APNIC 34
CONFERENCE
PHNOM PENH,
CAMBODIA

Internet Resource Management Tutorial

28 August 2012, Phnom Penh, Cambodia

Presenter

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  - champika@apnic.net

Agenda (IRM)

- Introduction to APNIC
- Policy Development Process
- Internet Registry Policies
- Requesting IP Addresses
- Whois Database and MyAPNIC
- Autonomous System Numbers
- Reverse DNS
- IPv6 Overview

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- **Introduction to APNIC**
- Policy Development Process
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- Autonomous System Numbers
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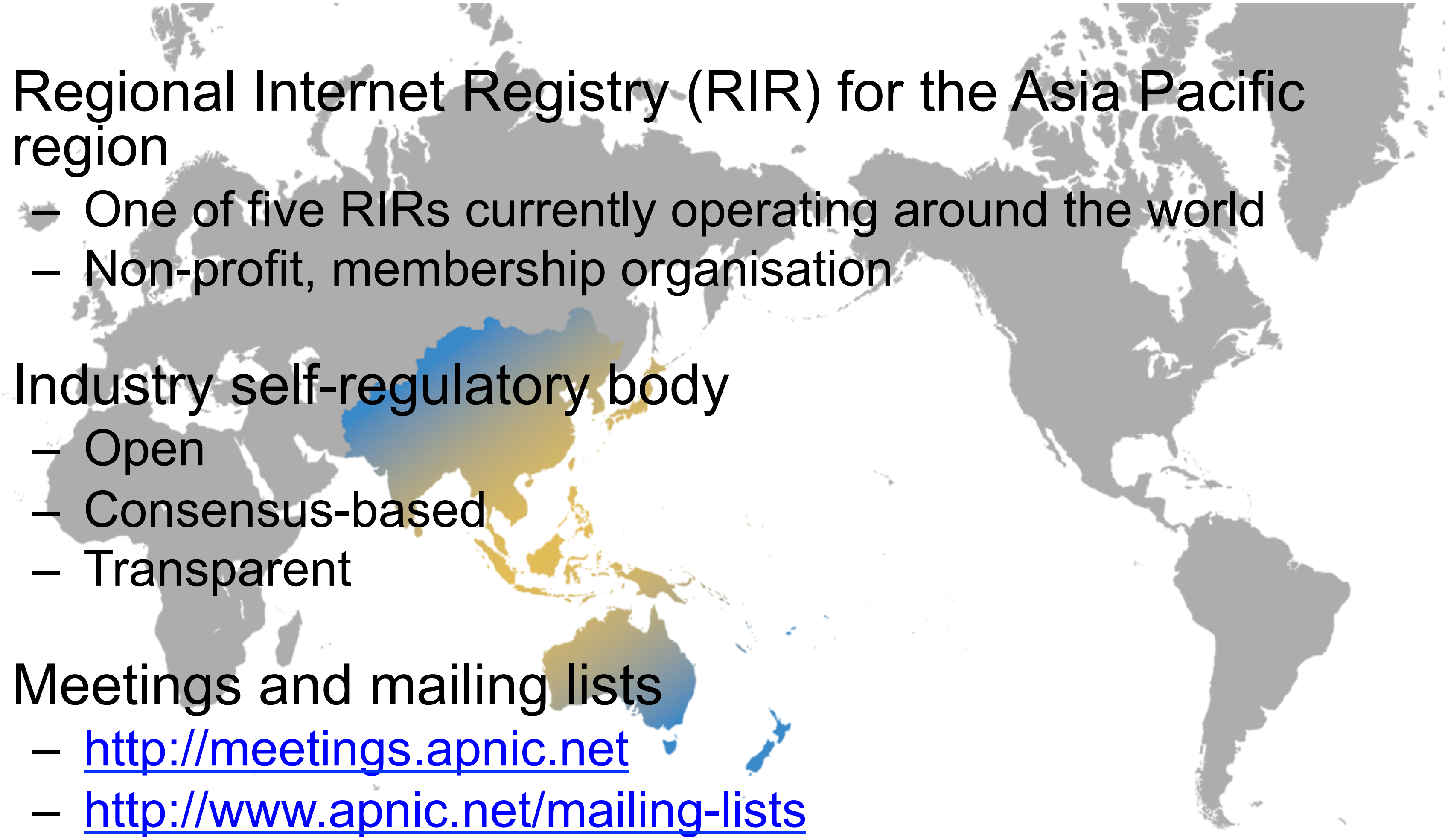
- IPv6 Overview

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
- Industry self-regulatory body
  - Open
  - Consensus-based
  - Transparent
- Meetings and mailing lists
  - http://meetings.apnic.net
  - http://www.apnic.net/mailing-lists

What does APNIC do?

Resource service

- IPv4, IPv6, ASNs
- Reverse DNS delegation
- Resource registration
    - Authoritative registration server
        - Whois
        - IRR

Policy development

- Facilitating the policy development process
- Implementing policy changes

Information dissemination

- APNIC meetings
- Web and ftp site
- Publications, mailing lists
- Outreach seminars

http://www.apnic.net/community/participate/join-discussions/sigs

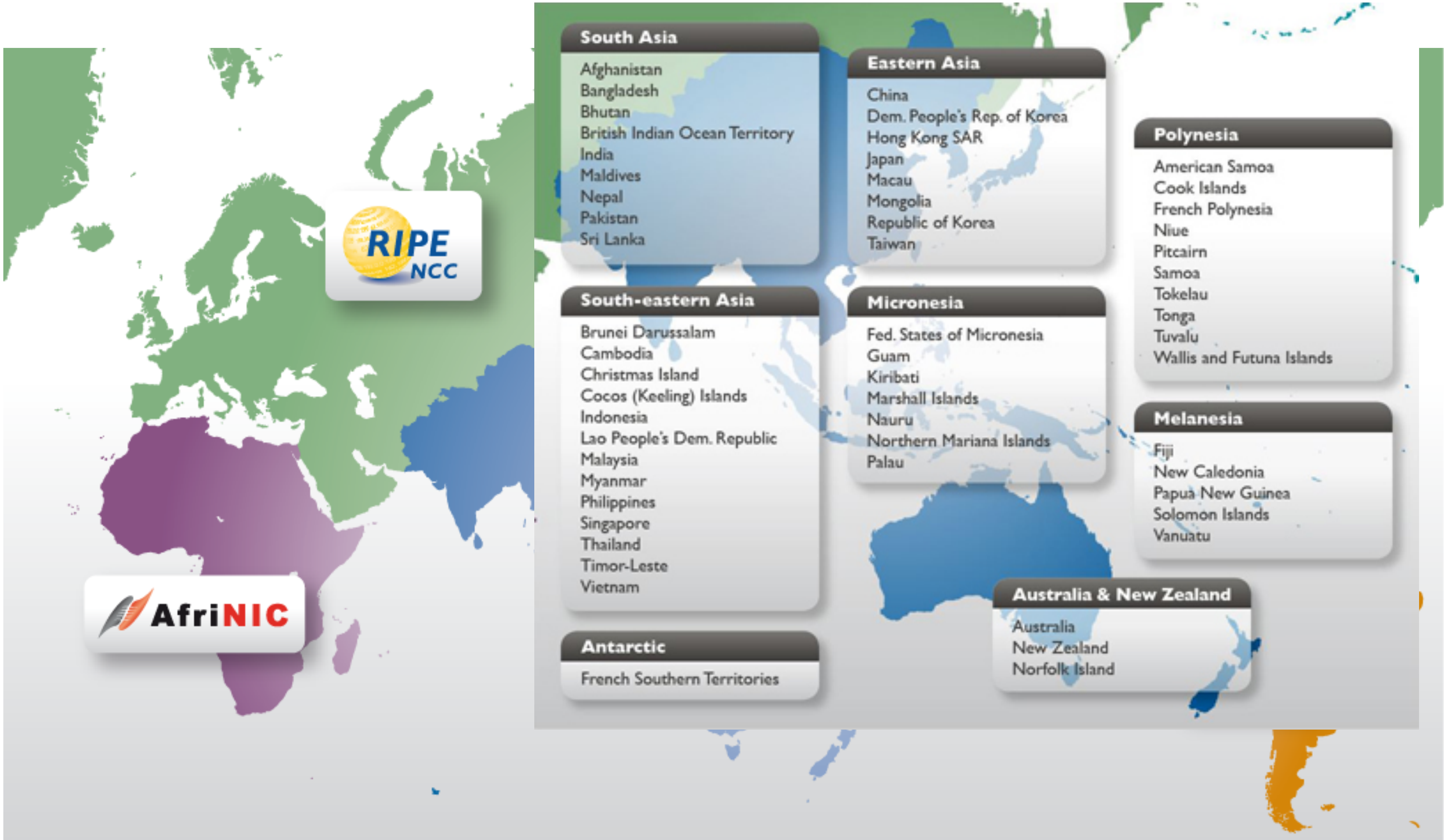
Training

- Face to Face
- Via eLearning

- Subsidised for members

Schedule:
http://www.apnic.net/training

Where is the APNIC Region?



South Asia
- Afghanistan
- Bangladesh
- Bhutan
- British Indian Ocean Territory
- India
- Maldives
- Nepal
- Pakistan
- Sri Lanka

Eastern Asia
- China
- Dem. People's Rep. of Korea
- Hong Kong SAR
- Japan
- Macau
- Mongolia
- Republic of Korea
- Taiwan

Polynesia
- American Samoa
- Cook Islands
- French Polynesia
- Niue
- Pitcairn
- Samoa
- Tokelau
- Tonga
- Tuvalu
- Wallis and Futuna Islands

South-eastern Asia
- Brunei Darussalam
- Cambodia
- Christmas Island
- Cocos (Keeling) Islands
- Indonesia
- Lao People's Dem. Republic
- Malaysia
- Myanmar
- Philippines
- Singapore
- Thailand
- Timor-Leste
- Vietnam

Micronesia
- Fed. States of Micronesia
- Guam
- Kiribati
- Marshall Islands
- Nauru
- Northern Mariana Islands
- Palau

Melanesia
- Fiji
- New Caledonia
- Papua New Guinea
- Solomon Islands
- Vanuatu

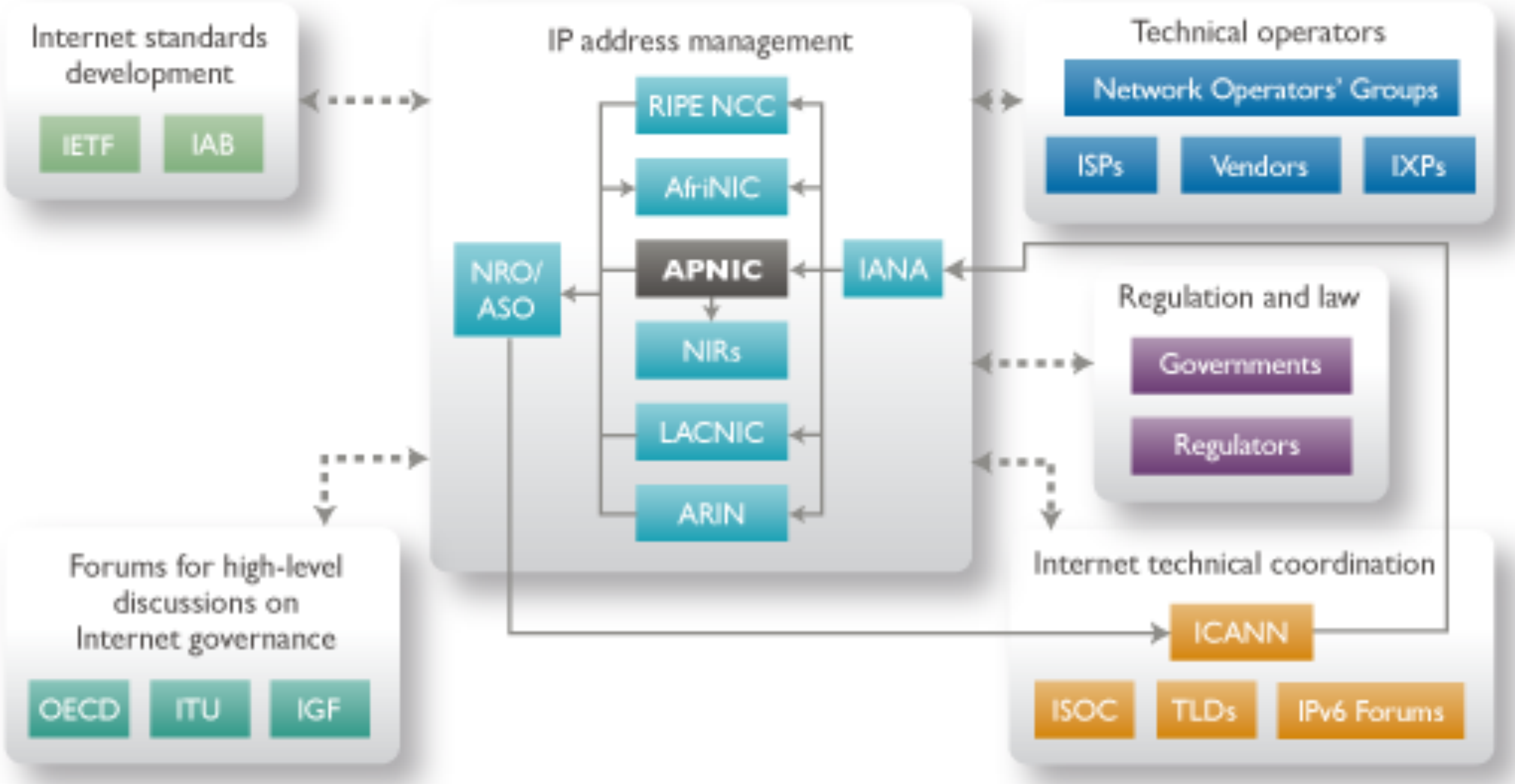
Antarctic
- French Southern Territories

Australia & New Zealand
- Australia
- New Zealand
- Norfolk Island

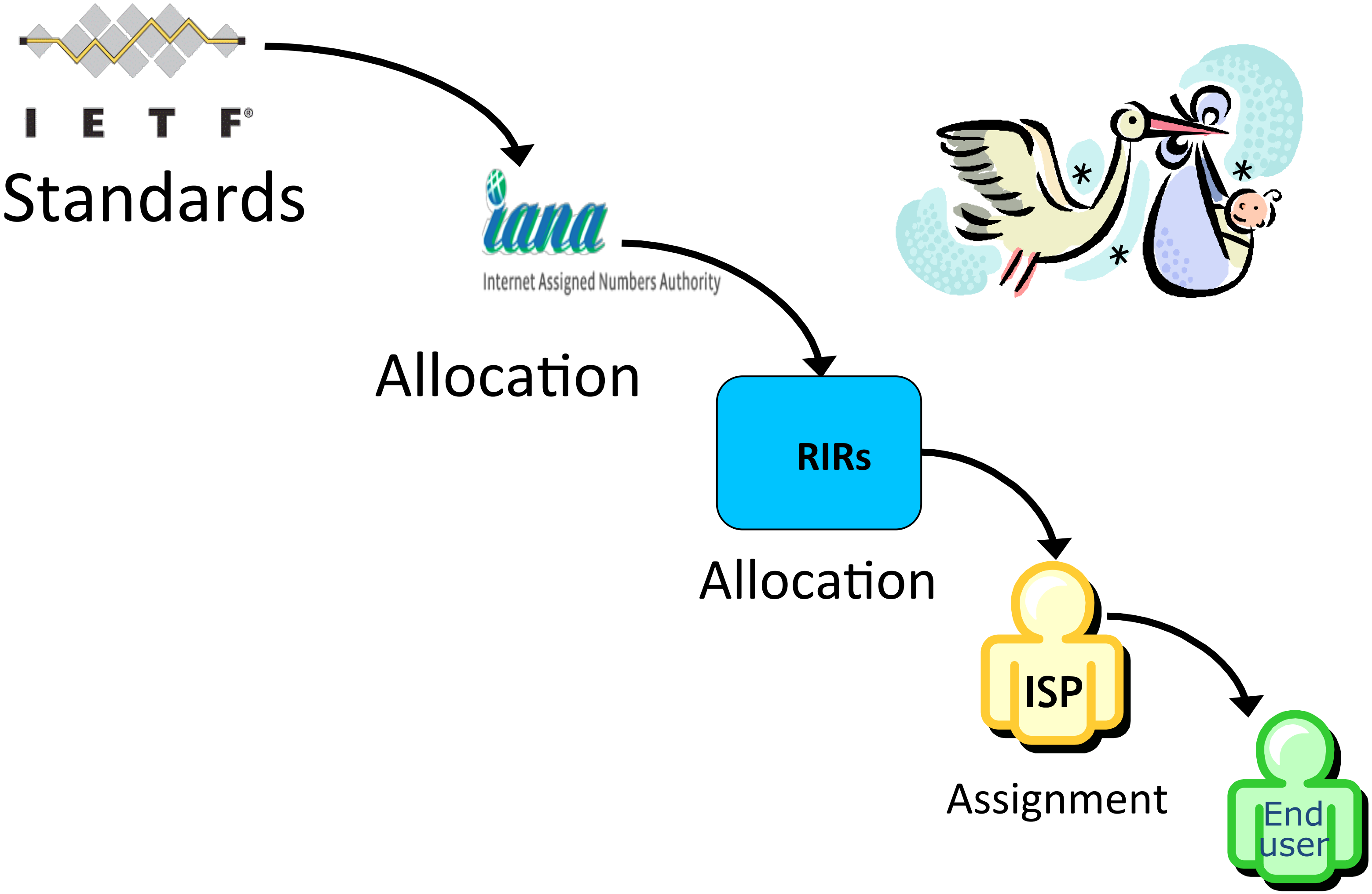
APNIC is NOT

- 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

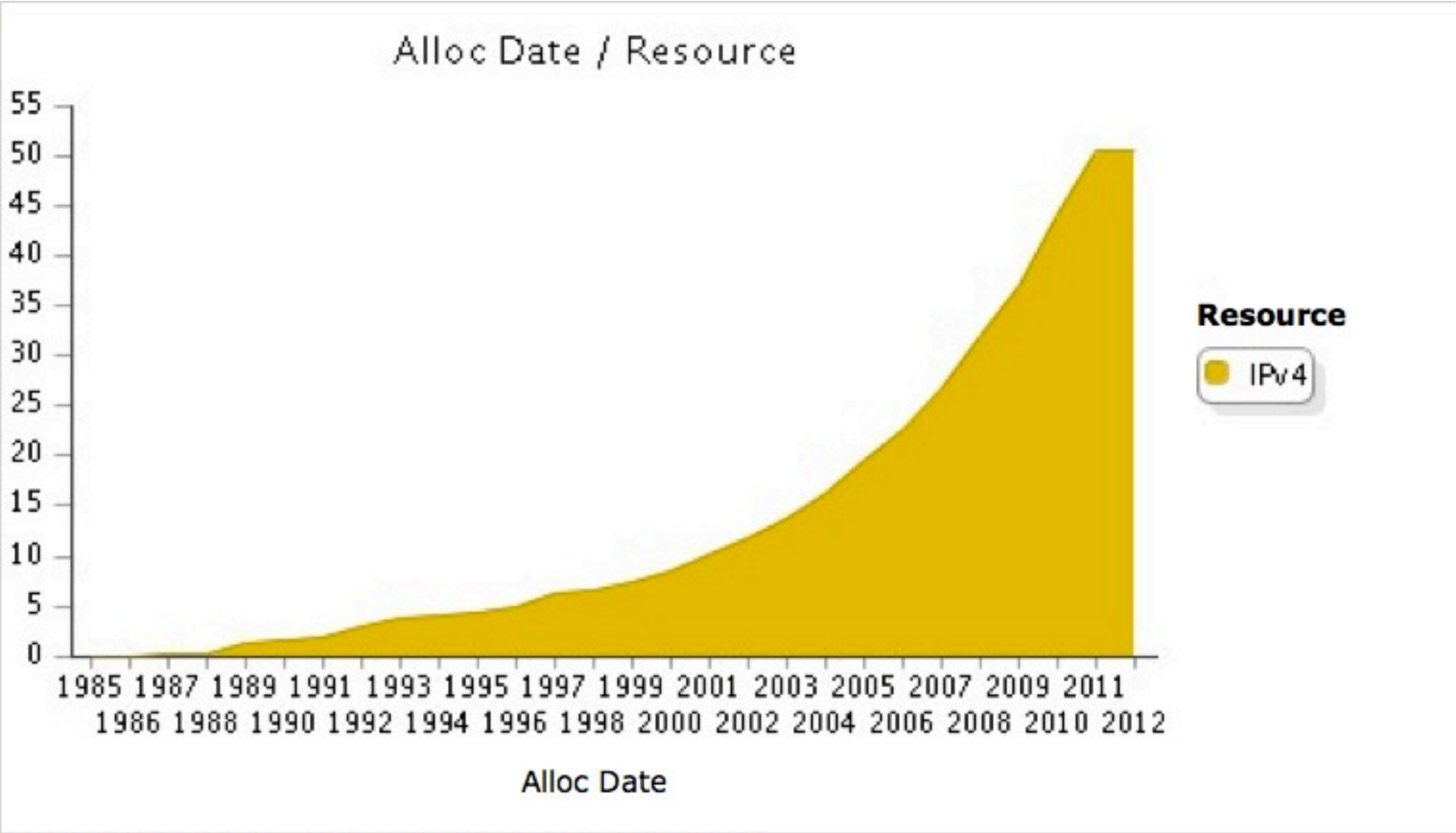
APNIC from a Global Perspective


Internet standards development
IETF
IAB
IP address management
RIPE NCC
AfriNIC
APNIC
NIRs
LACNIC
ARIN
NRO/ ASO
IANA
Technical operators
Network Operators' Groups
ISPs
Vendors
IXPs
Regulation and law
Governments
Regulators
Forums for high-level discussions on Internet governance
OECD
ITU
IGF
Internet technical coordination
ICANN
ISOC
TLDs
IPv6 Forums

Where do IP Addresses come from?


I E T F
Standards
iana
Internet Assigned Numbers Authority
Allocation
RIRs
Allocation
ISP
Assignment
End user

APNIC IPv4 Distribution



IPv4 cumulative distribution (number of /8 delegated)

Questions?

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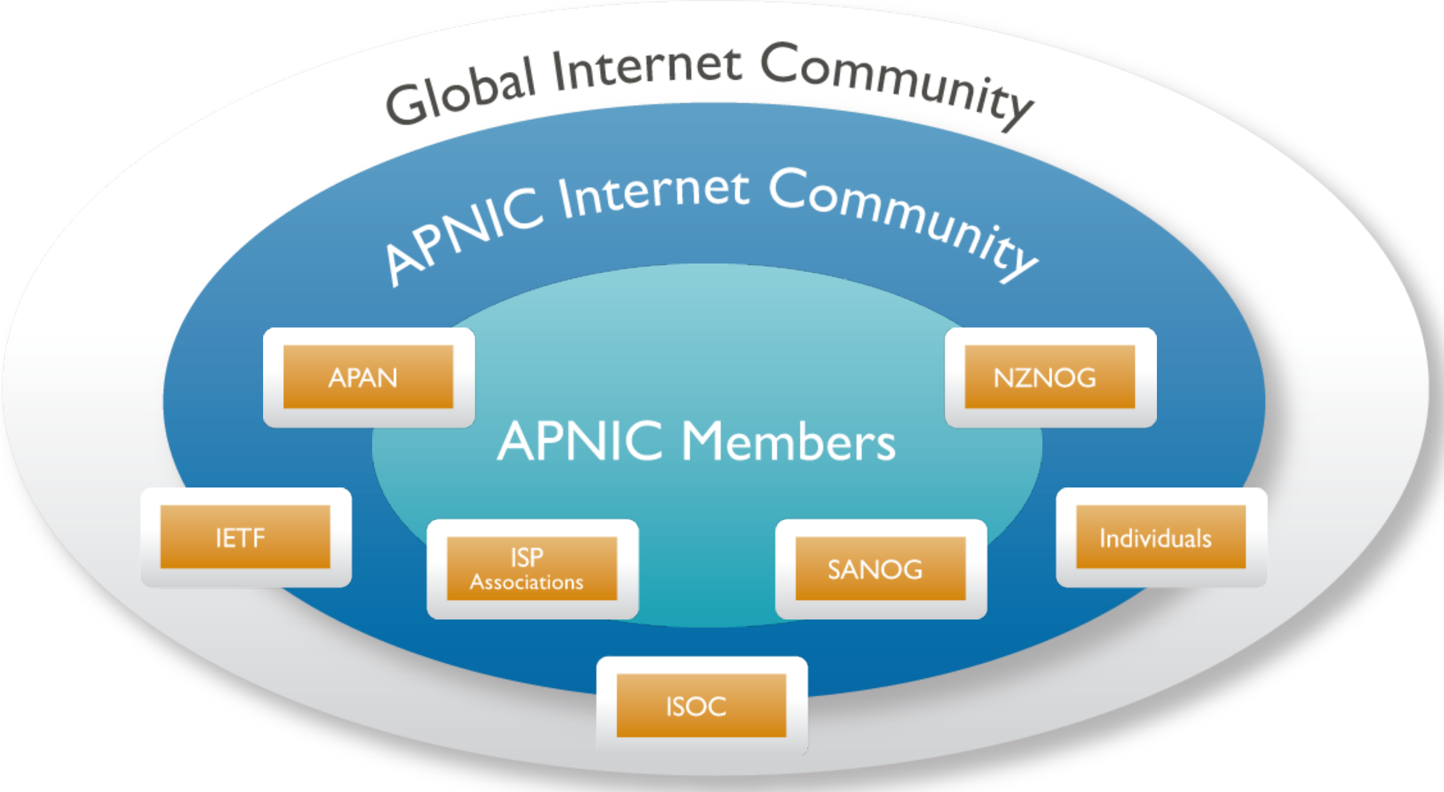
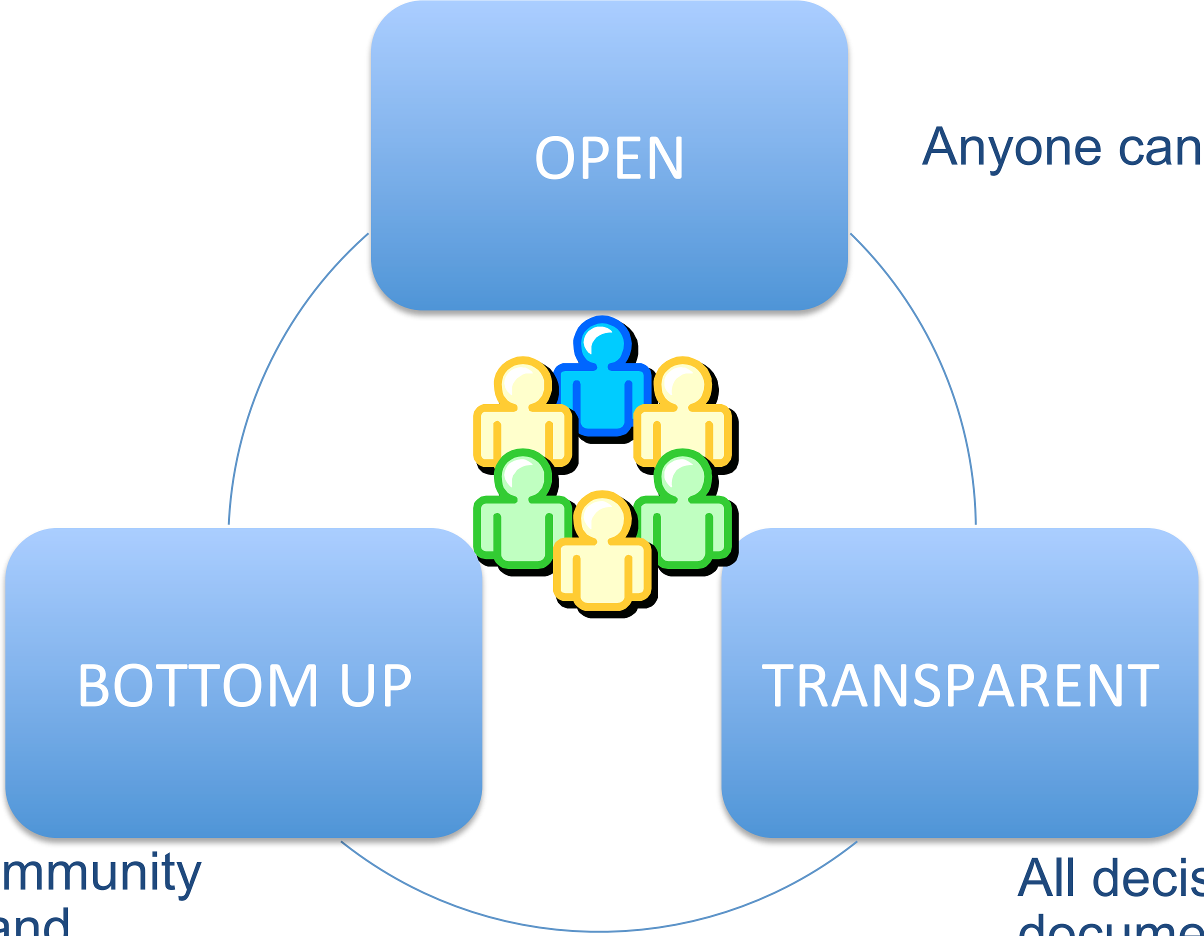
You are Part of the APNIC Community!

Open forum in the Asia Pacific


Global Internet Community
APNIC Internet Community
APNIC Members
APAN
NZNOG
IETF
ISP Associations
SANOG
Individuals
ISOC

A voice in regional Internet operations through participation in APNIC

Policy Development Process



OPEN

Anyone can participate

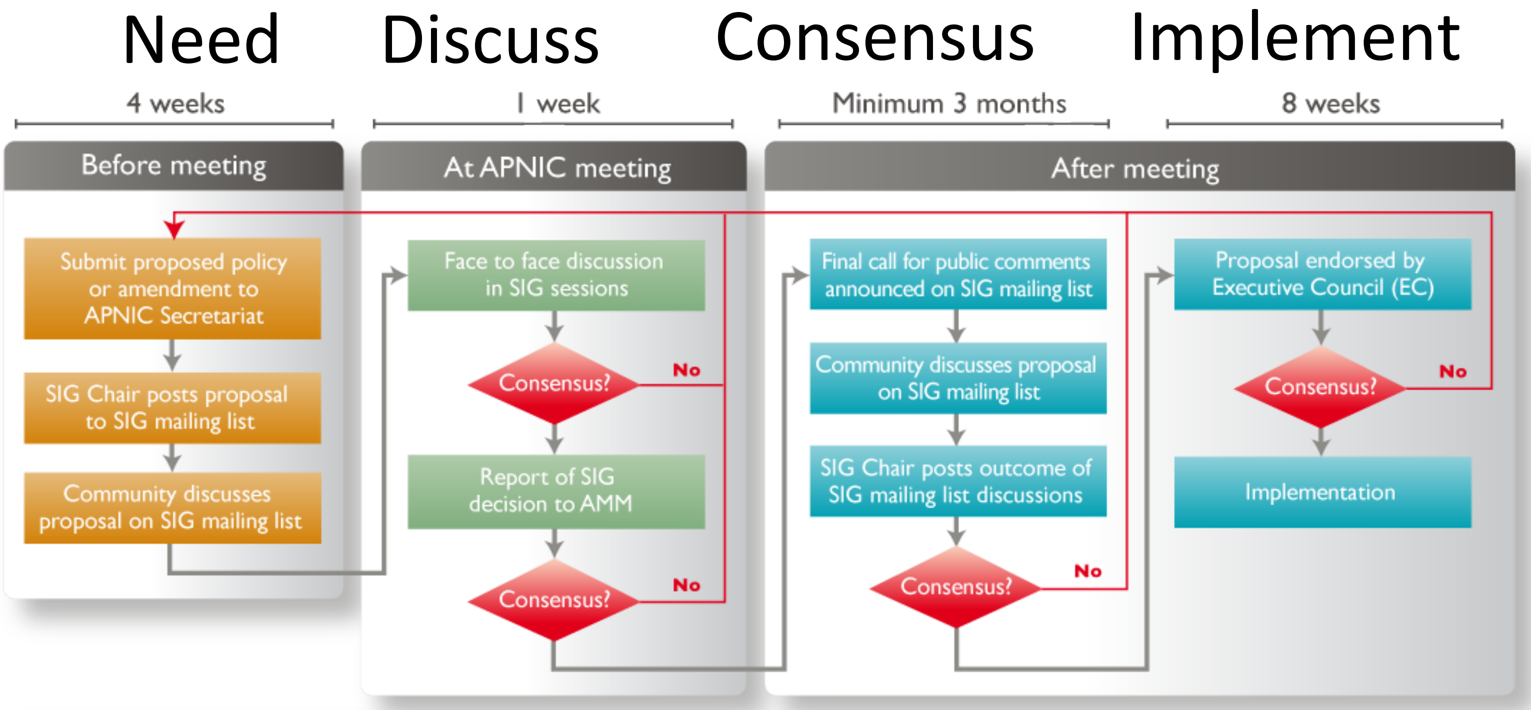
BOTTOM UP

Internet community proposes and approves policy

TRANSPARENT

All decisions & policies documented & freely available to anyone

Policy Development Process



Need

4 weeks

Before meeting

Submit proposed policy or amendment to APNIC Secretariat

SIG Chair posts proposal to SIG mailing list

Community discusses proposal on SIG mailing list

Discuss

1 week

At APNIC meeting

Face to face discussion in SIG sessions

Consensus?

No

Report of SIG decision to AMM

Consensus?

No

Consensus

Minimum 3 months

After meeting

Final call for public comments announced on SIG mailing list

Community discusses proposal on SIG mailing list

SIG Chair posts outcome of SIG mailing list discussions

Consensus?

No

Implement

8 weeks

Proposal endorsed by Executive Council (EC)

Consensus?

No

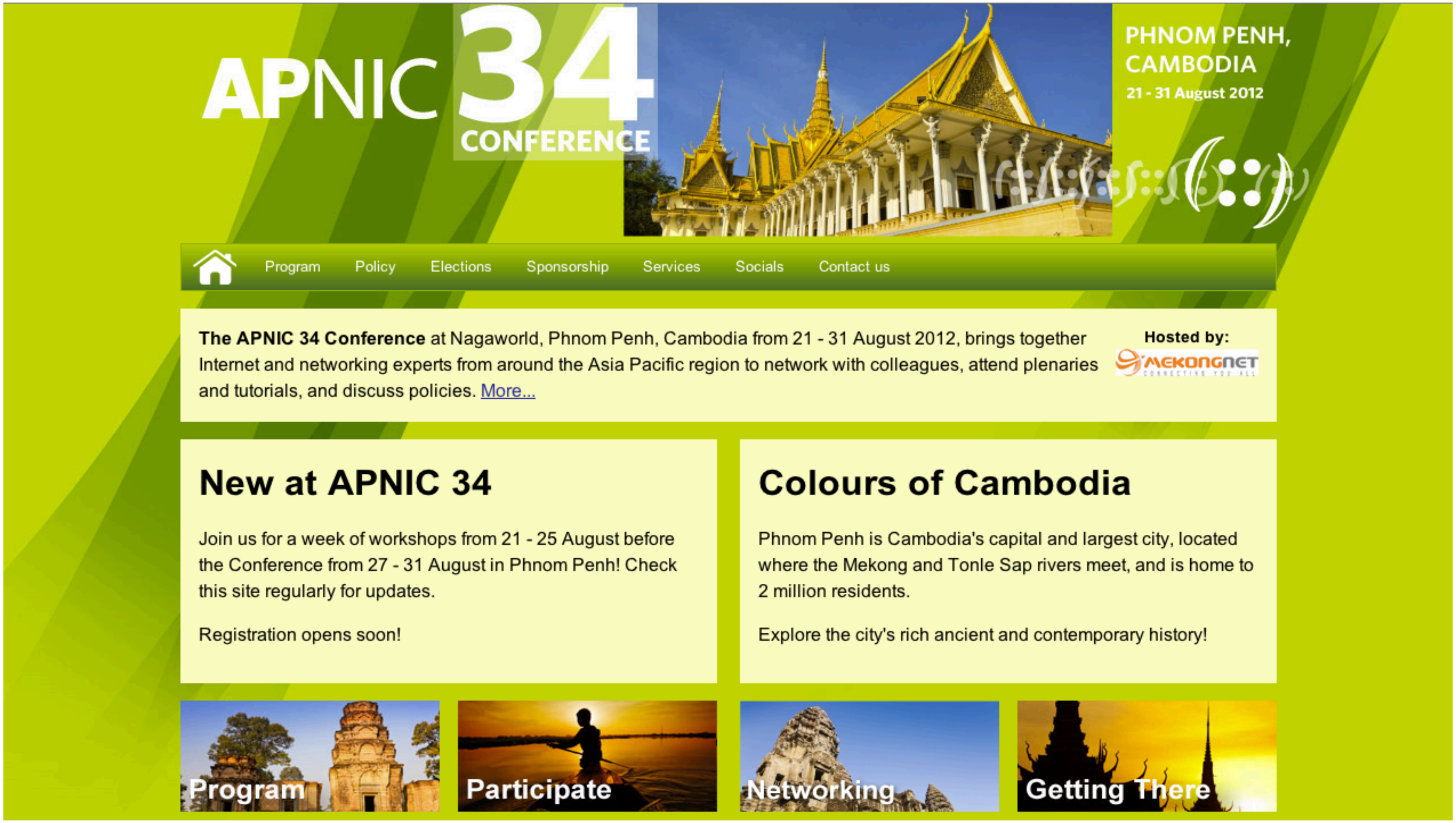
Implementation

You can participate!

More information about policy development can be found at:

http://www.apnic.net/policy

APNIC Conferences


APNIC 34 CONFERENCE
PHNOM PENH, CAMBODIA
21 - 31 August 2012
Program
Policy
Elections
Sponsorship
Services
Socials
Contact us
Hosted by:
MEKONGNET
CONNECTING YOU ALL
Program
Participate
Networking
Getting There

The APNIC 34 Conference at Nagaworld, Phnom Penh, Cambodia from 21 - 31 August 2012, brings together Internet and networking experts from around the Asia Pacific region to network with colleagues, attend plenaries and tutorials, and discuss policies. More...

New at APNIC 34

Join us for a week of workshops from 21 - 25 August before the Conference from 27 - 31 August in Phnom Penh! Check this site regularly for updates.

Registration opens soon!

Colours of Cambodia

Phnom Penh is Cambodia's capital and largest city, located where the Mekong and Tonle Sap rivers meet, and is home to 2 million residents.

Explore the city's rich ancient and contemporary history!

How to Make Your Voice Heard

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

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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 ISP customers, or used for an ISP’s infrastructure (‘self-assignment’)

Allocation and Assignment

APNIC
Allocates
to APNIC Member

↓

APNIC Member

Allocates
to downstream

↓

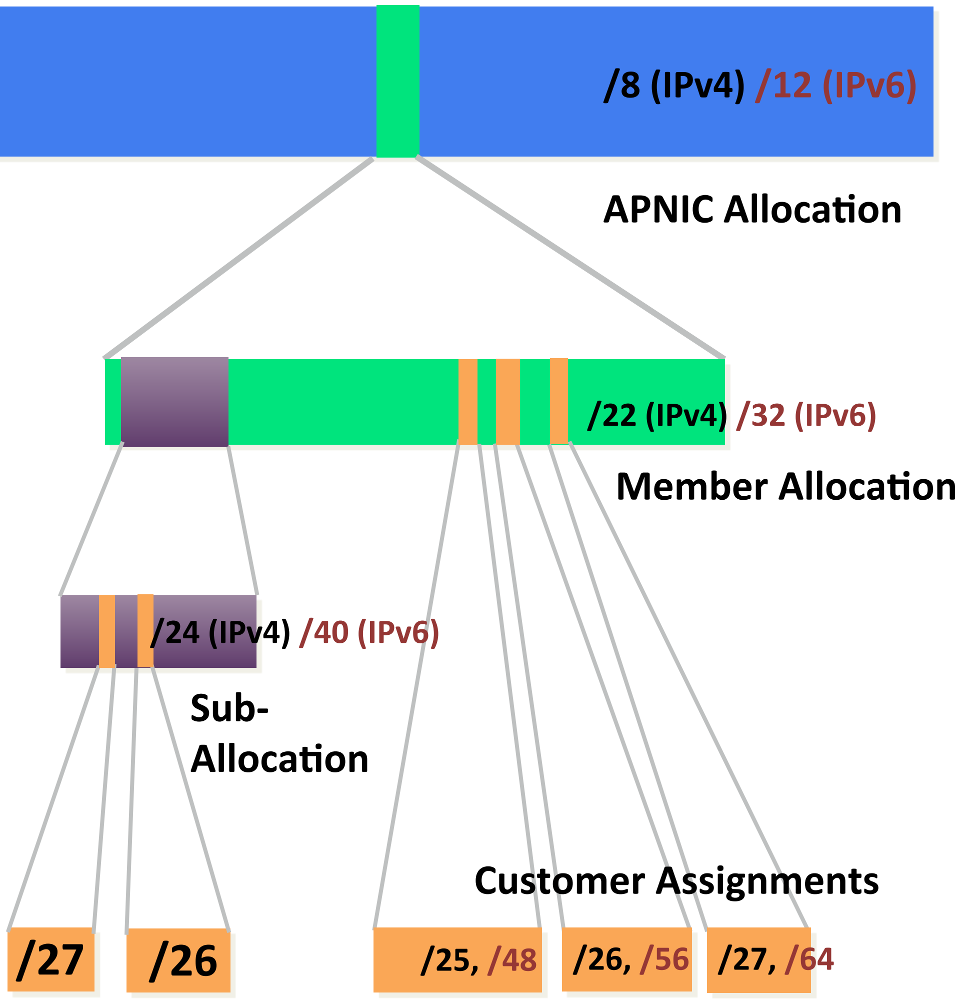
Downstream
Assigns
to end-user

↓

Assigns
to end-user

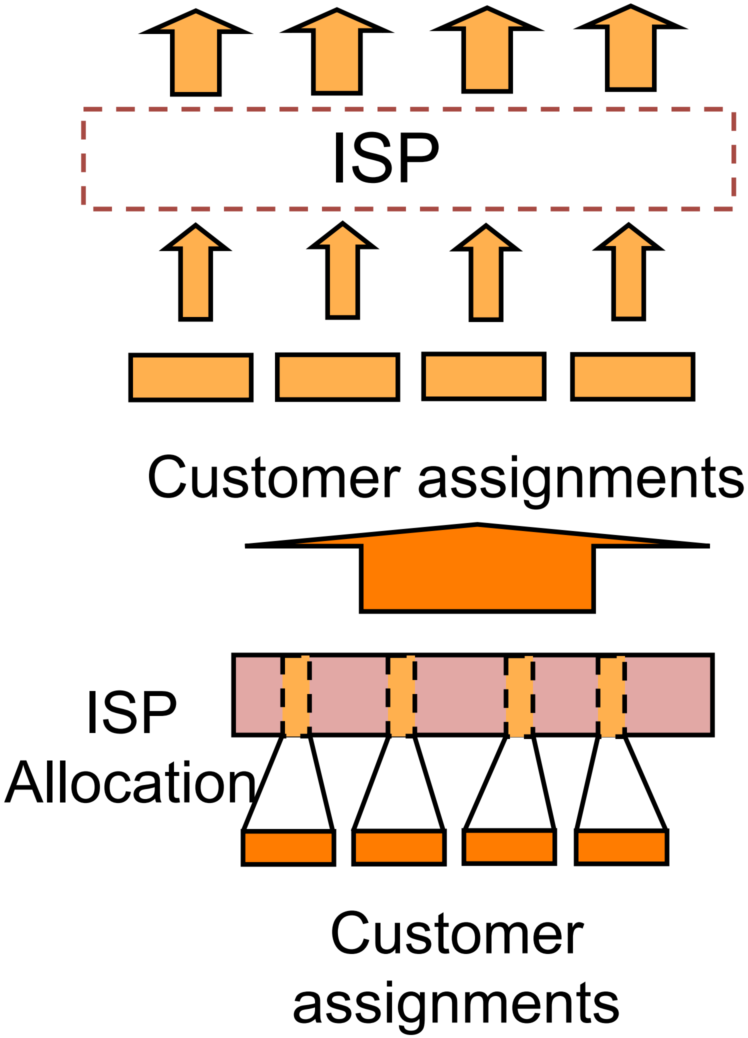
↓

Customer / End User


/8 (IPv4) /12 (IPv6)
APNIC Allocation
/22 (IPv4) /32 (IPv6)
Member Allocation
/24 (IPv4) /40 (IPv6)
Sub-Allocation
Customer Assignments
/27
/26
/25, /48
/26, /56
/27, /64

Portable and 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



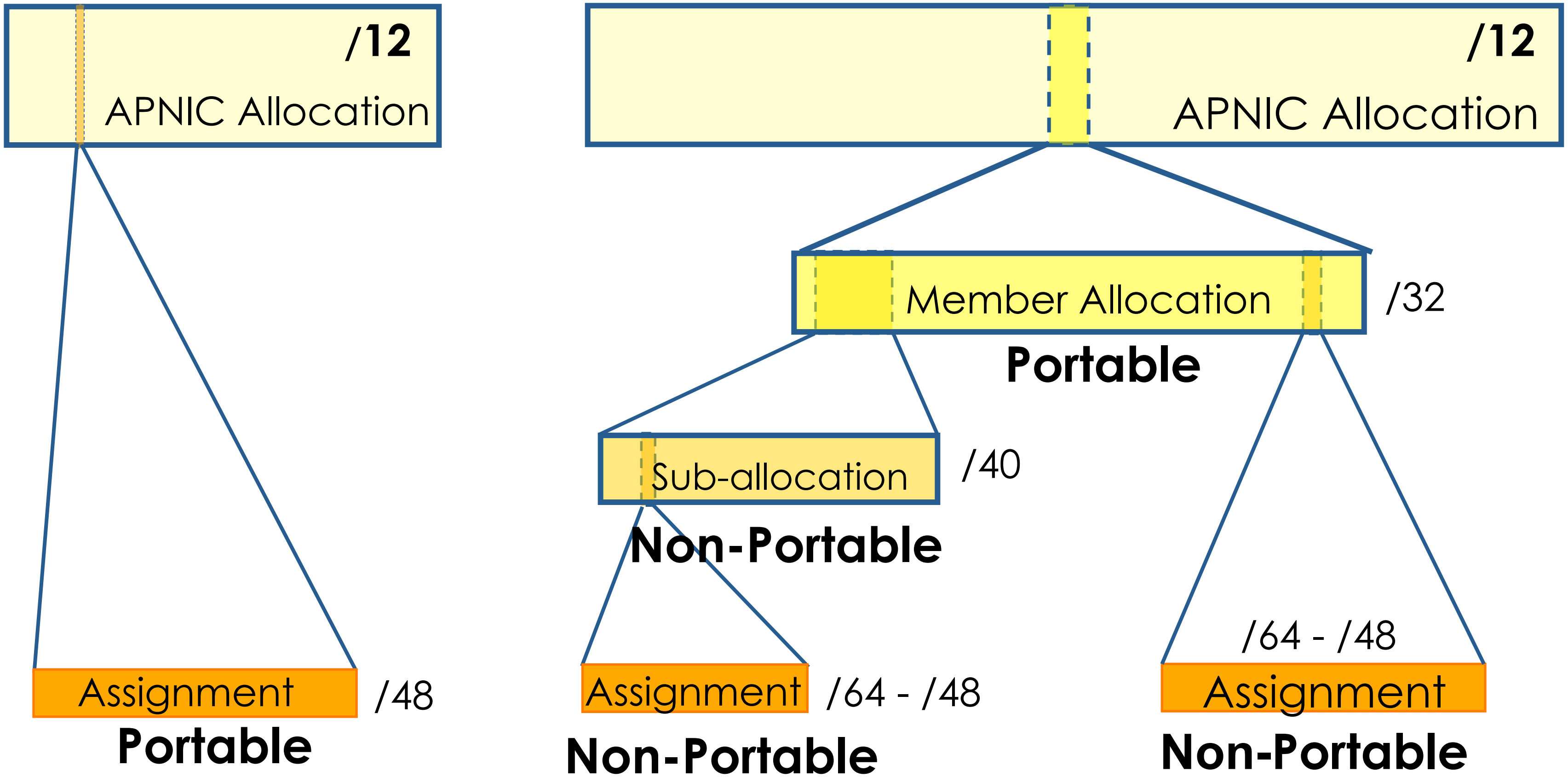
ISP

Customer assignments

ISP Allocation

Customer assignments

Address Management Hierarchy


/12
APNIC Allocation
/12
APNIC Allocation
Member Allocation
/32
Portable
Sub-allocation
/40
Non-Portable
Assignment
/48
Portable
Assignment
/64 - /48
Non-Portable
/64 - /48
Assignment
Non-Portable

Describes "portability" of the address space

Internet Resource Management Objectives

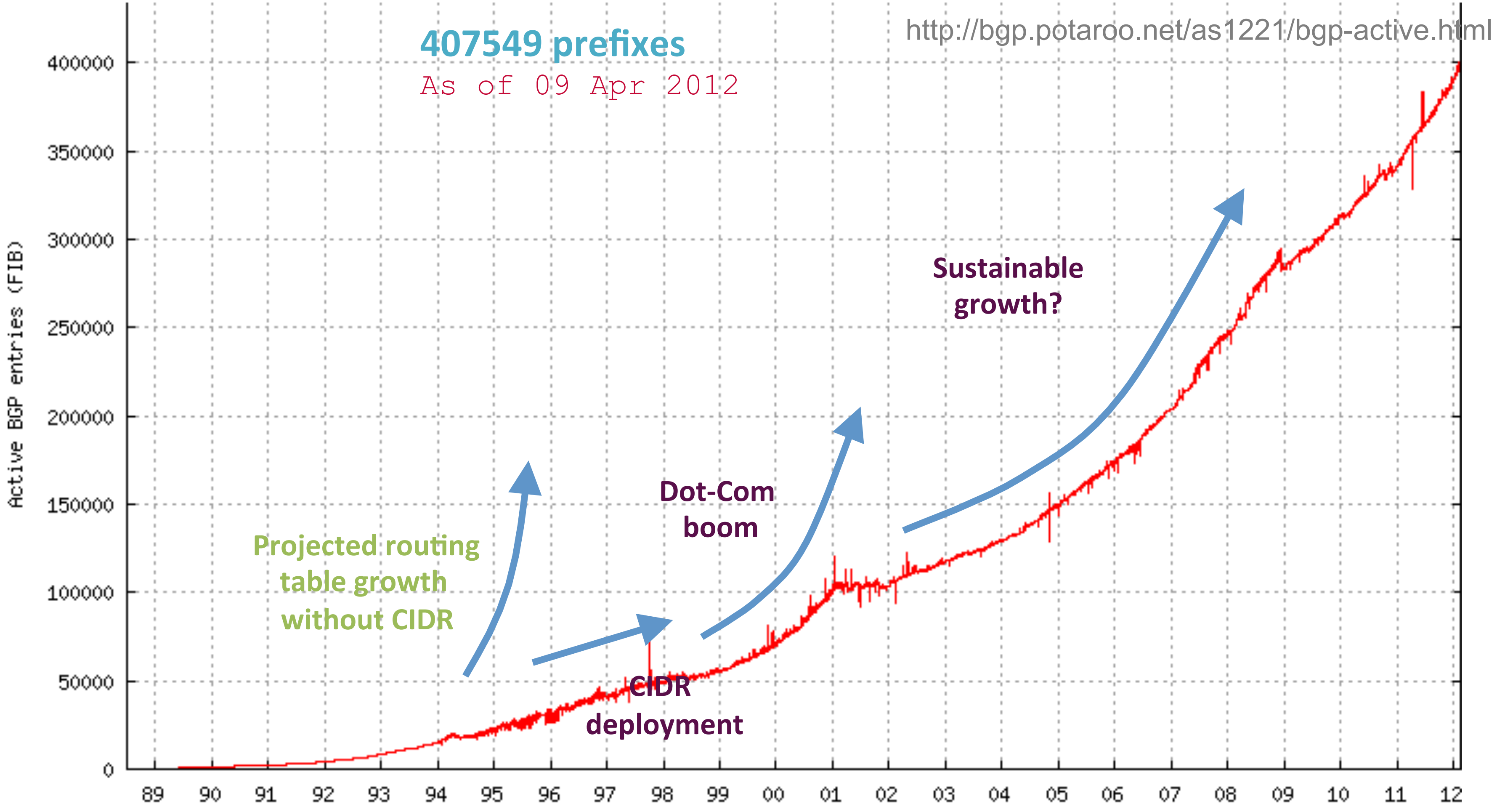
Conservation
- Efficient use of resources
- Based on demonstrated need

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

Registration
- Ensure uniqueness
- Facilitate trouble shooting

Uniqueness, fairness and consistency

Growth of the Global Routing Table



407549 prefixes

As of 09 Apr 2012

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

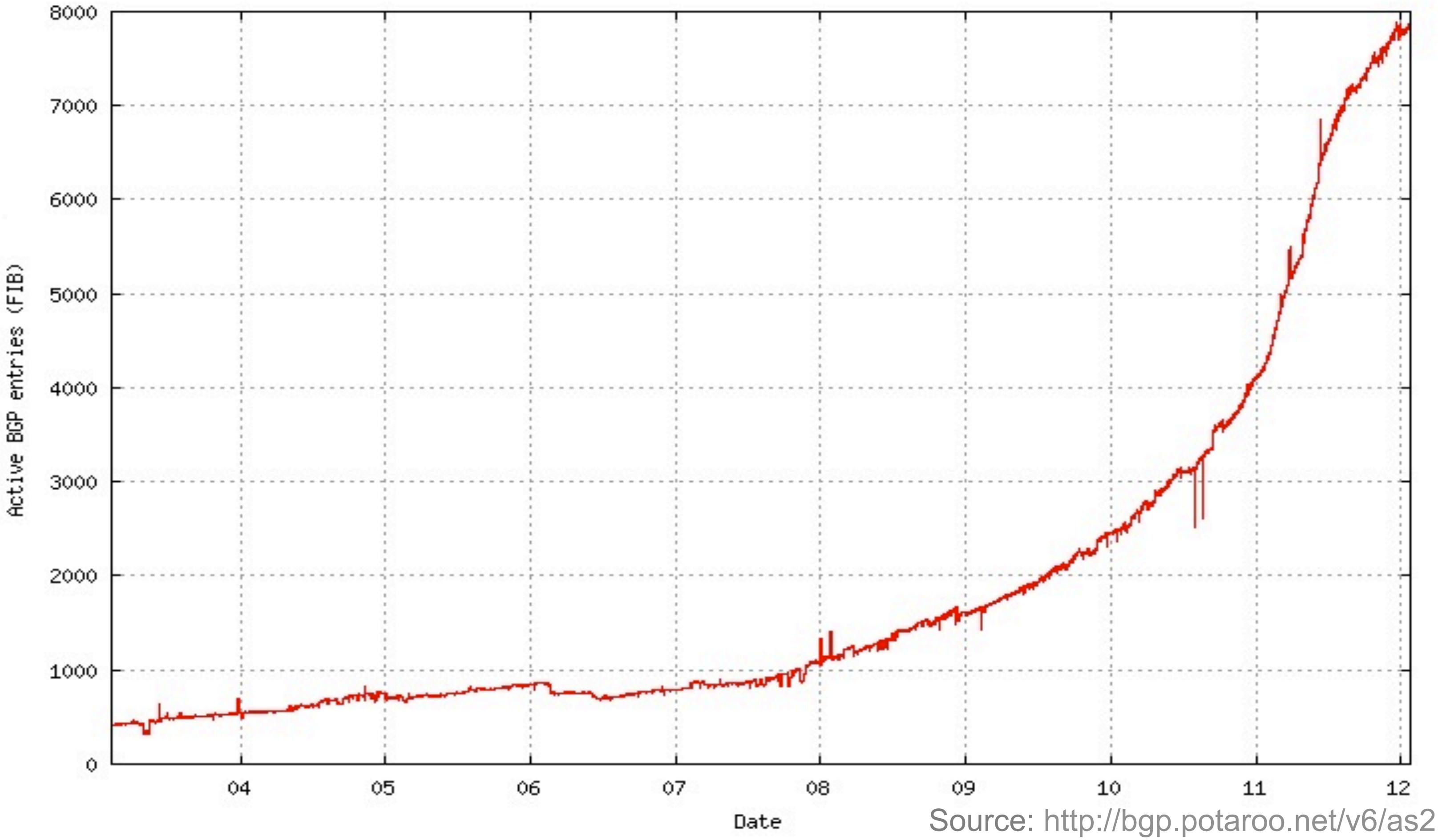
Sustainable growth?

Dot-Com boom

Projected routing table growth without CIDR

CIDR deployment

Growth of the Global Routing Table – IPv6



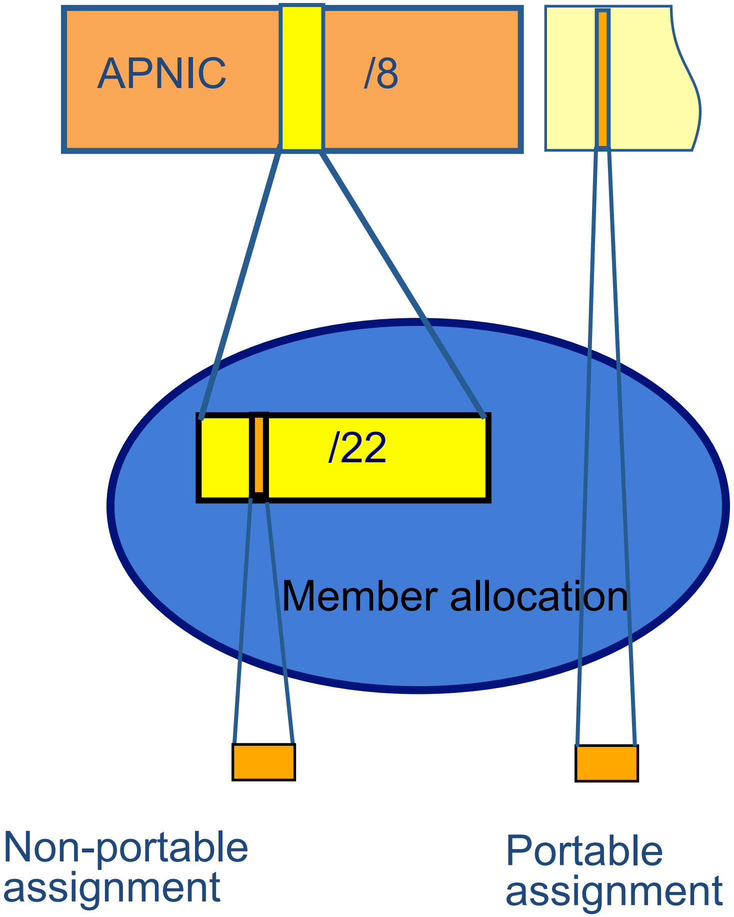
Source: http://bgp.potaroo.net/v6/as2.0/

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
  - Stockpiling is not permitted

APNIC IPv4 Allocation Policies

- APNIC IPv4 allocation size per account holder
  - Minimum /24
  - Maximum /22
- According to current allocation from the final /8 block
  - Allocation is based on demonstrated need



APNIC

/8

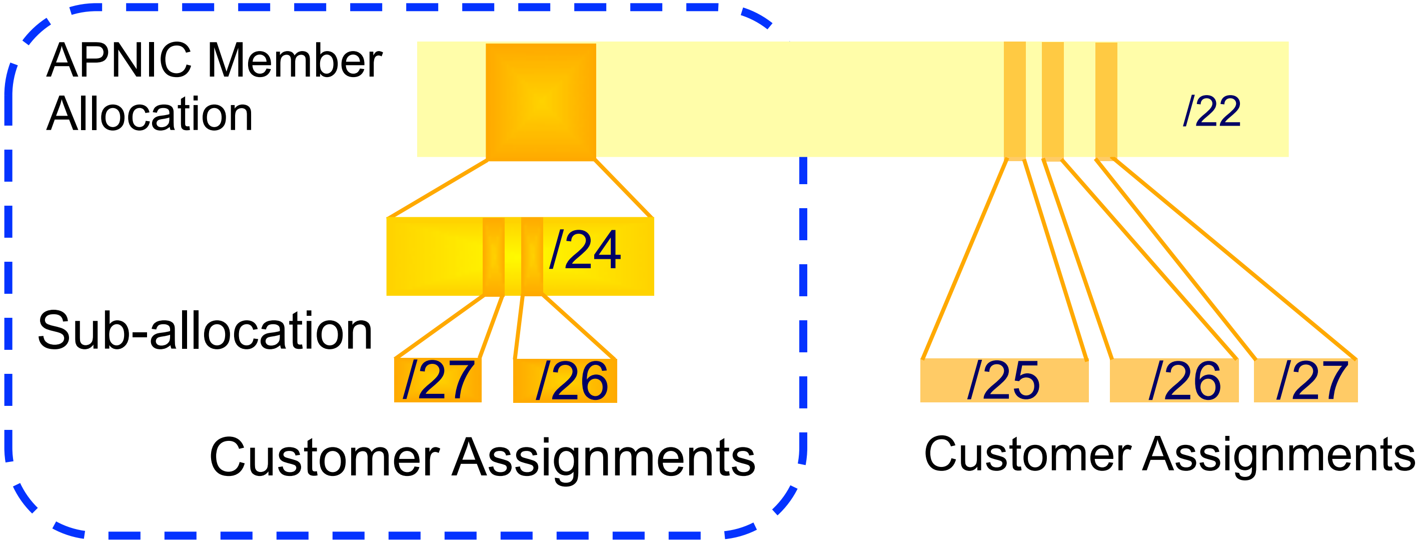
/22

Member allocation

Non-portable assignment

Portable assignment

IPv4 Sub-allocations



APNIC Member Allocation

Sub-allocation

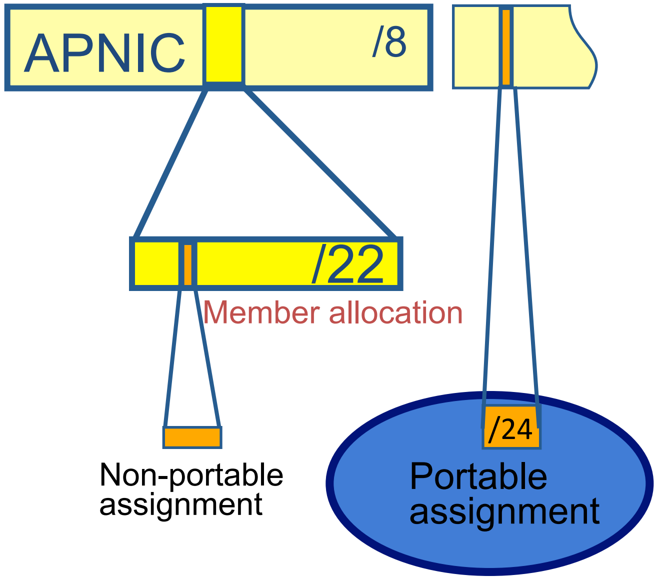
Customer Assignments

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

Portable Assignments

- Small multihoming assignment policy
  - For (small) organisations who require a portable assignment for multi-homing purposes
- Criteria
  - Applicants currently multihomed, OR
  - Demonstrate a plan to multihome within 1 month
  - Demonstrate need to use 25% of requested space immediately, and 50% within 1 year


APNIC
/8
/22
Member allocation
Non-portable assignment
/24
Portable assignment

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

Mergers, Acquisitions, and Takeovers

- LIR should advise APNIC of any changes in ownership (due to merger, sale or takeover)
- APNIC membership is not transferable
- APNIC will review the status of any allocations held by the new entity.
- Full disclosure of all address space held by all of the entities in question is required

Questions?

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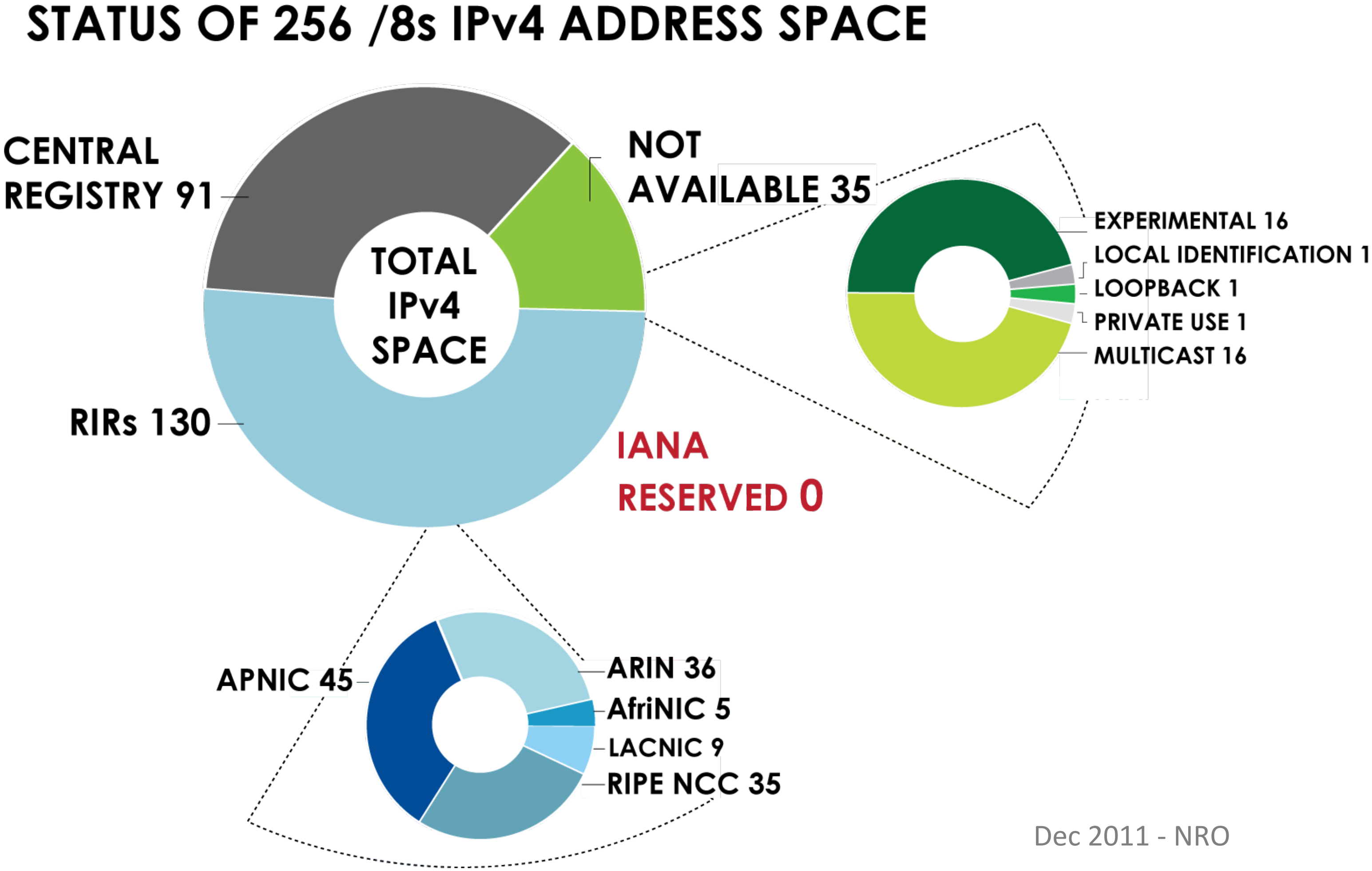
How Do I Get Addresses?

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

IPv4 Address Space



Dec 2011 - NRO

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 an initial address allocation at the same time.
  - – http://www.apnic.net/services/become-a-member

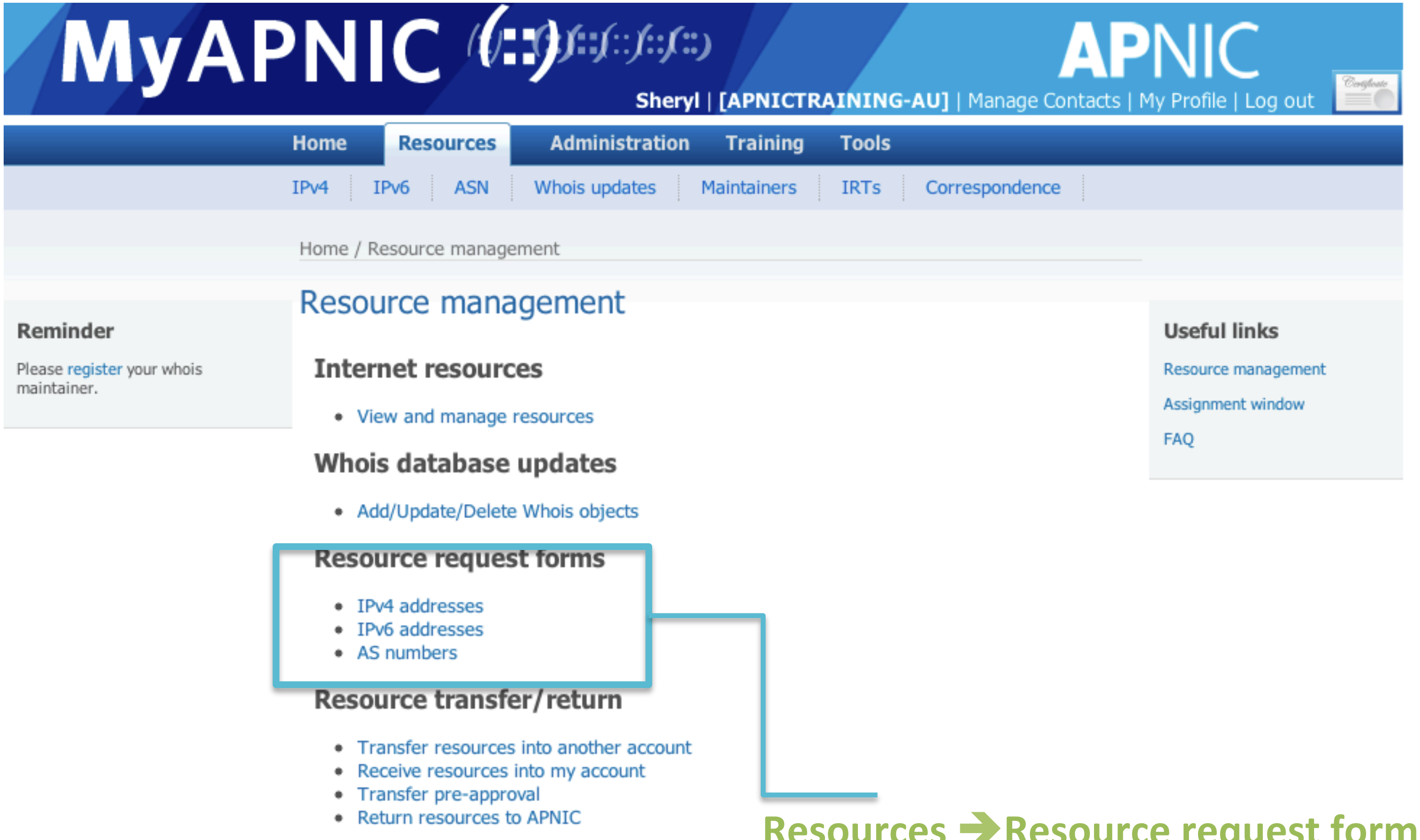
Complete the Client First Form

1	Agreement	**Agreement**
2	Type organisation's and billing details	**Organisation details**
3	Type applicant's billing & public contact details	**Organisation contacts**
4	Type account name & select membership tier	**Account details**
5	Select type of resources required or membership only	**Resource request**
6	Confirm details	**Confirm**

Resource request

- Resource type
- Existing resources
- Network plan
- Understand AW

Applying for Resources


MyAPNIC
APNIC
Sheryl | [APNICTRAINING-AU] | Manage Contacts | My Profile | Log out
Home
Resources
Administration
Training
Tools
IPv4
IPv6
ASN
Whois updates
Maintainers
IRTs
Correspondence

Home / Resource management

Resource management

Reminder

Please register your whois maintainer.

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

Useful links

Resource management
Assignment window
FAQ

Resources → Resource request forms

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Resource Registration

- As part of your membership agreement with APNIC, all Members are required to register their resources in the APNIC database.
  - First allocation/assignment, APNIC will create:
    - Inetnum or inet6num object
    - Autnum object (if you received an ASN)
    - Maintainer object (to protect your data)
    - Role/Person object
- Members must keep records up to date:
  - Whenever there is a change in contacts
  - When new resources are received
  - When resources are sub-allocated or assigned

What is the APNIC Database?

- Public network management database
  - – Operated by Internet Registries
    - 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)
  - – Authorization

Object Types

OBJECT	PURPOSE
person	contact persons
role	contact groups/roles
inetnum	IPv4 addresses
Inet6num	IPv6 addresses
aut-num	Autonomous System number
domain	reverse domains
route	prefixes being announced
mntner	(maintainer) data protection
mnt-irt	Incident Response Team

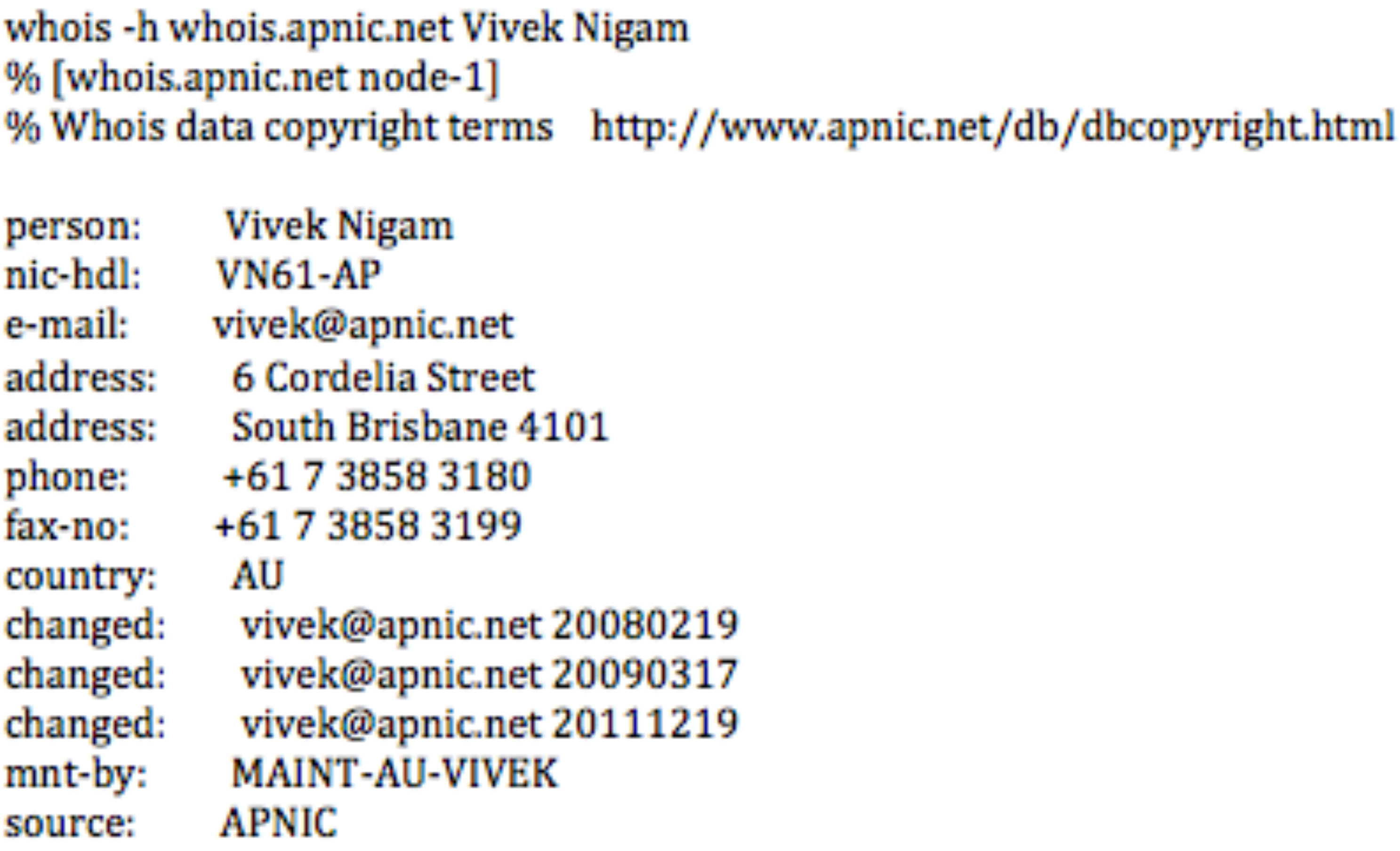
APNIC
whois

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

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 nic-hdl
  - Eg. EC17-AP

Person Object



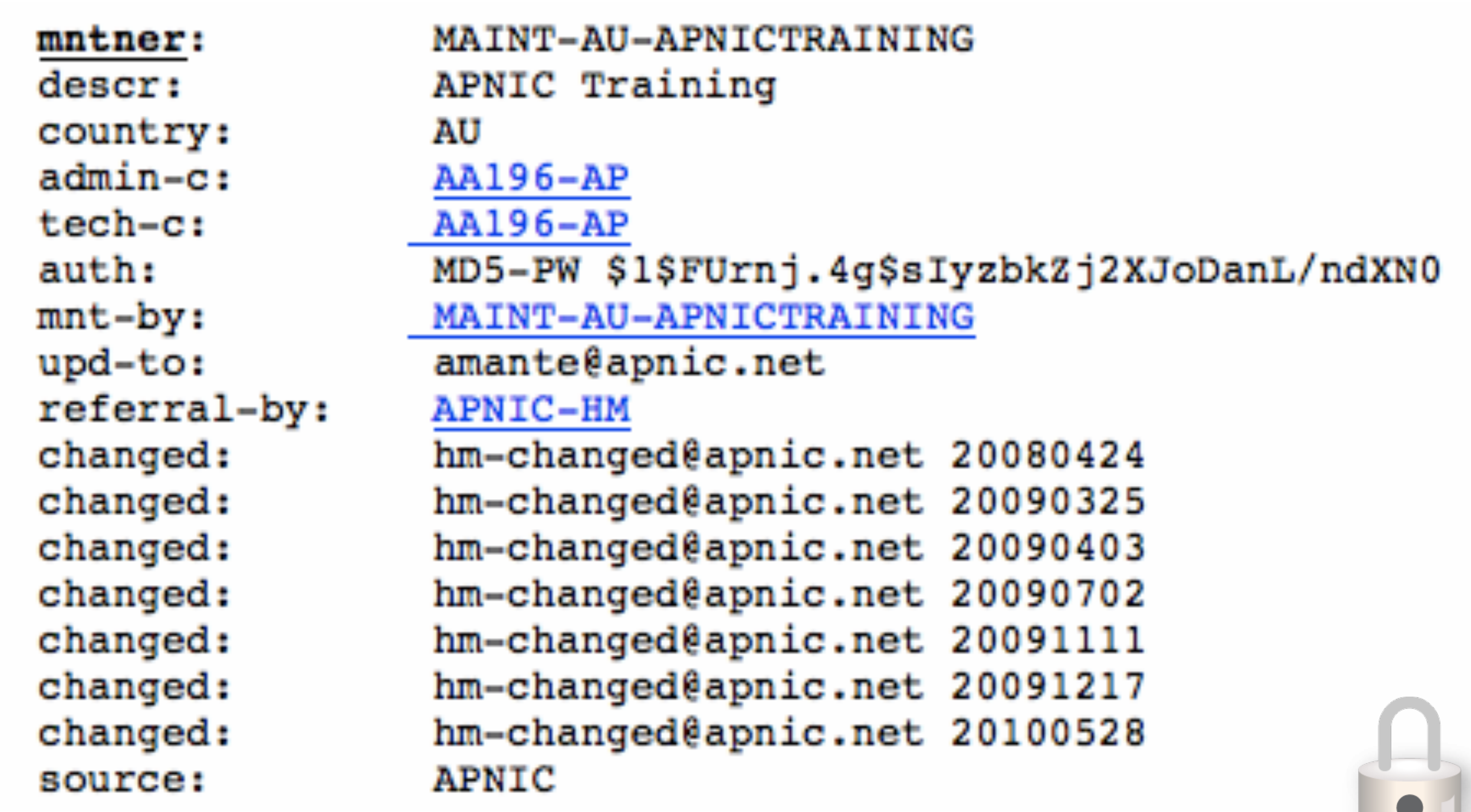
```
whois -h whois.apnic.net Vivek Nigam
% [whois.apnic.net node-1]
% Whois data copyright terms    http://www.apnic.net/db/dbcopyright.html

person:       Vivek Nigam
nic-hdl:      VN61-AP
e-mail:       vivek@apnic.net
address:      6 Cordelia Street
address:      South Brisbane 4101
phone:        +61 7 3858 3180
fax-no:       +61 7 3858 3199
country:      AU
changed:      vivek@apnic.net 20080219
changed:      vivek@apnic.net 20090317
changed:      vivek@apnic.net 20111219
mnt-by:       MAINT-AU-VIVEK
source:       APNIC
```

Maintainers

- WHAT: protects other objects in the APNIC Whois Database
- WHY: Maintainers are used to prevent unauthorized persons from changing the details in whois
- Multiple levels of maintainers exist in a hierarchical manner
  - Maint-by
  - Maint-lower
- Applied to any object created directly below that maintainer object

Database Protection - Maintainer Object

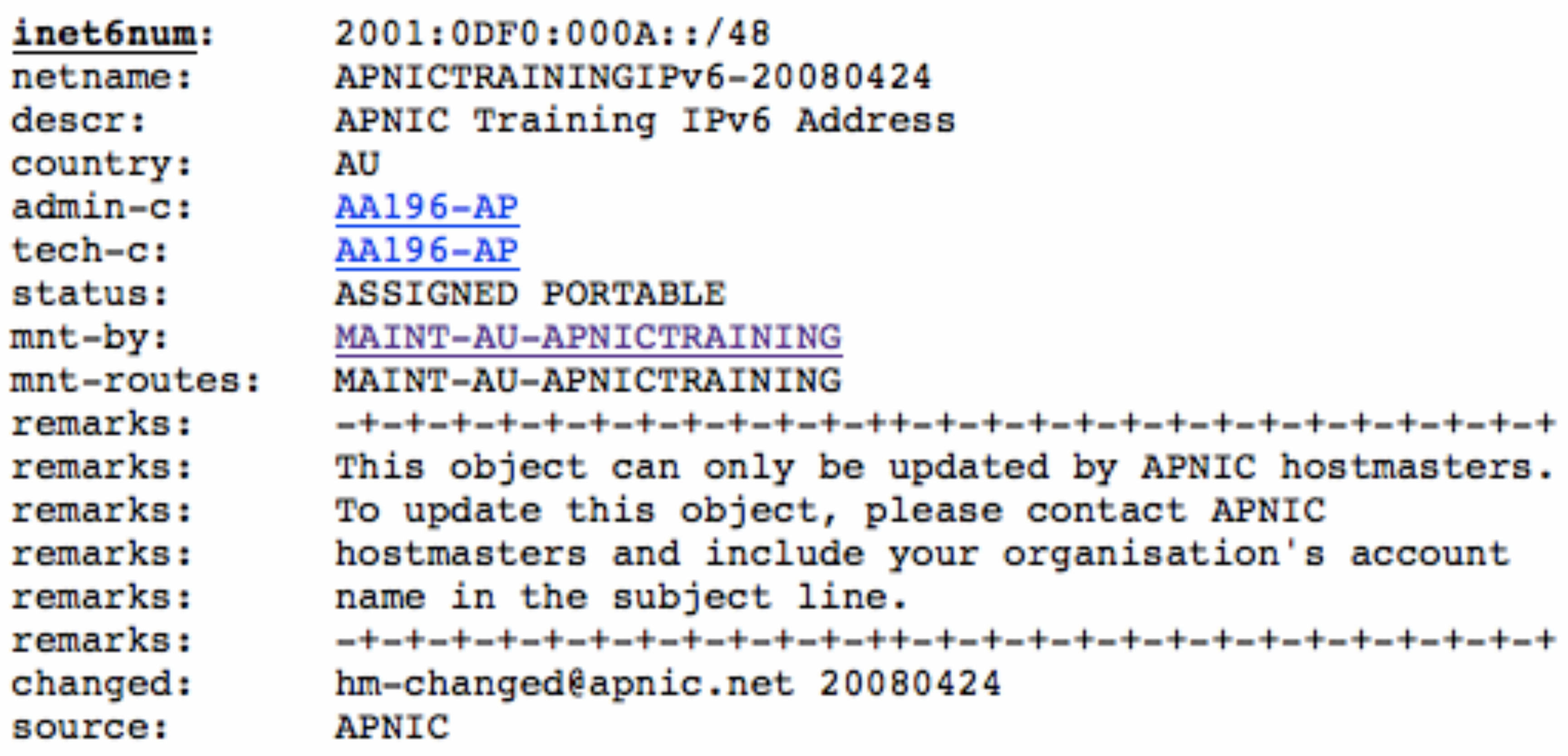


```
mntner:         MAINT-AU-APNICTRAINING
descr:          APNIC Training
country:        AU
admin-c:        AA196-AP
tech-c:         AA196-AP
auth:           MD5-PW $1$FUrnj.4g$sIyzbkZj2XJoDanL/ndXN0
mnt-by:         MAINT-AU-APNICTRAINING
upd-to:         amante@apnic.net
referral-by:    APNIC-HM
changed:        hm-changed@apnic.net 20080424
changed:        hm-changed@apnic.net 20090325
changed:        hm-changed@apnic.net 20090403
changed:        hm-changed@apnic.net 20090702
changed:        hm-changed@apnic.net 20091111
changed:        hm-changed@apnic.net 20091217
changed:        hm-changed@apnic.net 20100528
source:         APNIC
```

Inetnum / Inet6num Objects

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

Whois – Inet6num Example



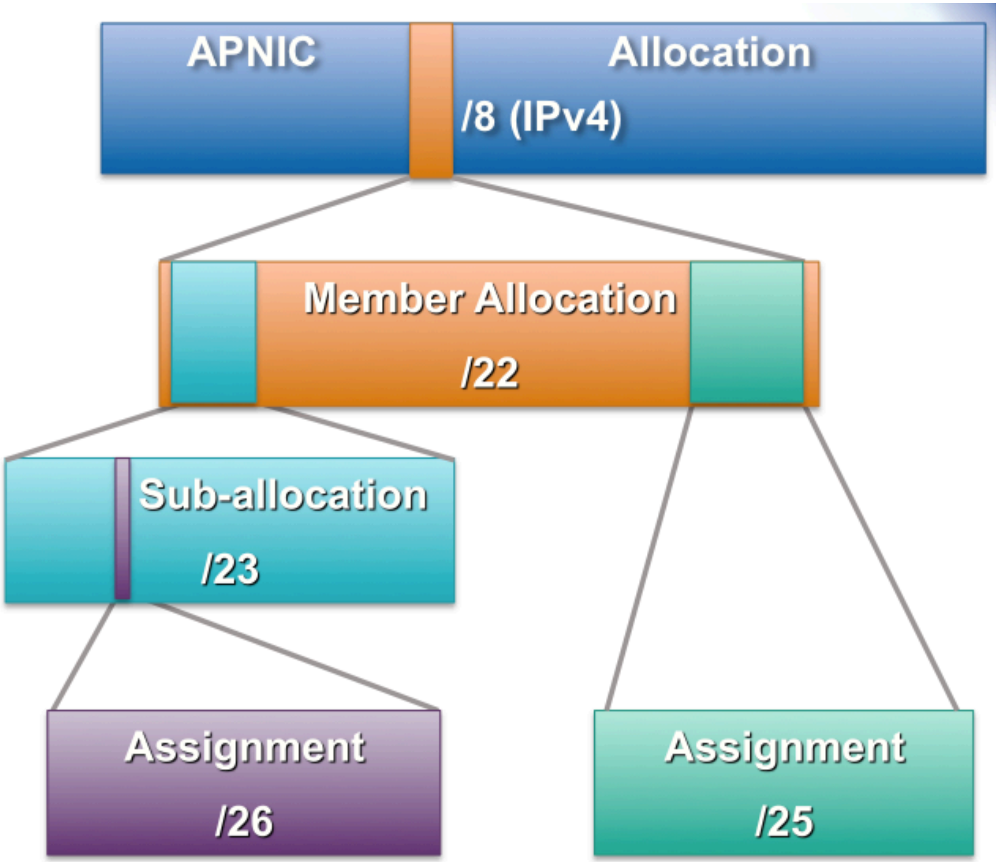
```
inet6num:     2001:0DF0:000A::/48
netname:      APNICTRAININGIPv6-20080424
descr:        APNIC Training IPv6 Address
country:      AU
admin-c:      AA196-AP
tech-c:       AA196-AP
status:       ASSIGNED PORTABLE
mnt-by:       MAINT-AU-APNICTRAINING
mnt-routes:   MAINT-AU-APNICTRAINING
remarks:      -+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+
remarks:      This object can only be updated by APNIC hostmasters.
remarks:      To update this object, please contact APNIC
remarks:      hostmasters and include your organisation's account
remarks:      name in the subject line.
remarks:      -+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+
changed:      hm-changed@apnic.net 20080424
source:       APNIC
```

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



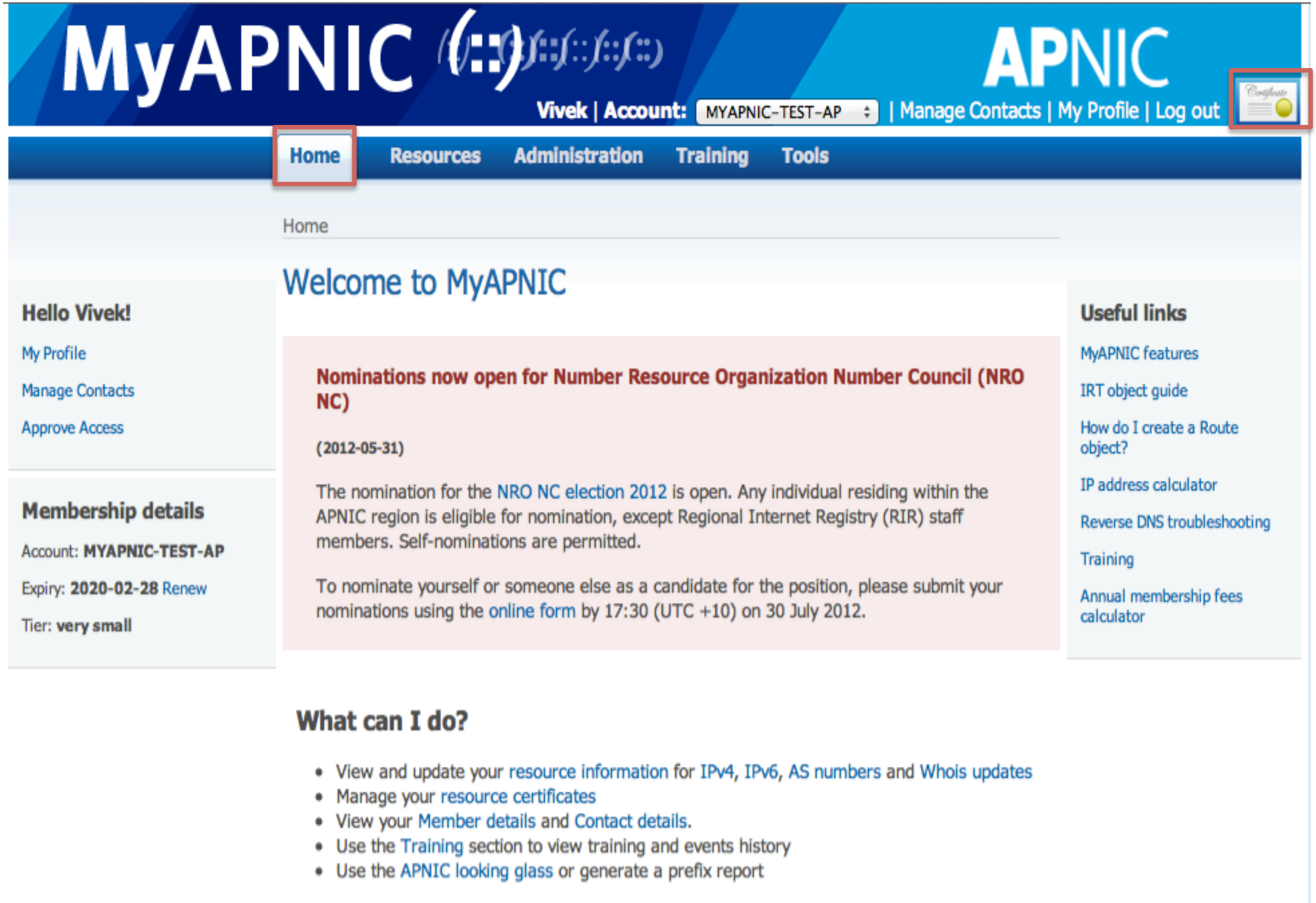
APNIC
Allocation
/8 (IPv4)
Member Allocation
/22
Sub-allocation
/23
Assignment
/26
Assignment
/25

What is MyAPNIC?

- A secure services website that enables Members to manage Internet resources and account interactions with APNIC online
- Uses 128-bit SSL
- https://myapnic.net

Access and Permissions

- Register at https://myapnic.net
  - You must know your member account name
- If Corporate Contact
  - Click the activation link in the email sent by MyAPNIC
- Non-corporate contact
  - Register
  - Forward the authorization code to your corporate contact for approval
- Login with your username and password


MyAPNIC
APNIC
Vivek | Account: MYAPNIC-TEST-AP | Manage Contacts | My Profile | Log out
Home
Resources
Administration
Training
Tools

Home

Welcome to MyAPNIC

Hello Vivek!

- My Profile
- Manage Contacts
- Approve Access

Membership details

Account: **MYAPNIC-TEST-AP**

Expiry: **2020-02-28** Renew

Tier: **very small**

Nominations now open for Number Resource Organization Number Council (NRO NC)

(2012-05-31)

The nomination for the NRO NC election 2012 is open. Any individual residing within the APNIC region is eligible for nomination, except Regional Internet Registry (RIR) staff members. Self-nominations are permitted.

To nominate yourself or someone else as a candidate for the position, please submit your nominations using the online form by 17:30 (UTC +10) on 30 July 2012.

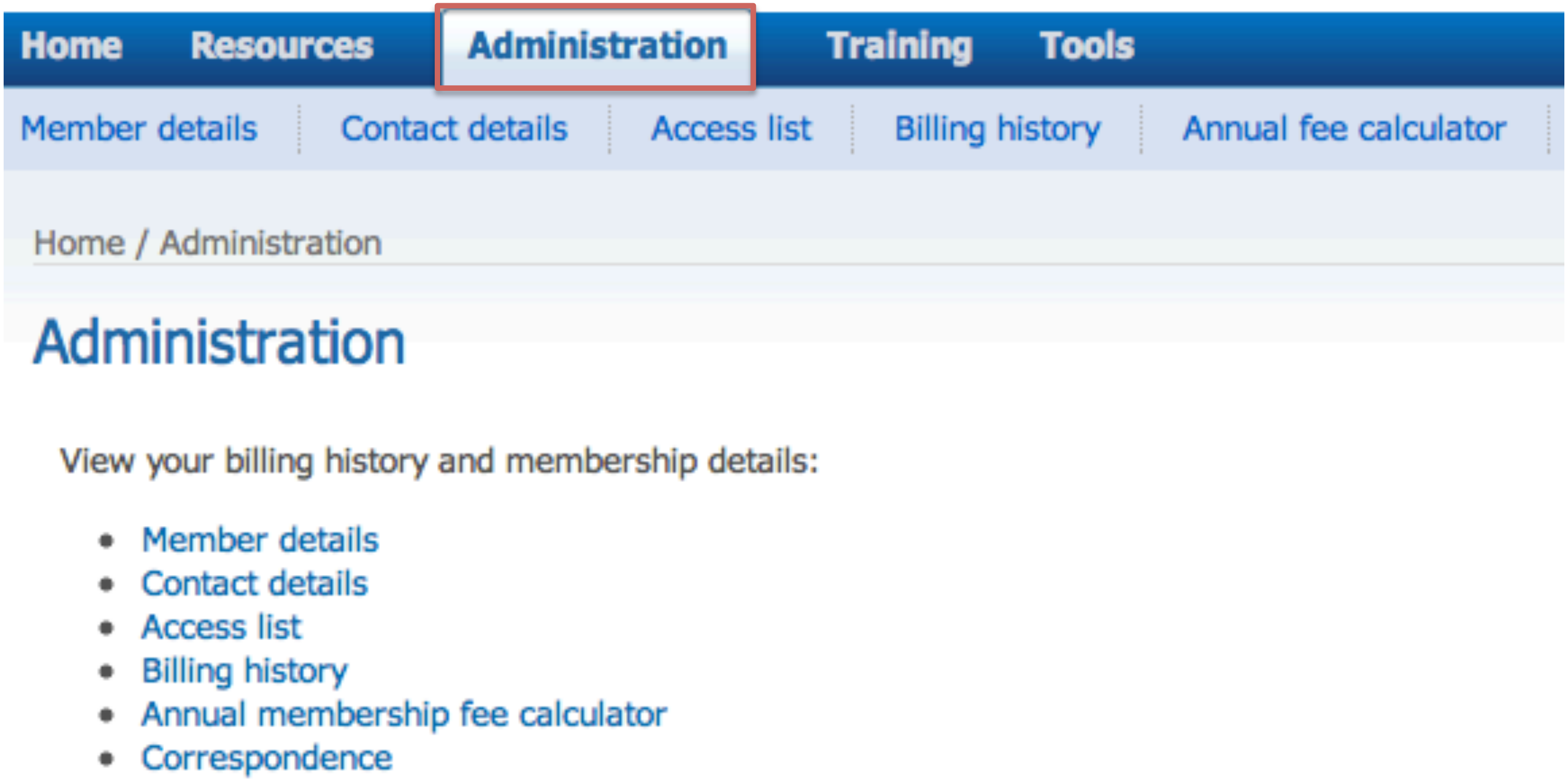
Useful links

- MyAPNIC features
- IRT object guide
- How do I create a Route object?
- IP address calculator
- Reverse DNS troubleshooting
- Training
- Annual membership fees calculator

What can I do?

- 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 Training section to view training and events history
- Use the APNIC looking glass or generate a prefix report

Administration


Home
Resources
Administration
Training
Tools
Member details
Contact details
Access list
Billing history
Annual fee calculator

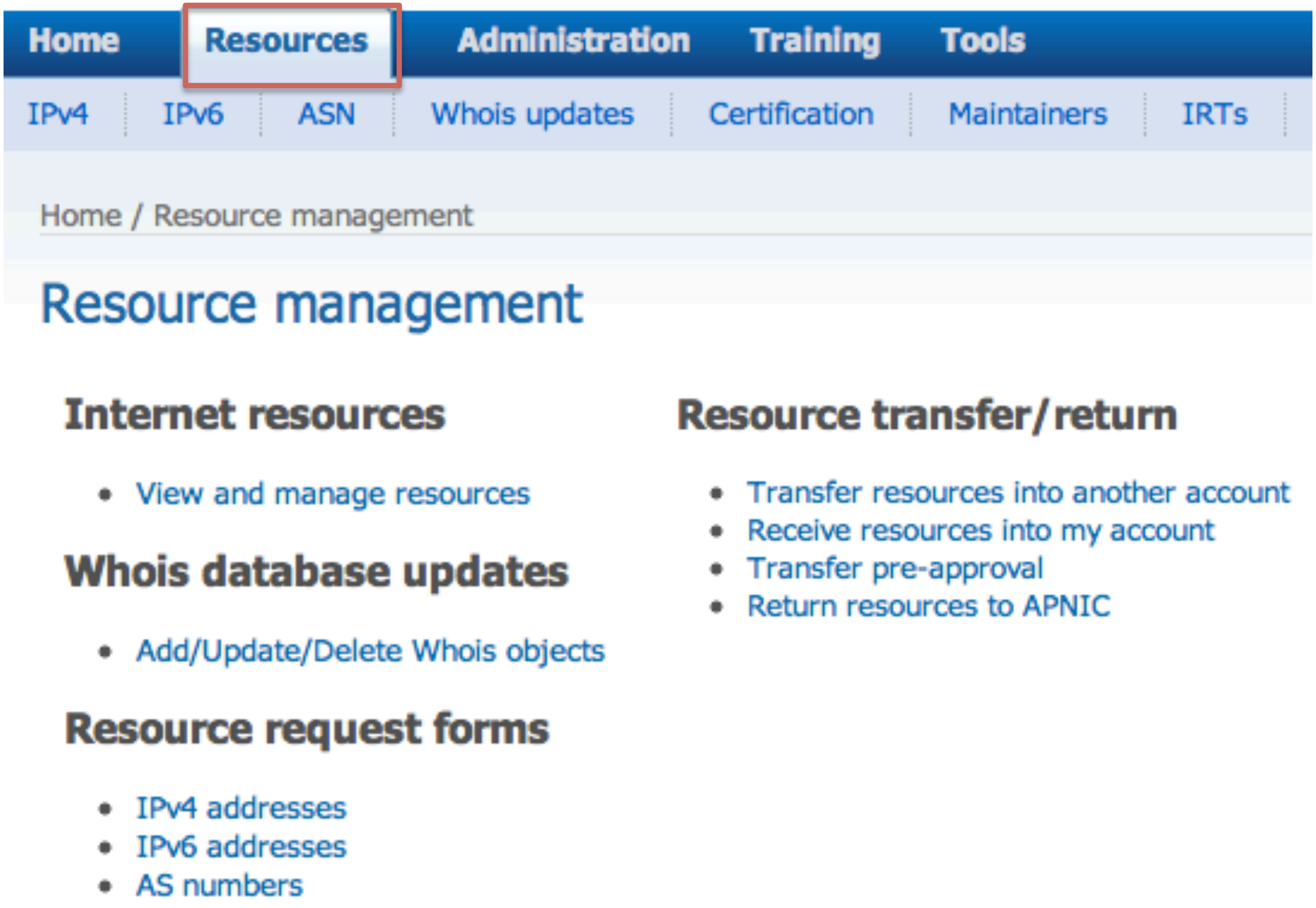
Home / Administration

Administration

View your billing history and membership details:

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

Resources


Home
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Administration
Training
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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

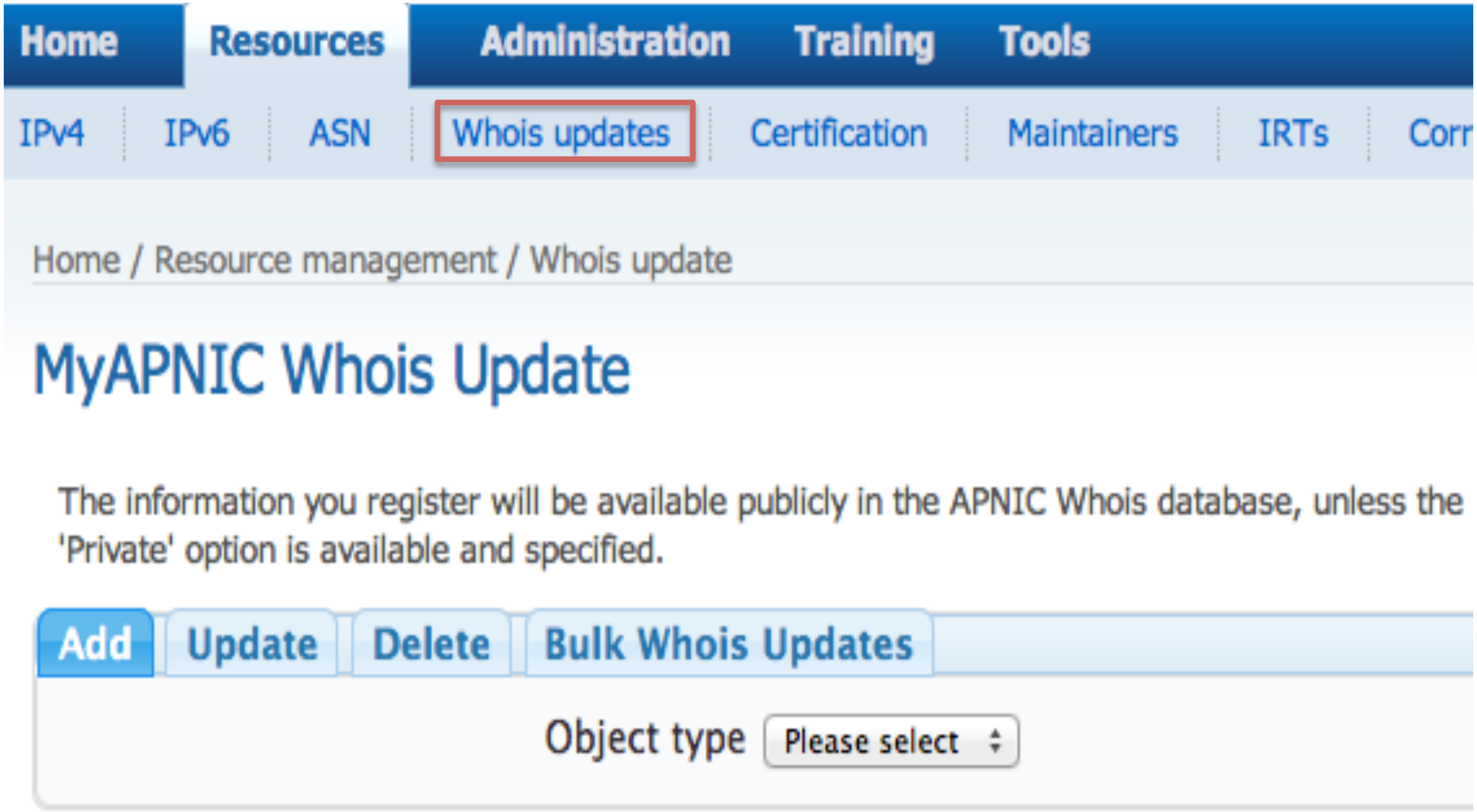
Resource request forms

- 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

Whois updates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Certification
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IRTs
Corr
Add
Update
Delete
Bulk Whois Updates

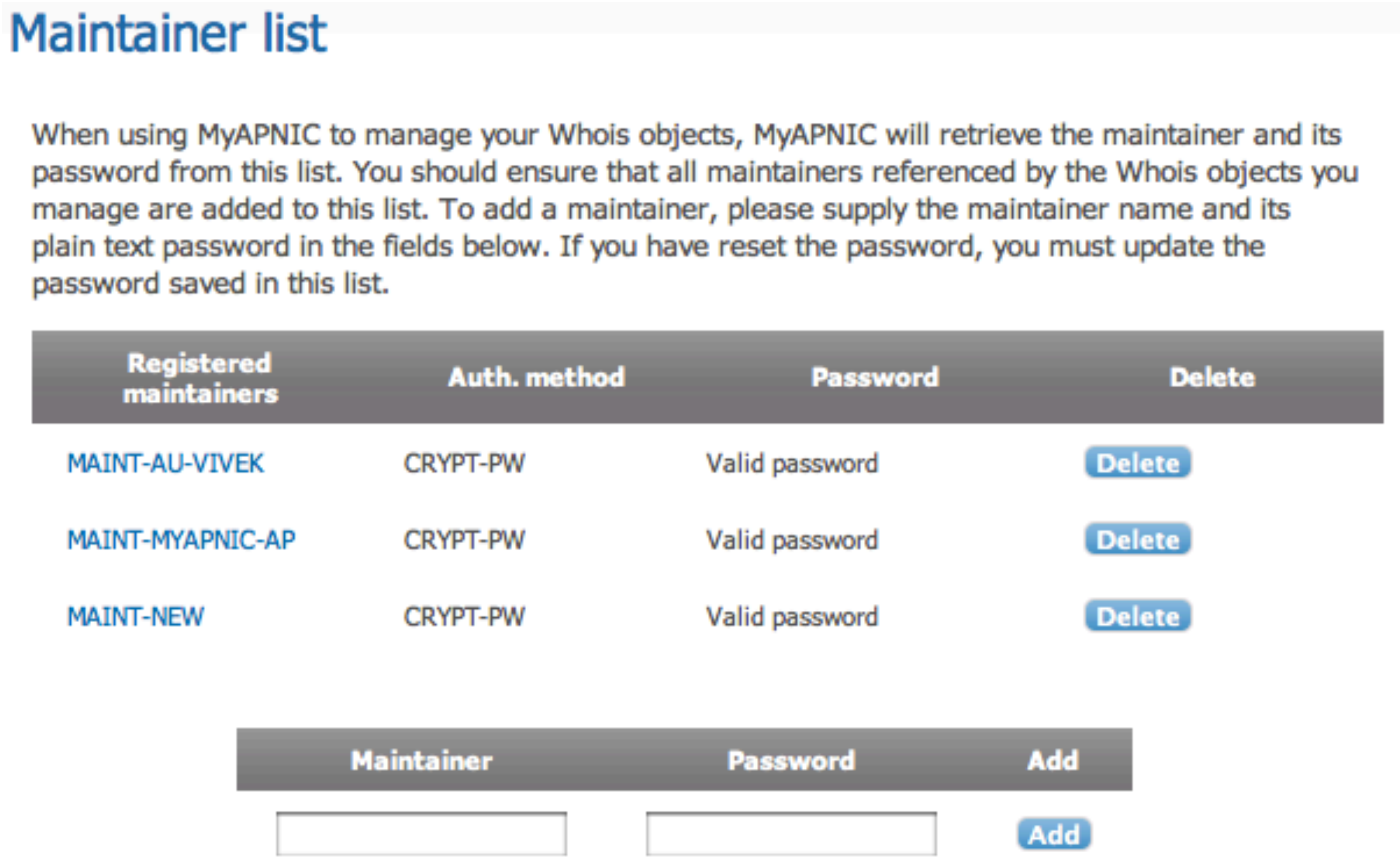
Home / Resource management / Whois update

MyAPNIC Whois Update

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

Object type: Please select

Maintainers



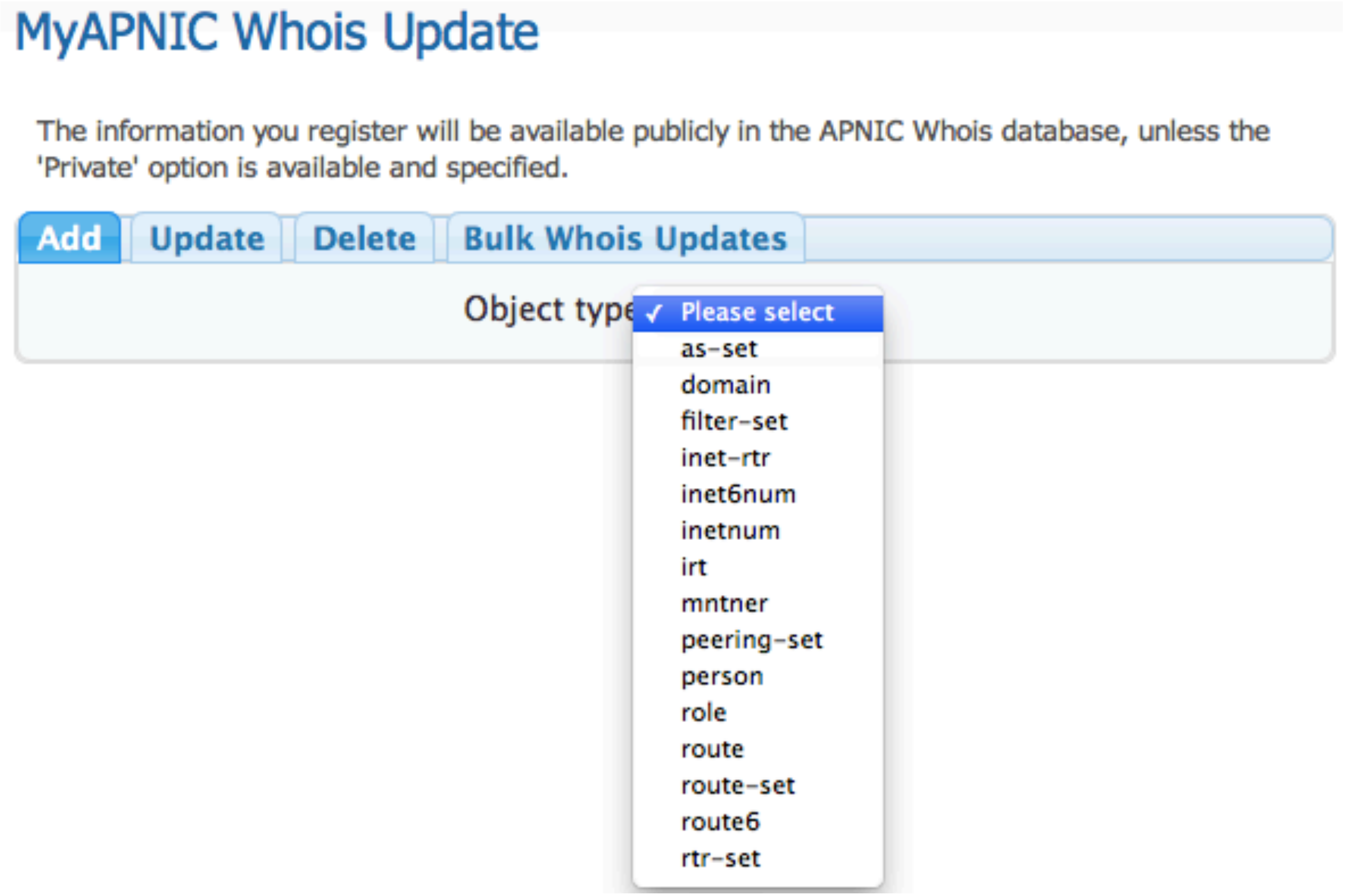
Maintainer list

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.

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

Maintainer	Password	Add
		Add

Whois database objects



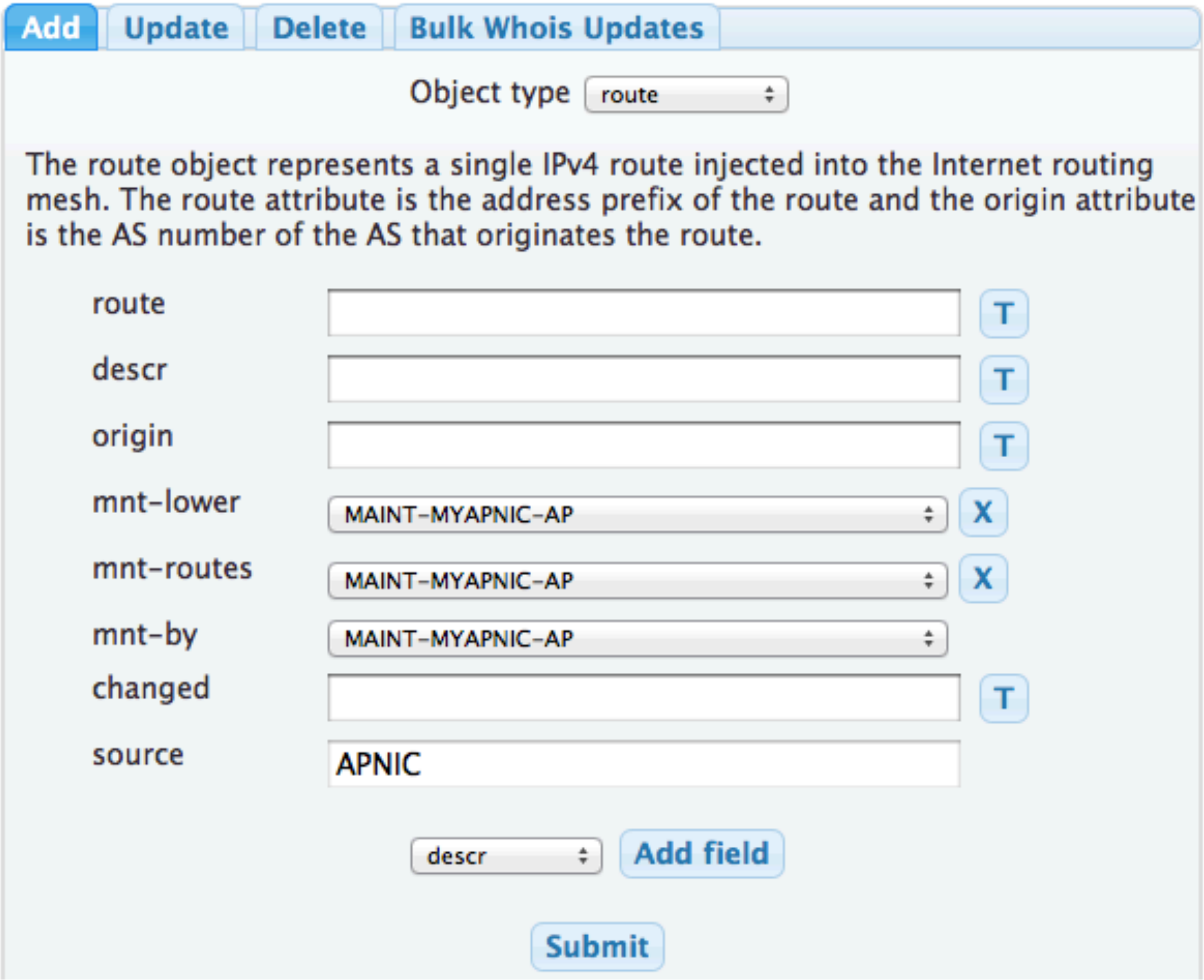
MyAPNIC Whois Update

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

Object type: ✓ Please select

- as-set
- domain
- filter-set
- inet-rtr
- inet6num
- inetnum
- irt
- mntner
- peering-set
- person
- role
- route
- route-set
- route6
- rtr-set

Route objects


Add
Update
Delete
Bulk Whois Updates

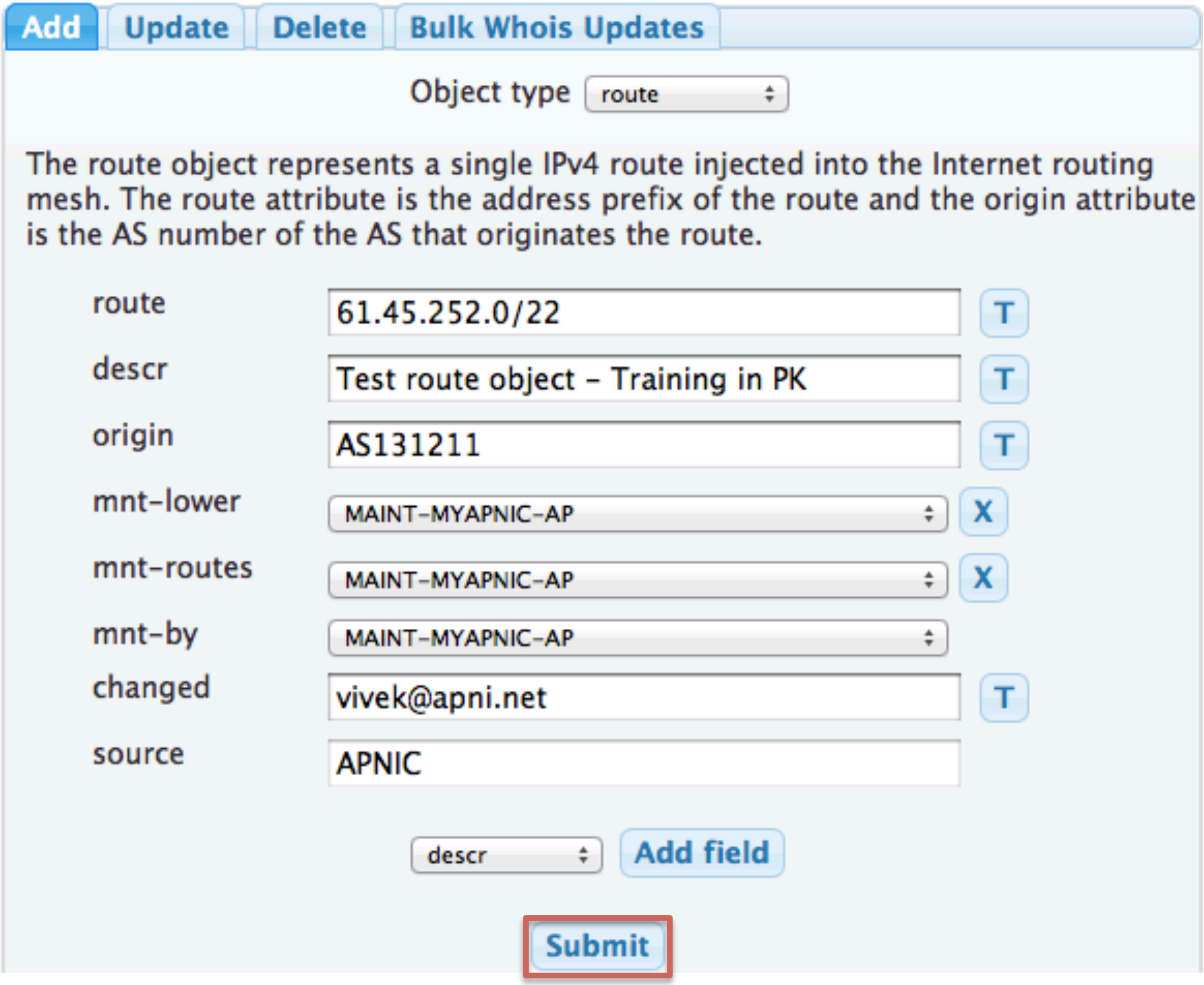
Object type: route

The route object represents a single IPv4 route injected into the Internet routing 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	
descr	
origin	
mnt-lower	MAINT-MYAPNIC-AP
mnt-routes	MAINT-MYAPNIC-AP
mnt-by	MAINT-MYAPNIC-AP
changed	
source	APNIC

T
T
T
X
X
T
descr
Add field
Submit

Route objects


Add
Update
Delete
Bulk Whois Updates

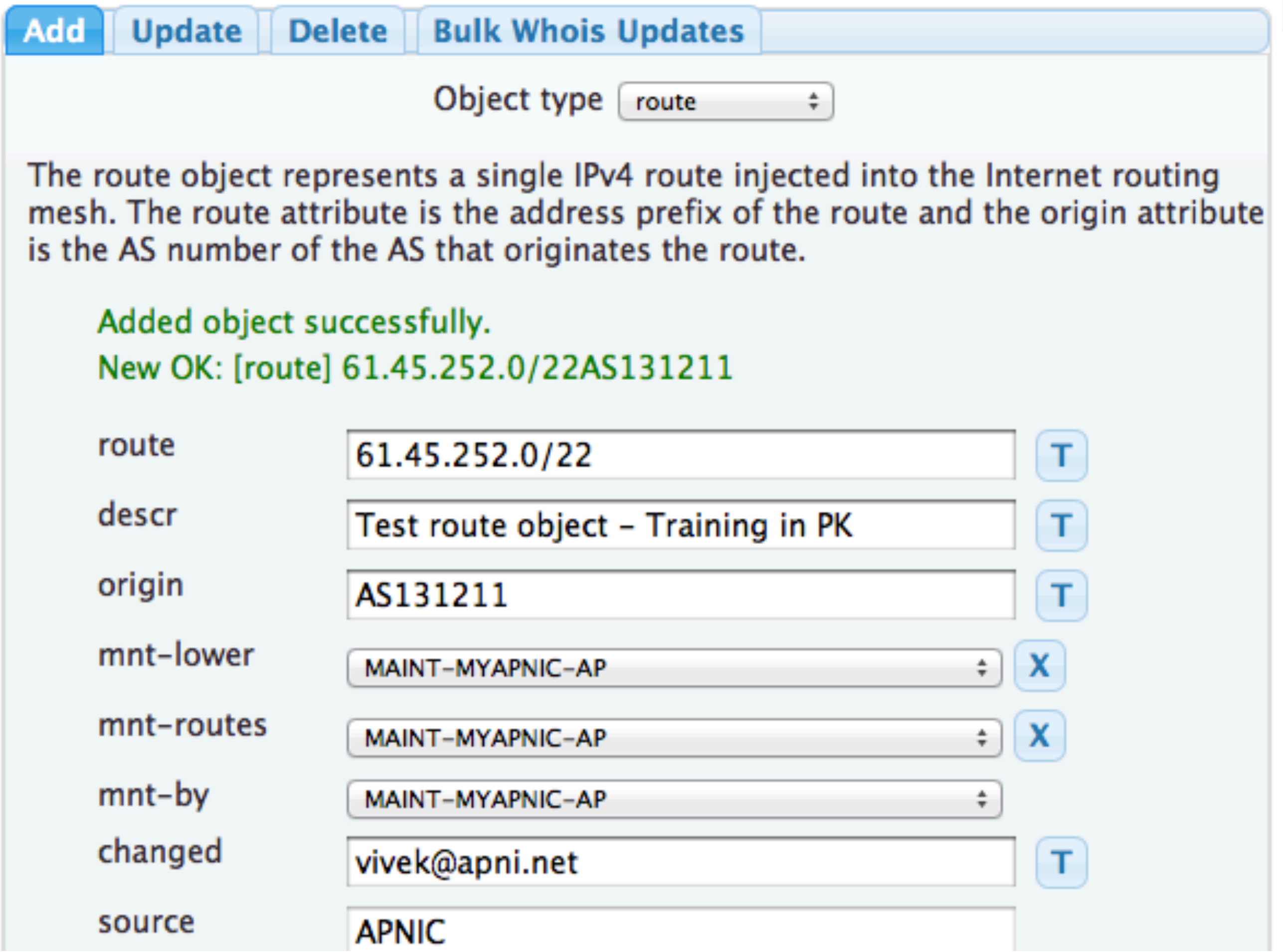
Object type: route

The route object represents a single IPv4 route injected into the Internet routing 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	61.45.252.0/22
descr	Test route object – Training in PK
origin	AS131211
mnt-lower	MAINT-MYAPNIC-AP
mnt-routes	MAINT-MYAPNIC-AP
mnt-by	MAINT-MYAPNIC-AP
changed	vivek@apni.net
source	APNIC

T
X
descr
Add field
Submit

Route Objects



Object type: route

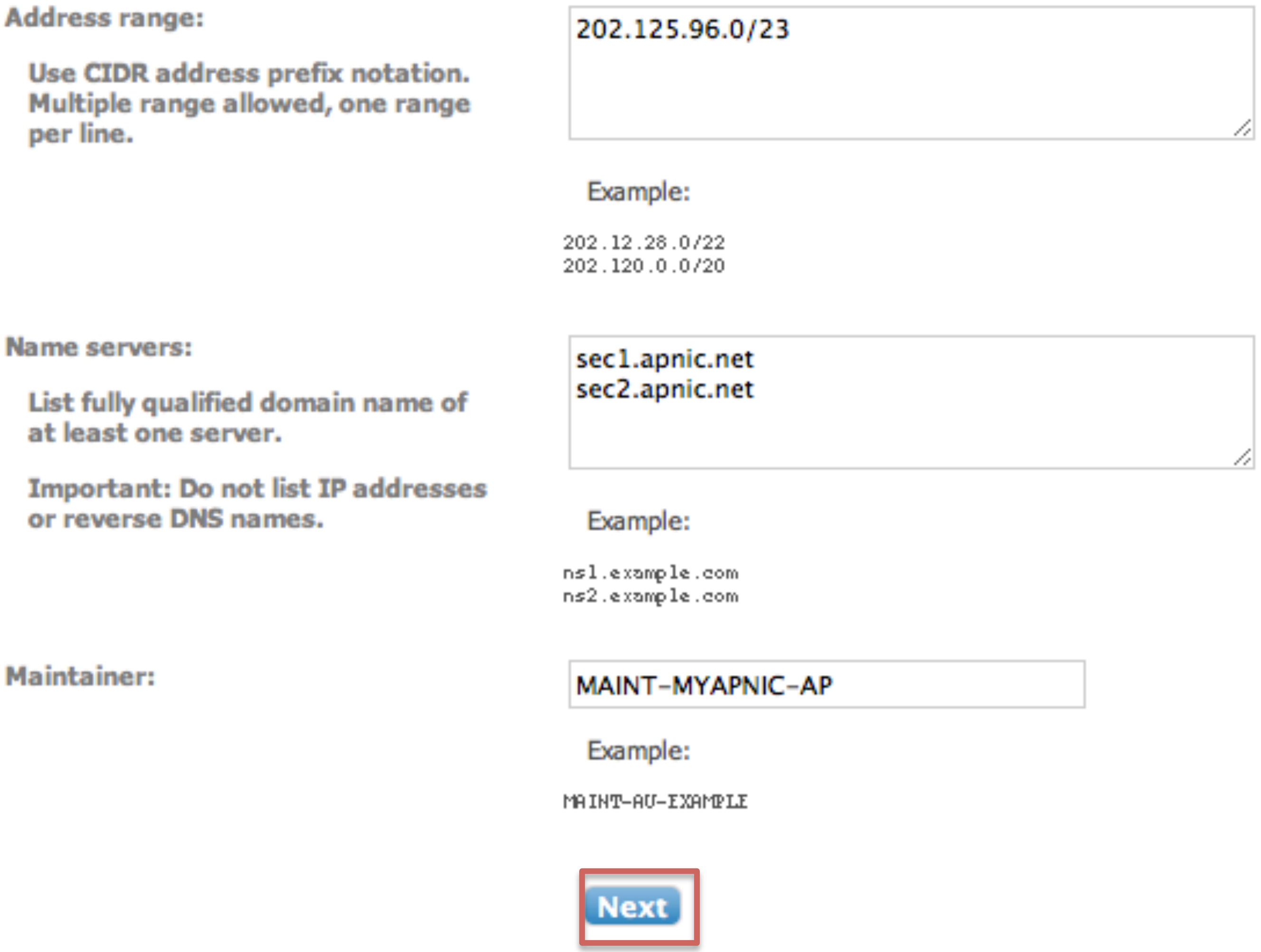
The route object represents a single IPv4 route injected into the Internet routing mesh. The route attribute is the address prefix of the route and the origin attribute is the AS number of the AS that originates the route.

Added object successfully.

New OK: [route] 61.45.252.0/22AS131211

route	61.45.252.0/22
descr	Test route object – Training in PK
origin	AS131211
mnt-lower	MAINT-MYAPNIC-AP
mnt-routes	MAINT-MYAPNIC-AP
mnt-by	MAINT-MYAPNIC-AP
changed	vivek@apni.net
source	APNIC

Reverse DNS Delegation



Address range:

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

```
202.125.96.0/23
```

Example:

```
202.12.28.0/22
202.120.0.0/20
```

Name servers:

List fully qualified domain name of at least one server.

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

```
sec1.apnic.net
sec2.apnic.net
```

Example:

```
ns1.example.com
ns2.example.com
```

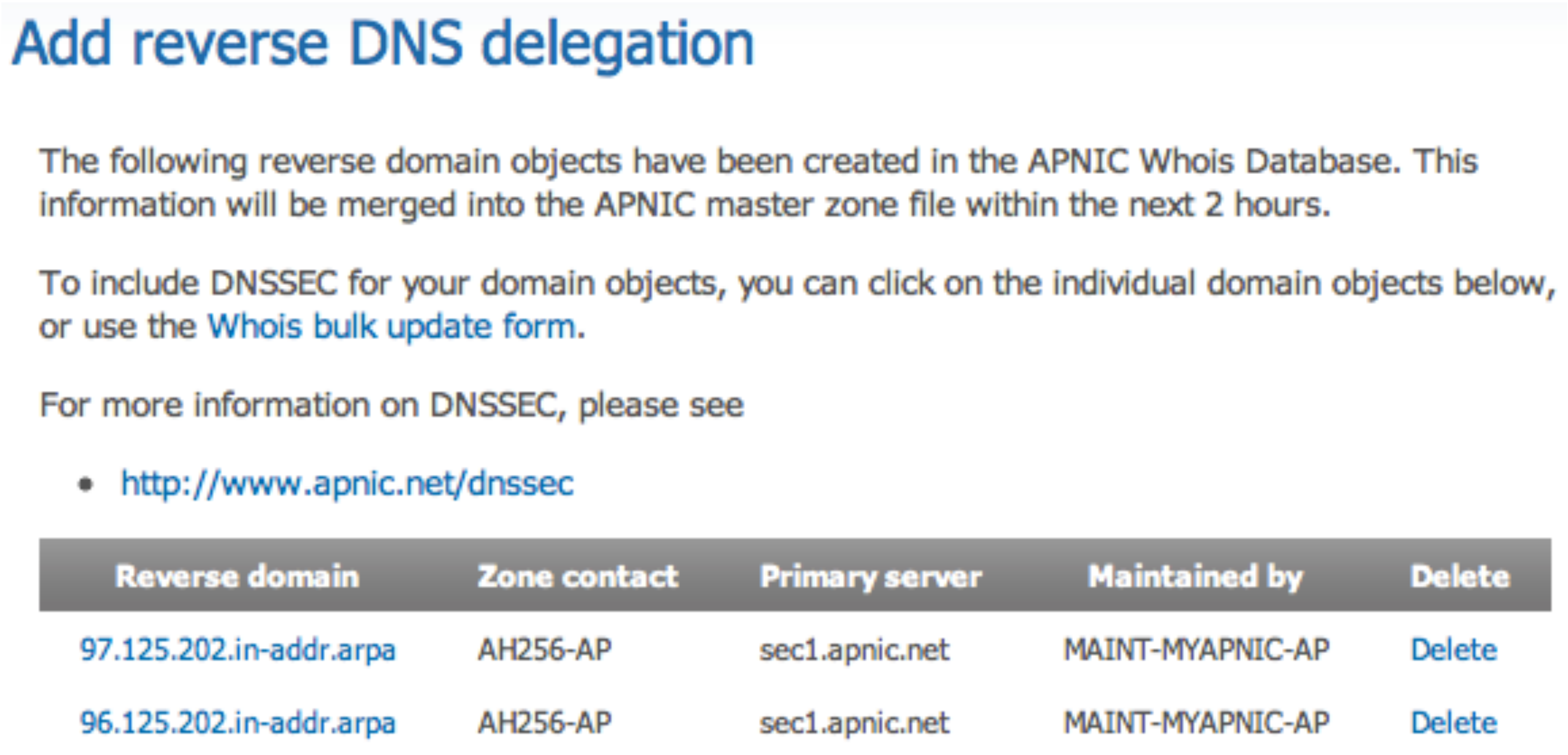
Maintainer:

```
MAINT-MYAPNIC-AP
```

Example:

```
MAINT-AU-EXAMPLE
```

Reverse DNS Delegation



Add reverse DNS delegation

The following reverse domain objects have been created in the APNIC Whois Database. This information will be merged into the APNIC master zone file within the next 2 hours.

To include DNSSEC for your domain objects, you can click on the individual domain objects below, or use the Whois bulk update form.

For more information on DNSSEC, please see

- http://www.apnic.net/dnssec

Reverse domain	Zone contact	Primary server	Maintained by	Delete
97.125.202.in-addr.arpa	AH256-AP	sec1.apnic.net	MAINT-MYAPNIC-AP	Delete
96.125.202.in-addr.arpa	AH256-AP	sec1.apnic.net	MAINT-MYAPNIC-AP	Delete

Questions?

Agenda (IRM)

- Introduction to APNIC
- Policy Development Process
- Internet Registry Policies
- Requesting IP Addresses
- Whois Database and MyAPNIC
- **Autonomous System Numbers**
- Reverse DNS
- IPv6 Overview

What Is An Autonomous System?

- Group of Internet Protocol-based networks with the same routing policy
- Usually under single ownership, trust or administrative control
- The AS is used both in the exchange of exterior routing information (between neighboring ASes) and as an identifier of the AS itself

What is an Autonomous System Number?

- Autonomous System Numbers (ASNs) are globally unique identifiers for IP networks
- ASNs are allocated to each Autonomous System (AS) for use in BGP routing
- AS numbers are important because the ASN uniquely identifies each network on the Internet

When Do I Need an ASN?

- An ASN is needed if you have a
  - Multi-homed network to different providers

OR

  - Planning to multihome within 1 months time

AND

  - Routing policy different to external peers

  - * For more information please refer to RFC1930: Guidelines for creation, selection and registration of an Autonomous System

RFC 1930

Requesting an ASN

- 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
- Transfers of ASNs
  - Require legal documentation (mergers etc)

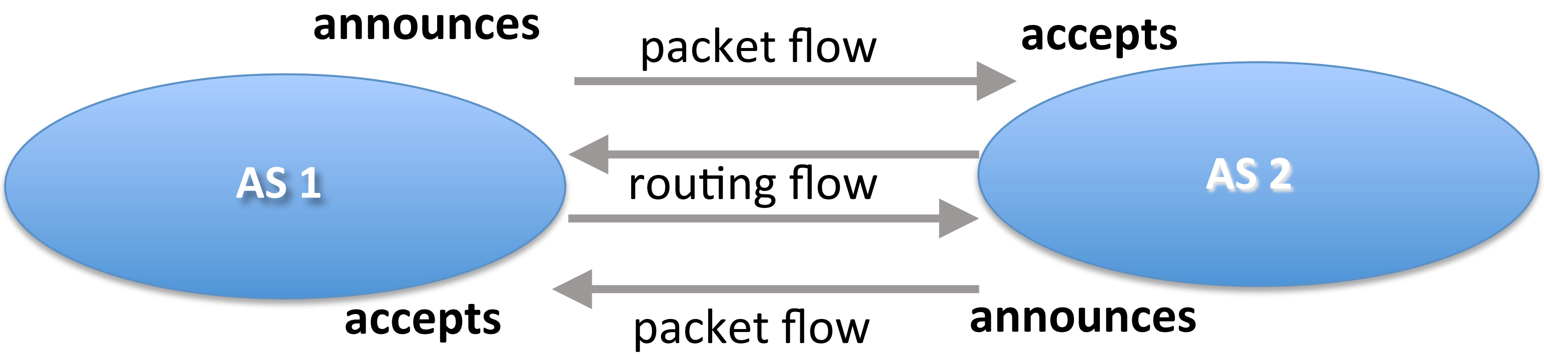
Requesting an ASN

- If a member requests an ASN from APNIC for own network infrastructure
  - AS number is "portable"

- If a member requests an ASN from APNIC for its downstream customer network
  - ASN is "non-portable"
  - ASN is returned if the customer changes provider

Representation of Routing Policy

- Routing and packet flows



announces

packet flow

accepts

AS 1

routing flow

AS 2

accepts

packet flow

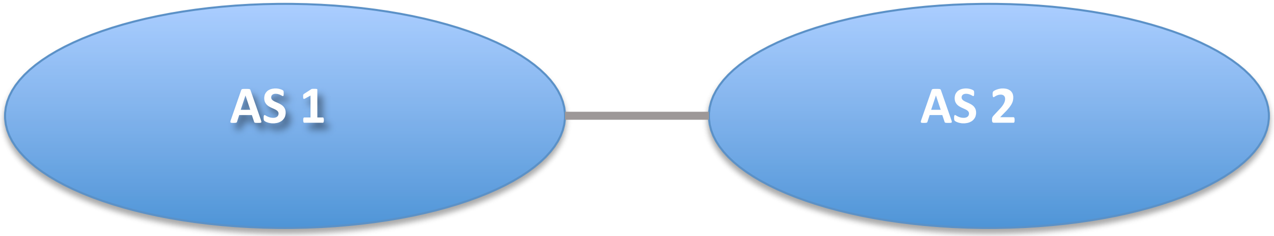
announces

For AS1 and AS2 networks to communicate

- AS1 must announce to AS2
- AS2 must accept from AS1
- AS2 must announce to AS1
- AS1 must accept from AS2

Representation of Routing Policy

Basic concept

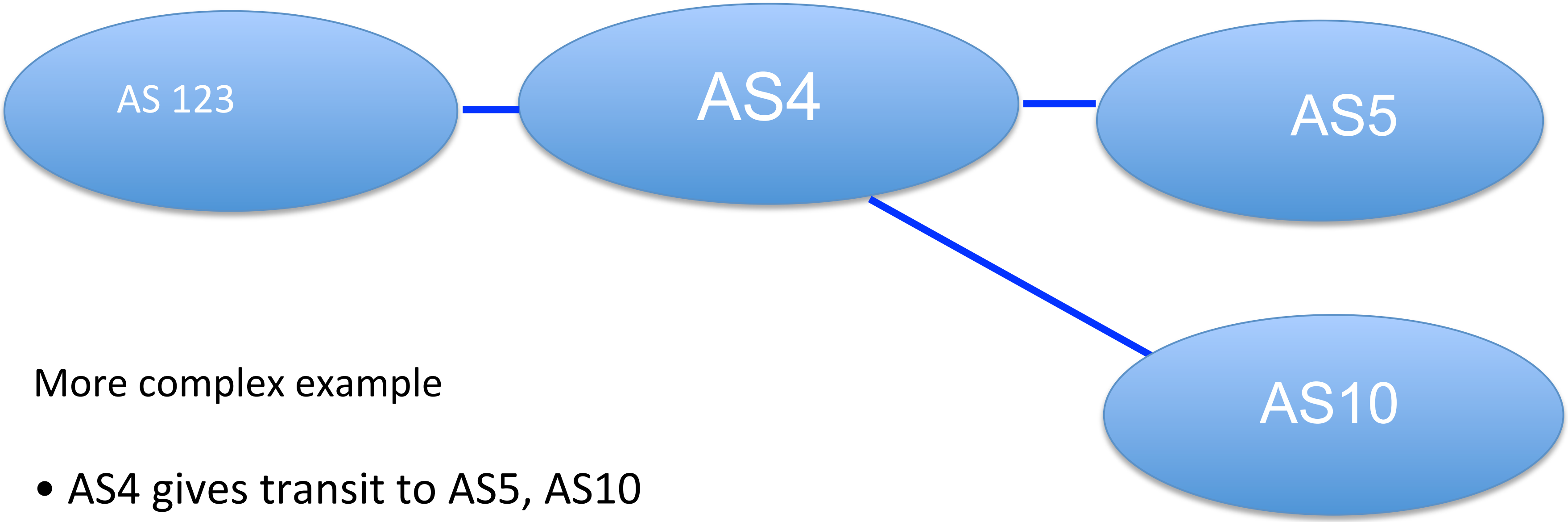


"action pref" - the lower the value, the more preferred the route

```
aut-num: AS1
…
import:    from AS2
       action pref=100;
       accept AS2
export:    to AS2 announce AS1
```

```
aut-num: AS2
…
import:    from AS1
       action pref=100;
       accept AS1
export:    to AS1 announce AS2
```

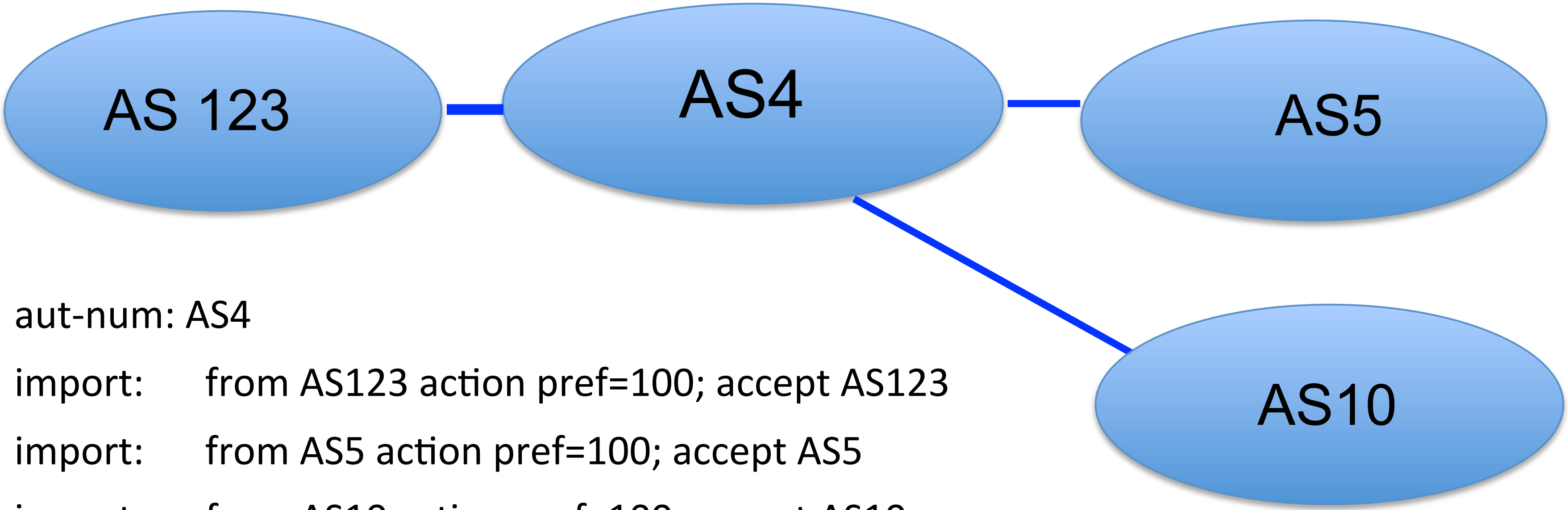
Representation of Routing Policy



More complex example

- AS4 gives transit to AS5, AS10
- AS4 gives local routes to AS123

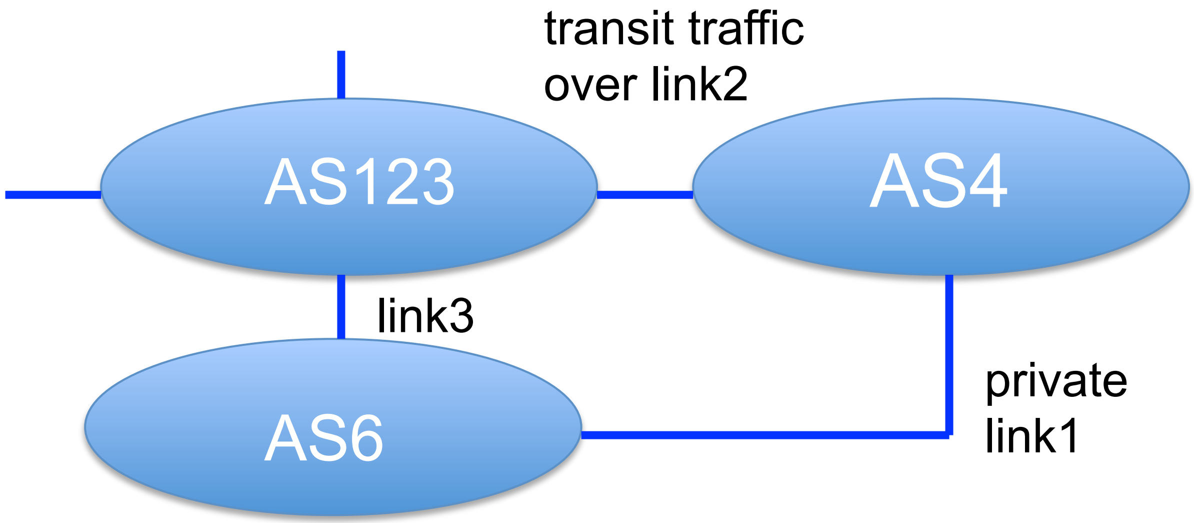
Representation of Routing Policy



```
aut-num: AS4
import:     from AS123 action pref=100; accept AS123
import:     from AS5 action pref=100; accept AS5
import:     from AS10 action pref=100; accept AS10
export:     to AS123  announce  AS4
export:     to AS5 announce AS4 AS10
export:     to AS10 announce AS4 AS5
```

Not a path

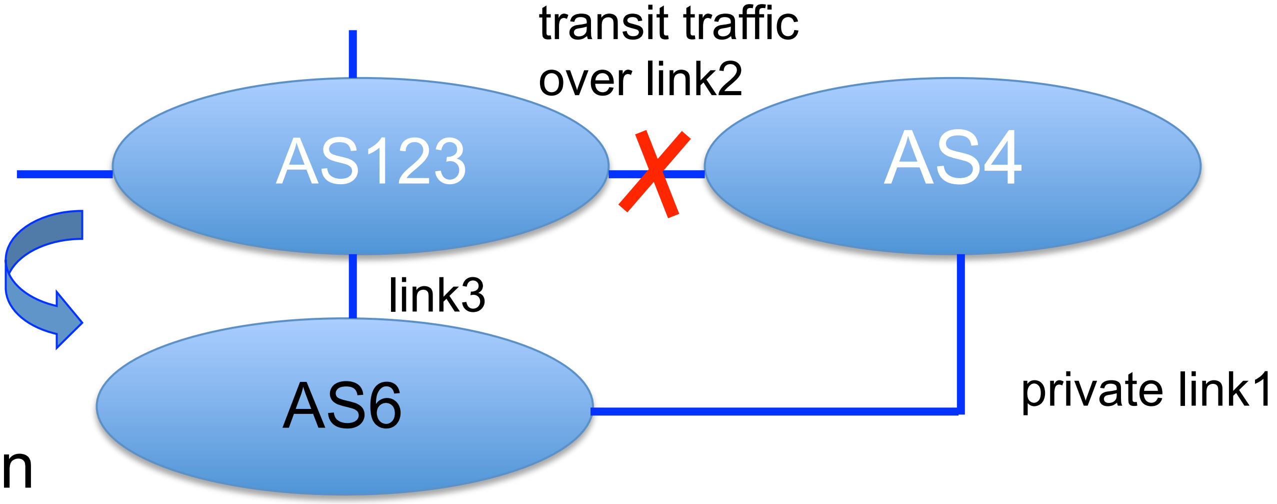
Representation of Routing Policy


transit traffic over link2
AS123
AS4
link3
AS6
private link1

More complex example

- AS4 and AS6 private link1
- AS4 and AS123 main transit link2
- backup all traffic over link1 and link3 in event of link2 failure

Representation of Routing Policy


transit traffic
over link2
AS123
AS4
link3
AS6
private link1

AS representation

```
aut-num:   AS4
import:   from AS123 action pref=100; accept  ANY
import:   from AS6     action pref=50; accept AS6
import:   from AS6     action pref=200; accept  ANY
export:   to     AS6     announce   AS4
export:   to   AS123  announce   AS4
```

← full routing received

higher cost for backup route

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:        XY1-AP
tech-c:         XY2-AP
remarks:        Filtering prefixes longer than /24
mnt-by:         MAINT-APNIC-AP
changed:        admin@apnic.net 20120412
source:         APNIC
```

POLICY
RPSL

AS Number Representation

- 2-byte only AS number
  - Range: 0 – 65535
- 4-byte only AS number
  - AS PLAIN: 65,536 - 4,294,967,295
  - AS DOT: 1.0 - 65535.65535
  - APNIC region uses the AS PLAIN style of numbering
- ASN converter
  - http://submit.apnic.net/cgi-bin/convert-asn.pl

Requesting for ASN

- Previously, APNIC distributes 2 byte ASN (16 bits)
    - – Possibly run into exhaustion
- IETF has adopted and directed the RIRs to distribute 4-byte ASN
- Currently, APNIC distributes 4 byte ASN distribution policy 32 bits
    - – 2 byte ASN on request with documented justification

32 Bit AS Number Representation: AS PLAIN

- IETF preferred standard notation RFC5396
- Continuation on how a 2-Byte AS number has been represented historically
- Notation: The 32 bit binary AS number is translated into a single decimal value
  - Example: AS 65546
- Total AS Plain range:
  2 byte: 0 – 65535 (original 16-bit range)
  4 byte: 65,536 - 4,294,967,295 (RFC4893)

Questions?

Agenda (IRM)

- Introduction to APNIC
- Policy Development Process
- Internet Registry Policies
- Requesting IP Addresses
- Whois Database and MyAPNIC
- Autonomous System Numbers
- **Reverse DNS**
- IPv6 Overview

What is ‘Reverse DNS’?

- ‘Forward DNS’ maps names to numbers
  - svc00.apnic.net ➔202.12.28.131

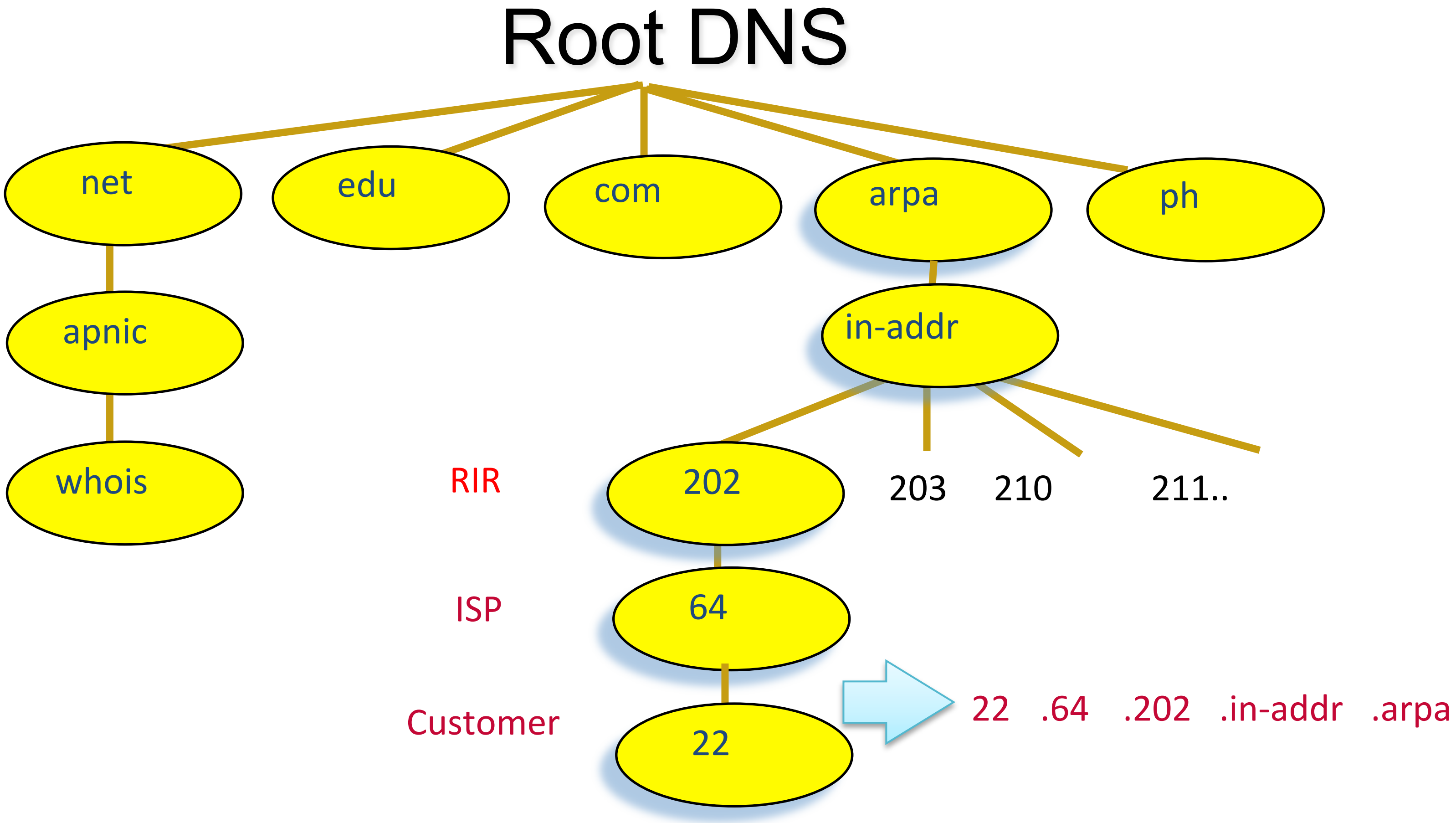
- ‘Reverse DNS’ maps numbers to names
  - 202.12.28.131 ➔ svc00.apnic.net

Reverse DNS - why bother?

- 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
- Registration responsibilities

Principles – DNS tree

- *Mapping numbers to names - 'reverse DNS'*



Root DNS

net

edu

com

arpa

ph

apnic

in-addr

whois

RIR

202

203

210

211..

ISP

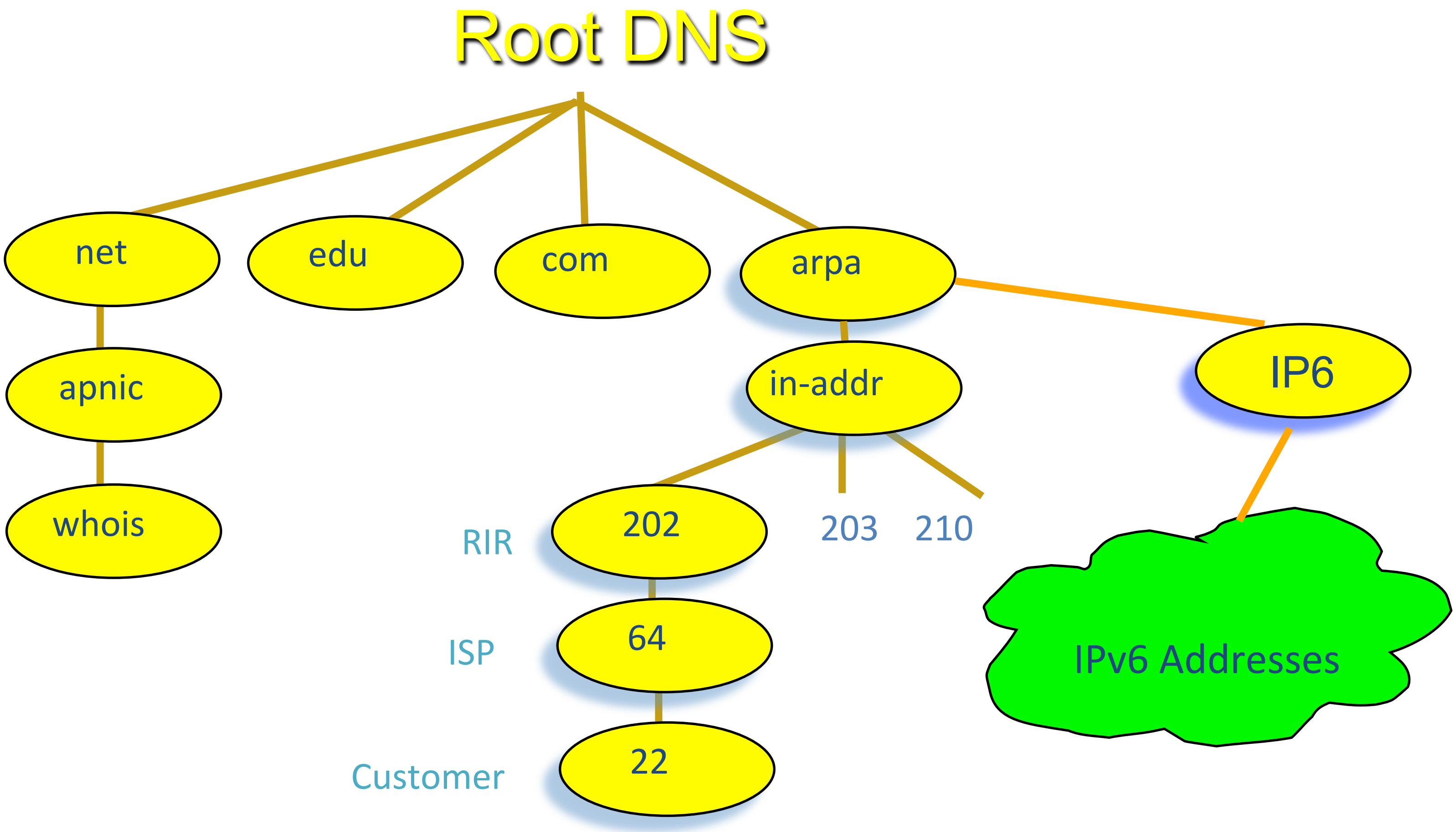
64

Customer

22

22 .64 .202 .in-addr .arpa

Reverse DNS Tree – with IPv6


Root DNS
net
edu
com
arpa
apnic
whois
in-addr
IP6
RIR
202
203
210
ISP
64
Customer
22
IPv6 Addresses

Creating reverse zones

- Same as creating a forward zone file
  - SOA and initial NS records are the same as normal zone
- Main difference
  - need to create additional PTR records
- Can use BIND or other DNS software to create and manage reverse zones
  - Details can be different

Start of Authority (SOA) record

-

```
<domain.name.>     CLASS  SOA    <hostname.domain.name.>
<mailbox.domain.name> (
    <serial-number>
                      <refresh>
                      <retry>
                      <expire>
                      <negative-caching> )
```

253.253.192.in-addr.arpa.

Pointer (PTR) records

- Create pointer (PTR) records for each IP address

```
131.28.12.202.in-addr.arpa. IN PTR svc00.apnic.net.
```

-

```
131          IN      PTR          svc00.apnic.net.
```

IPv6 Reverse Lookups – PTR records

- Similar to the IPv4 reverse record

```
b.a.9.8.7.6.5.0.4.0.0.0.3.0.0.0.2.0.0.0.1.0.0.0.0.0.0.0.1.2.3.4.ip6.arpa.
IN    PTR       test.ip6.example.com.
```

- Example: reverse name lookup for a host with address 3ffe: 8050:201:1860:42::1

- $ORIGIN 0.6.8.1.1.0.2.0.0.5.0.8.e.f.f.3.ip6.arpa.

```
  1.0.0.0.0.0.0.0.0.0.0.0.2.4.0.0  14400  IN PTR host.example.com.
```

A reverse zone example

```
$ORIGIN 1.168.192.in-addr.arpa.
@   3600  IN SOA test.company.org. (
          sys\.admin.company.org.
          2002021301    ; serial
          1h      ; refresh
          30M     ; retry
          1W      ; expiry
          3600 )      ; neg. answ. ttl

    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.
```

Reverse delegation requirements

- /24 Delegations
  - Address blocks should be assigned/allocated
  - At least two name servers
- /16 Delegations
  - Same as /24 delegations
  - APNIC delegates entire zone to member
- < /24 Delegations
  - Read “classless in-addr.arpa delegation”

RFC 2317

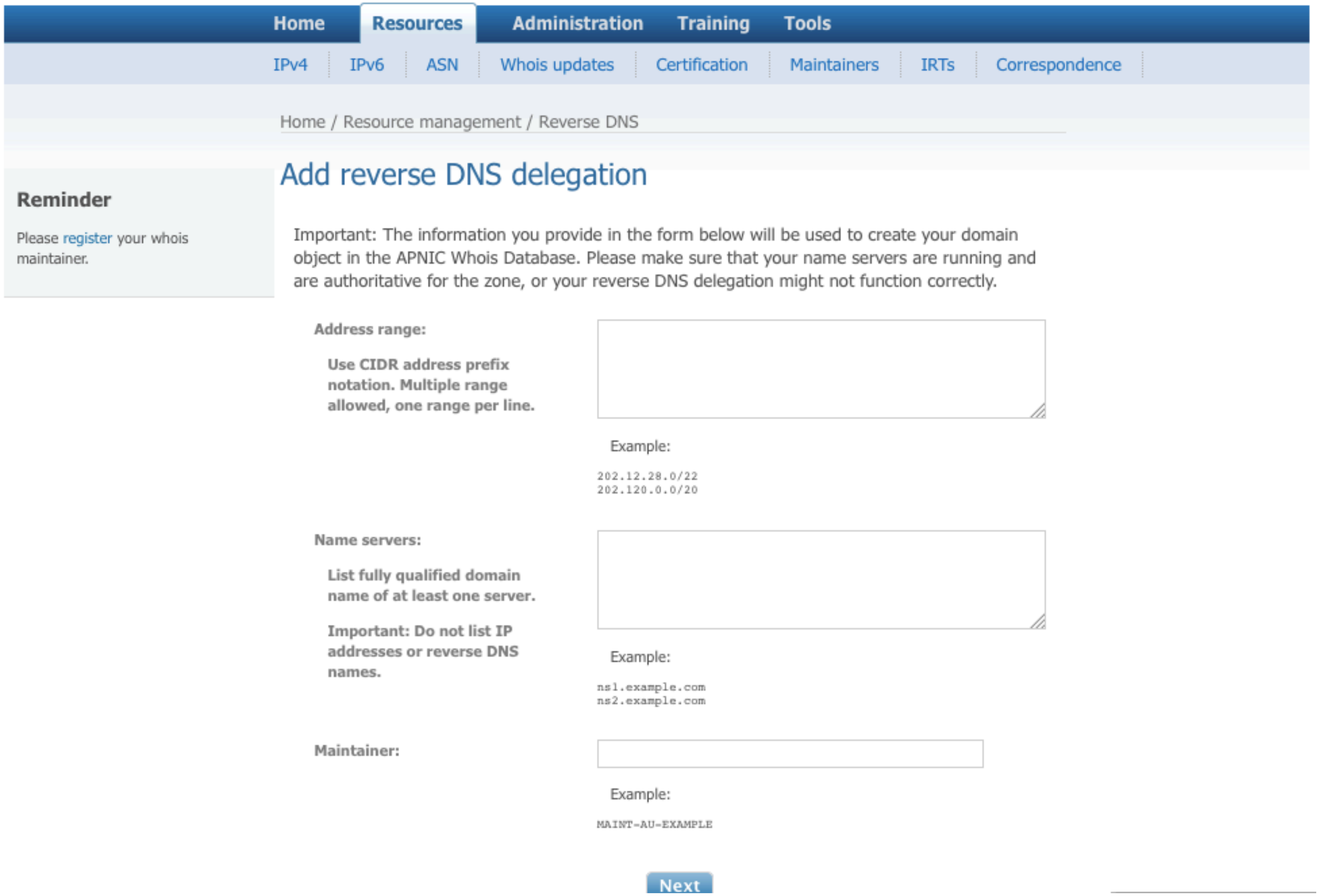
APNIC & ISPs Responsibilities

- 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 nameservers for allocations
  - Minimise pollution of DNS

Reverse Delegation Procedures

- Standard APNIC database object,
  - can be updated through myAPNIC
- Nameserver/domain set up verified before being submitted to the database.
- Protection by maintainer object
  - (current auths: CRYPT-PW, PGP).
- Any queries
  - Contact helpdesk@apnic.net

Reverse Delegation Procedures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Whois updates
Certification
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Correspondence
Next

Home / Resource management / Reverse DNS

Add reverse DNS delegation

Reminder

Please register your whois maintainer.

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:

```
202.12.28.0/22
202.120.0.0/20
```

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:

Example:

```
MAINT-AU-EXAMPLE
```

Whois domain object

```
domain:     28.12.202.in-addr.arpa
Descr:     in-addr.arpa zone for 28.12.202.in-addr.arpa
admin-c:    NO4-AP
tech-c:     AIC1-AP
zone-c:     NO4-AP
nserver:    cumin.apnic.net
nserver:    tinnie.apnic.net
nserver:    tinnie.arin.net
mnt-by:     MAINT-APNIC-AP
mnt-lower: MAINT-AP-DNS
changed:    inaddr@apnic.net 20021023
changed:    inaddr@apnic.net 20040109
changed:    hm-changed@apnic.net 20091007
changed:    hm-changed@apnic.net 20111208
source:     APNIC
```

Reverse Zone

Contacts

Name Servers

Maintainers (protection)

Questions?

Agenda (IRM)

- Introduction to APNIC
- Policy Development Process
- Internet Registry Policies
- Requesting IP Addresses
- Whois Database and MyAPNIC
- Autonomous System Numbers
- Reverse DNS
- **IPv6 Overview**

What is IPv6?

- IP stands for Internet Protocol which is one of the main pillars that supports the Internet today
- Current version of IP protocol is IPv4
- The new version of IP protocol is IPv6
- There is a version of IPv5 but it was assigned for experimental use [RFC1190]
- IPv6 was also called IPng in the early days of IPv6 protocol development stage

Motivation Behind IPv6 Protocol

- New generation Internet need:
  - Plenty of address space (PDA, Mobile Phones, Tablet PC, Car, TV etc etc ☺)
  - Solution of very complex hierarchical addressing need, which IPv4 is unable to provide
  - End to end communication without the need of NAT for some real time application (i.e online transaction)
  - Ensure security, reliability of data and faster processing of protocol overhead
  - Stable service for mobile network (i.e Internet in airline)

New Functional Improvement

- Address Space
  - – Increase from 32-bit to 128-bit address space
- Management
  - – Stateless autoconfiguration means no more need to configure IP addresses for end systems, even via DHCP
- Performance
  - – Fixed header size (40 bytes) and 64-bit header alignment mean better performance from routers and bridges/switches

Source: http://www.opus1.com/ipv6/whatisipv6.html

IPv6 Addressing

- Hexadecimal values of eight 16 bit fields
  - X:X:X:X:X:X:X:X (X=16 bit number, ex: A2FE)
  - 16 bit number is converted to a 4 digit hexadecimal number
- Example:
  - FE38:DCE3:124C:C1A2:BA03:6735:EF1C:683D
  - Abbreviated form of address

    4EED:0023:**0000:0000:0000**:036E:1250:2B00 Leading zeroes

    →4EED:23:**0:0:0**:36E:1250:2B00 Groups of zeroes

    →4EED:23:**::**36E:1250:2B00 Double colons

    (Null value can be used only once)

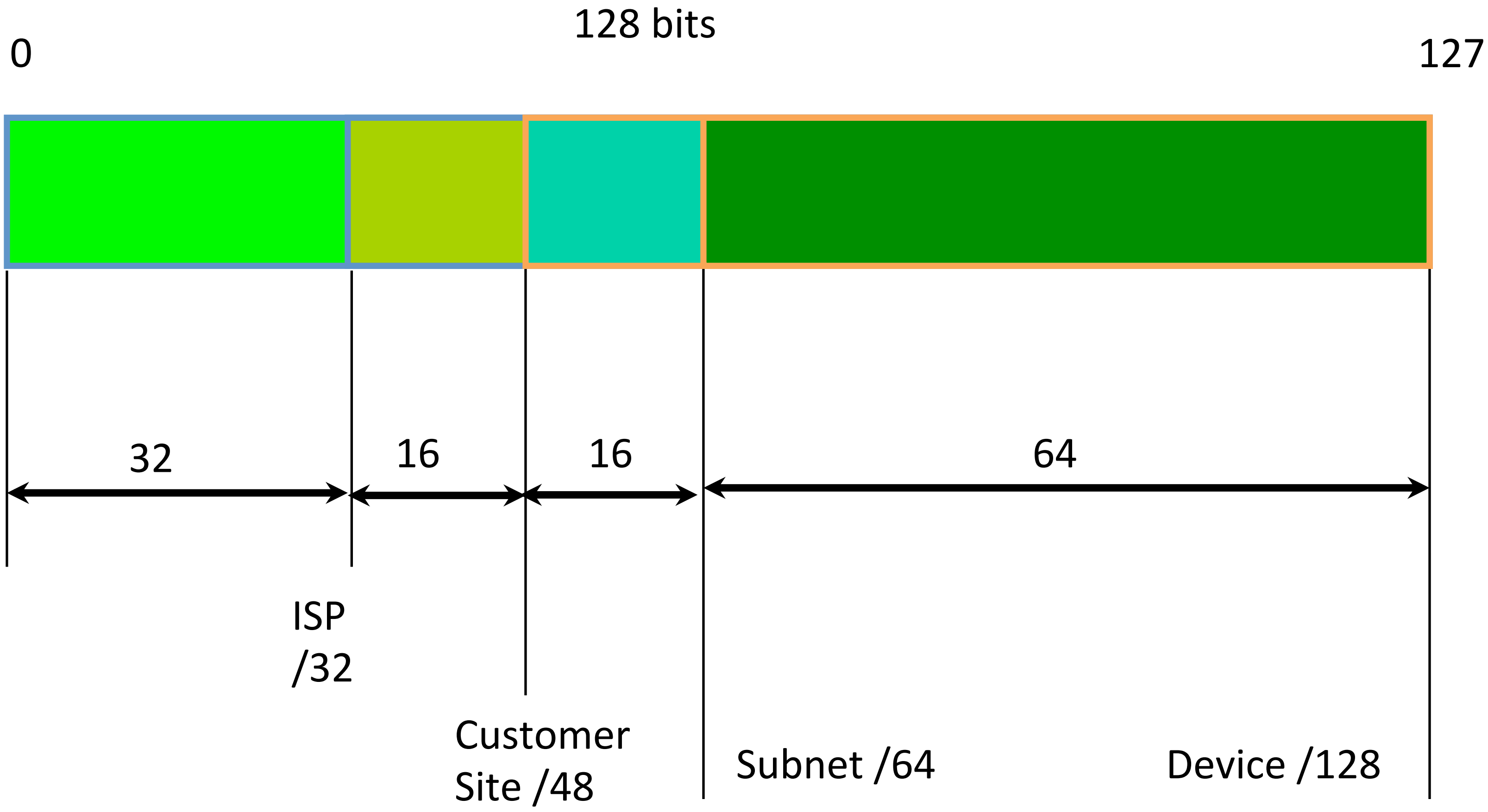
Initial IPv6 Allocation

- To qualify for an initial allocation of IPv6 address space, an organization must:
  - Not be an end site (must provide downstream services)
  - Plan to provide IPv6 connectivity to organizations to which it will make assignments
- Meet one of the two following criteria:
  - Have a plan for making at least 200 assignments to other organizations within two years OR
  - Be an existing ISP with IPv4 allocations from an APNIC or an NIR, which will make IPv6 assignments or sub-allocations to other organizations and announce the allocation in the inter-domain routing system within two years

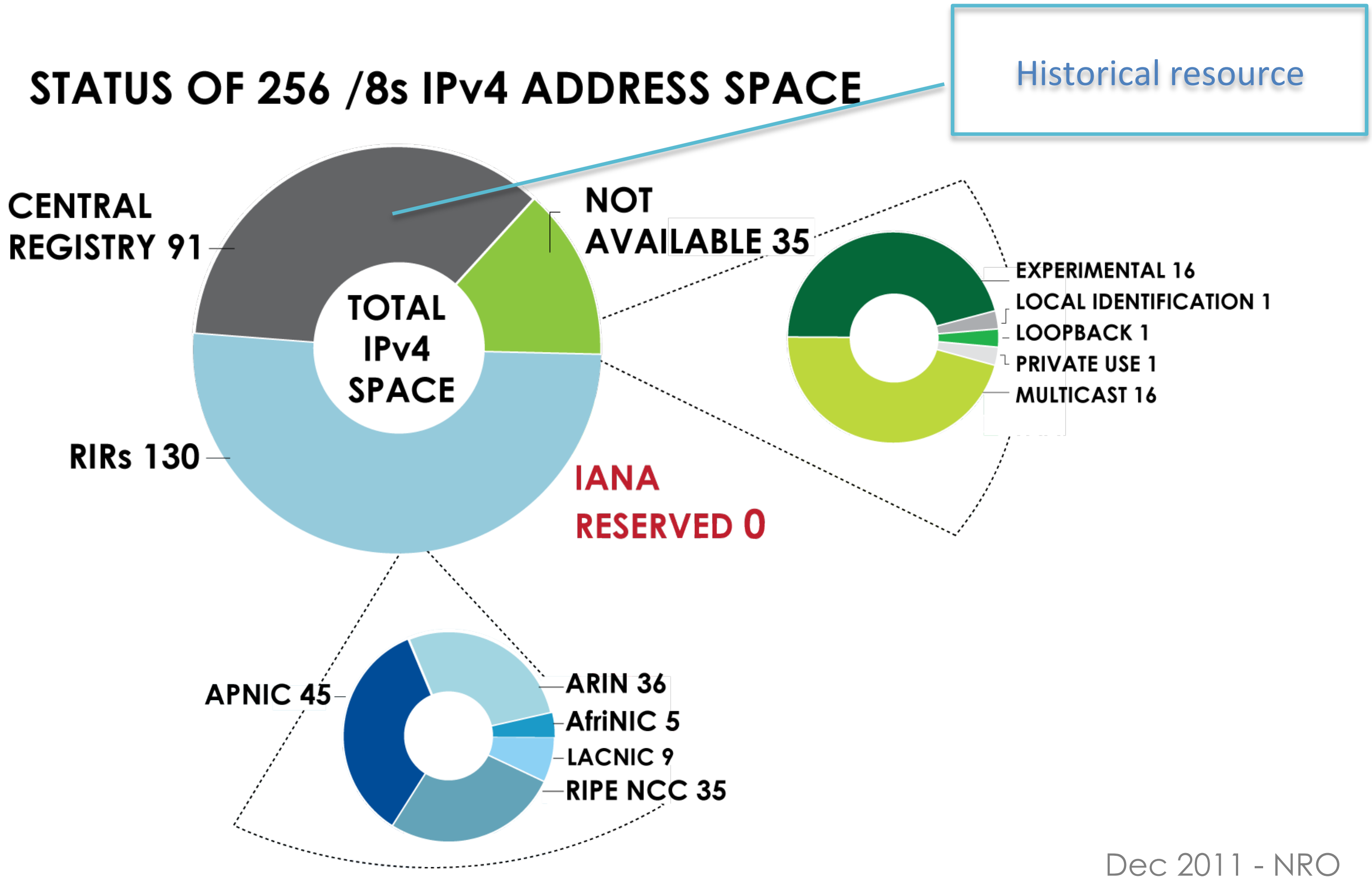
“One Click” IPv6 Policy

- Members with IPv4 holdings can click the button in MyAPNIC to instantly receive their IPv6 block
  - No forms to fill out!
  - “Get your IPv6 addresses” icon in the main landing page at MyAPNIC
- A Member that has an IPv4 allocation is eligible for a /32
- A Member that has an IPv4 assignment is eligible for a /48

IPv6 addressing structure


128 bits
0
127
32
16
16
64
ISP
/32
Customer
Site /48
Subnet /64
Device /128

Historical Resources



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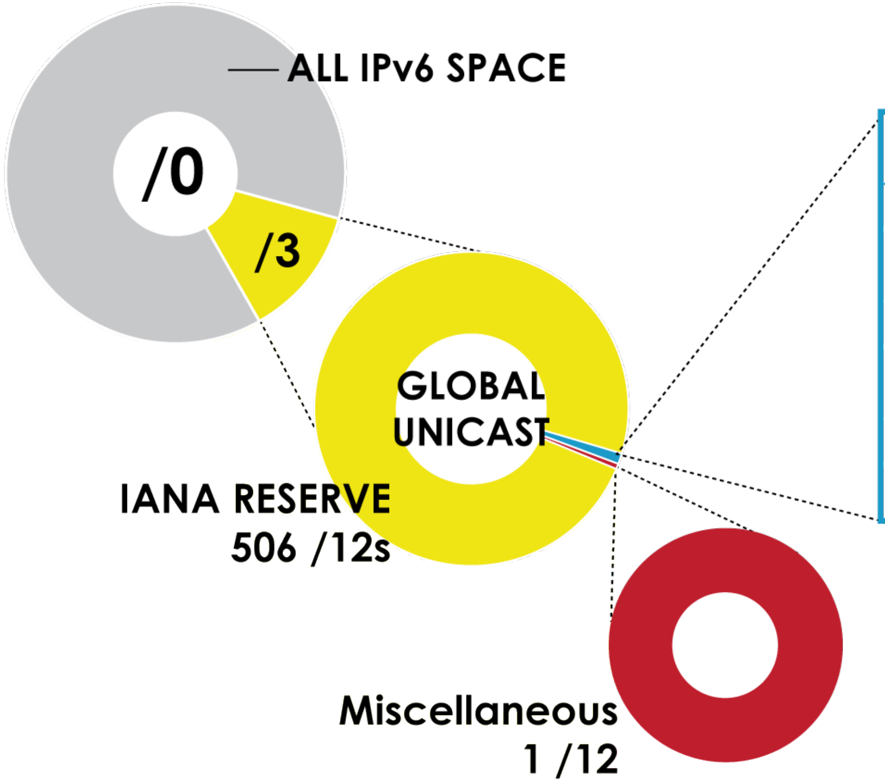
IPv6 Address Space


ALL IPv6 SPACE
/0
/3
GLOBAL UNICAST
IANA RESERVE
506 /12s
Miscellaneous
1 /12

RIRs 5 /12s (October 2006)

RIR	IPv6 ADDRESS
AfriNIC	2C00:0000::/12
APNIC	2400:0000::/12
ARIN	2600:0000::/12
LACNIC	2800:0000::/12
RIPE NCC	2A00:0000::/12

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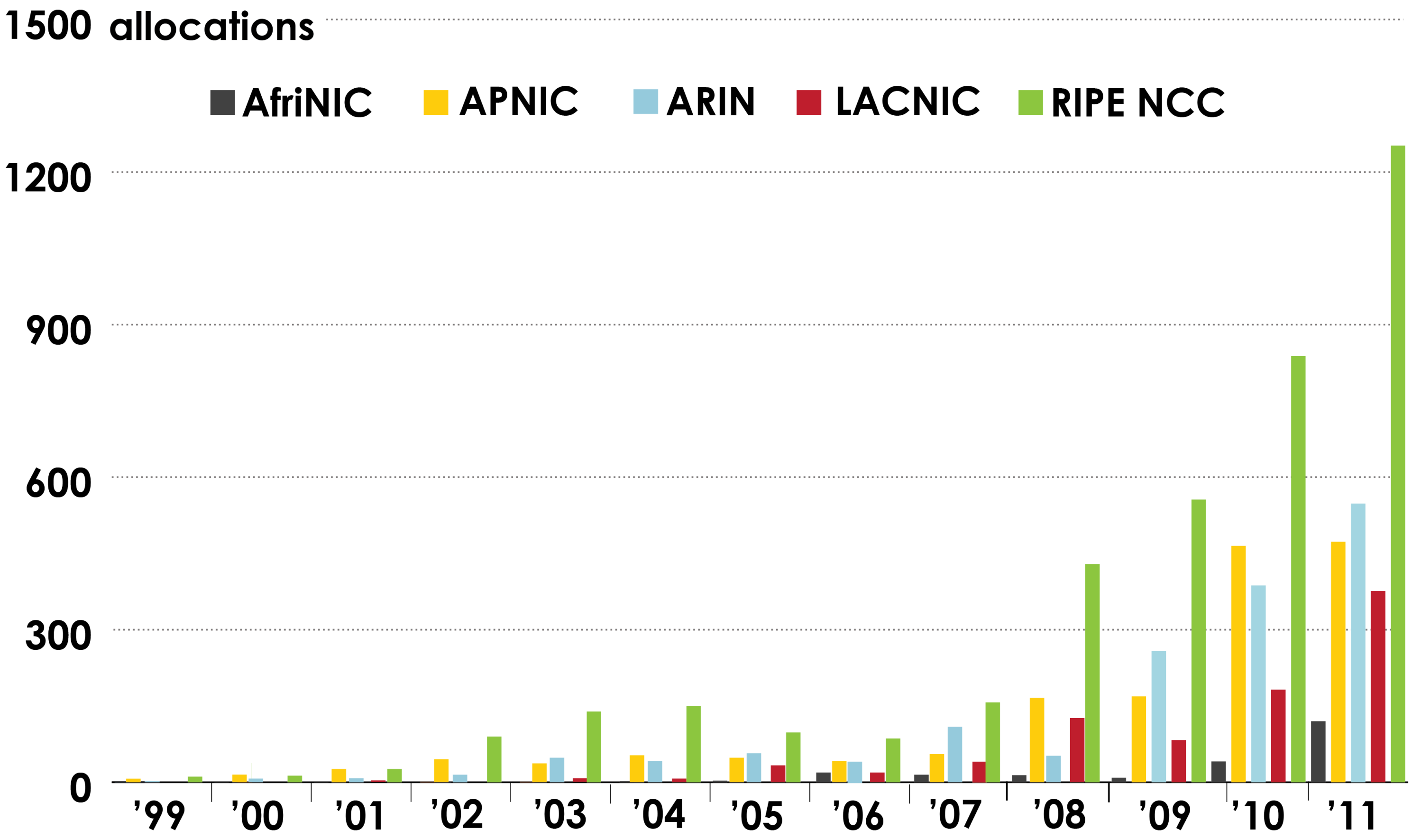
IPv6 Allocations RIRs to LIRs



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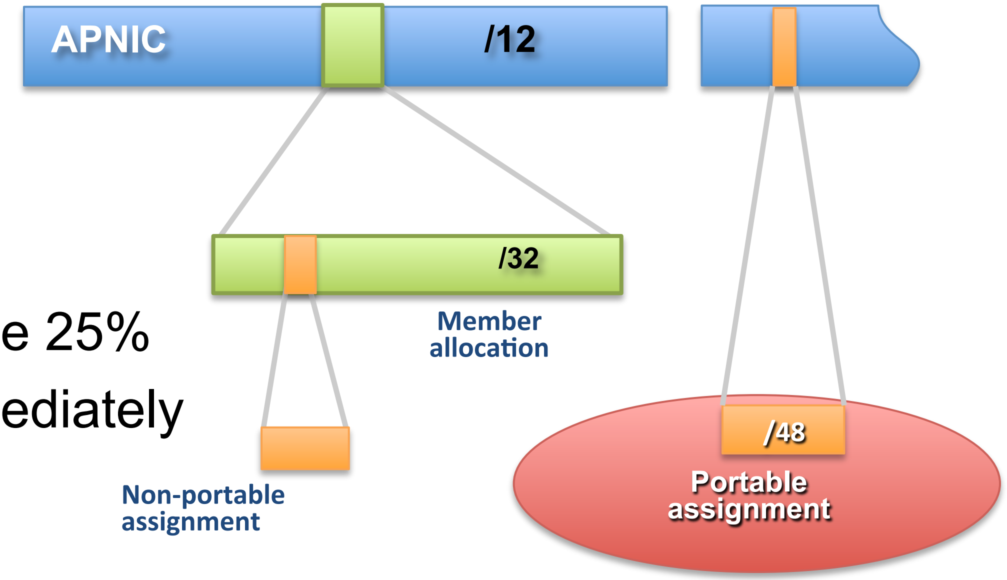
IPv6 Assignment Policy

- Assignment address space size
  - Minimum of /64 (only 1 subnet), Normal maximum of /48, Larger end-site assignment can be justified
- In typical deployments today
  - Several ISPs gives small customers a /56 or a /60 and Single LAN end sites a /64, e.g.,
    - /64 if end-site will ever only be a LAN
    - /60 for small end-sites (e.g. consumer)
    - /56 for medium end-sites (e.g. small business)
    - /48 for large end-sites
- 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 PoP as the service infrastructure of an IPv6 service operator

Portable Assignments for IPv6

- For (small) organisations who require a portable assignment for multi-homing purposes
  - The current policy allows for IPv6 portable assignment to end-sites
  - Size: /48, or a shorter prefix if the end site can justify it
  - To be multihomed within 1 month
  - Demonstrate need to use 25% of requested space immediately and 50% within a year


APNIC
/12
/32
Member allocation
Non-portable assignment
/48
Portable assignment

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

Portable Critical Infrastructure Assignments

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

IPv6 Utilisation

- Utilisation determined from end site assignments
  - ISP 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

Subsequent Allocation

- Must meet **HD = 0.94** utilisation requirement of previous allocation (subject to change)
- 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

HD Ratio

- The HD ratio threshold is
  - HD = log (/56 units assigned) / log (16,777,216)
  - 0.94 = 6,183,533 x /56 units
- Calculation of the HD ratio
  - Convert the assignment size into equivalent /56 units
    - Each /48 end site = 256 x /56 units
    - Each /52 end site = 16 x /56 units
    - Each /56 end site = 1 x /56 units
    - Each /60 end site = 1/16 x /56 units
    - Each /64 end site = 1/256 x /56 units

IPv6 utilisation (HD = 0.94)

- Percentage utilisation calculation

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

RFC 3194: “In a hierarchical address plan, as the size of the allocation increases, the density of assignments will decrease.”

Summary

- Explained the key essentials of Internet resource management.
- Focused on understanding the structures, processes, procedures, and policies involved in
  - Requesting, allocating, and managing Internet addresses (IPv4 and IPv6) and Autonomous System (AS) numbers.
- Discussed APNIC Whois Database, Reverse DNS delegations, and the MyAPNIC address management tool
- Introduced IPv6 address management

Questions?

Member Services Helpdesk

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

Helpdesk hours

9:00 am - 9:00 pm (AU EST, UTC + 10 hrs)

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

- More personalised service
  - Range of languages:

    Bahasa Indonesia, Bengali, Cantonese, English, Hindi, Mandarin, Thai, 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

Thank you! ☺

<champika@apnic.net>