range and 32 domain objects can be created in one go

Questions?
Member services

- 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

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
Discussion

Thank you!