Internet Resource Management

APNIC Tutorial in APNIC35

February 25, 2013, Singapore.

APNIC

Introduction

- Presenter

Nurul Islam Roman
Senior Training Specialist
nurul@apnic.net

Specialties:
Routing & Switching
MPLS, IPv6
DNS/DNSSEC
Internet Resource Management
Network Security

Overview

- IRM
  - Introduction to APNIC
  - Internet registry policies
  - APNIC policy development process
  - APNIC whois database
  - Reverse DNS Delegation
  - Autonomous System (AS) Number
  - APNIC helpdesk

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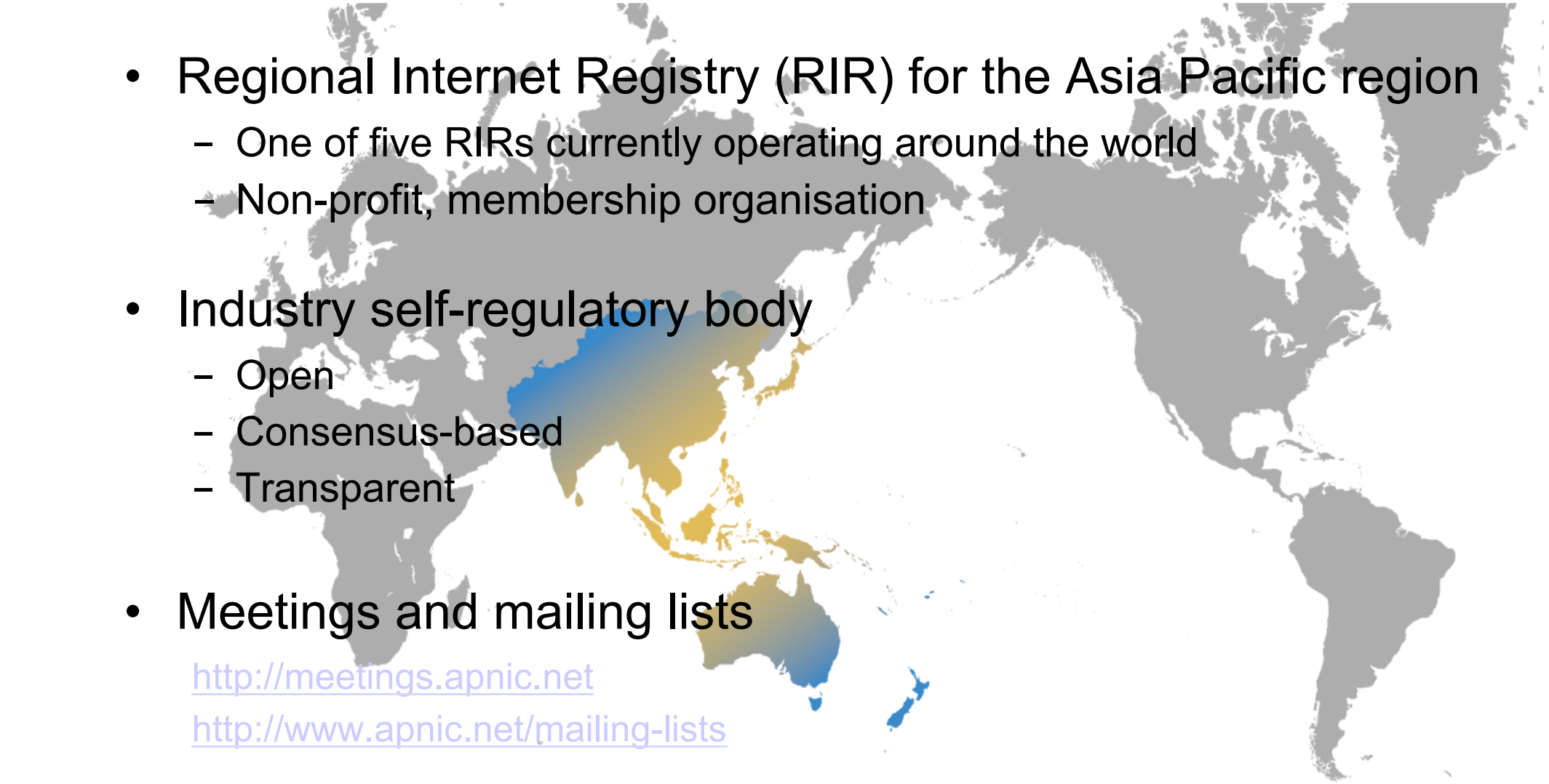
What is APNIC?



- 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

History of APNIC

- **1993**

  APNIC was established as a project of the Asia Pacific Networking Group (APNG)
- **1994**

  IANA authorized APNIC to commence allocating resources in its region
- **1995**

  Inaugural APNIC meeting in Bangkok
- **1998**

  APNIC relocated from Tokyo to Brisbane
- **2000**

  First independently-held three day Open Policy Meeting
- **2002**

  Introduced the Member Services Helpdesk with extended operating hours

What does APNIC do?

Resource service	Policy development

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

Information dissemination	**Training**
• APNIC meetings • Web and ftp site • Publications, mailing lists • Outreach seminars http://www.apnic.net/community/participate/join-discussions/sigs	• Face to Face • Via e-learning - Subsidised for members Schedule: http://www.apnic.net/training

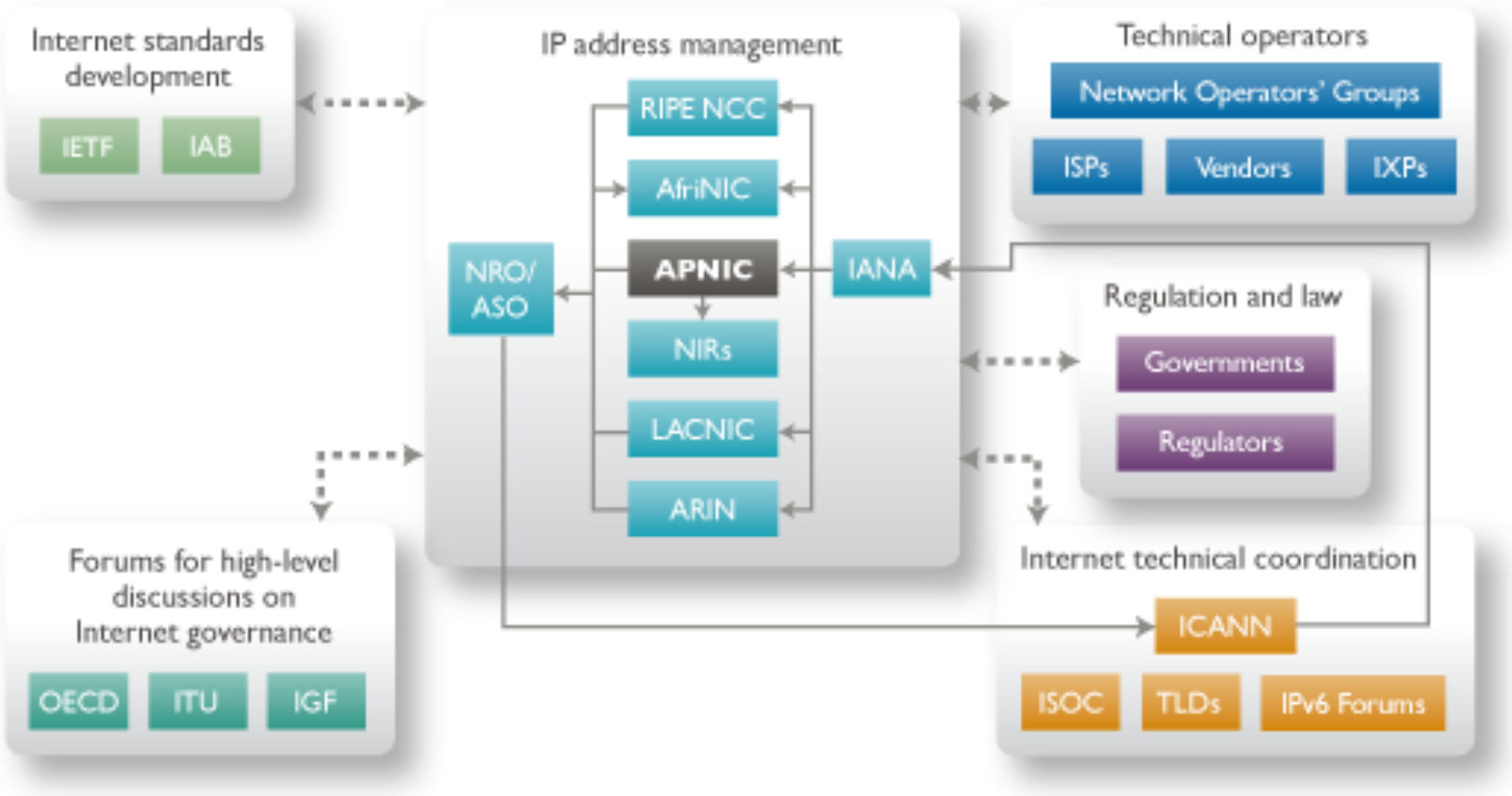
Where is the APNIC region?

http://w

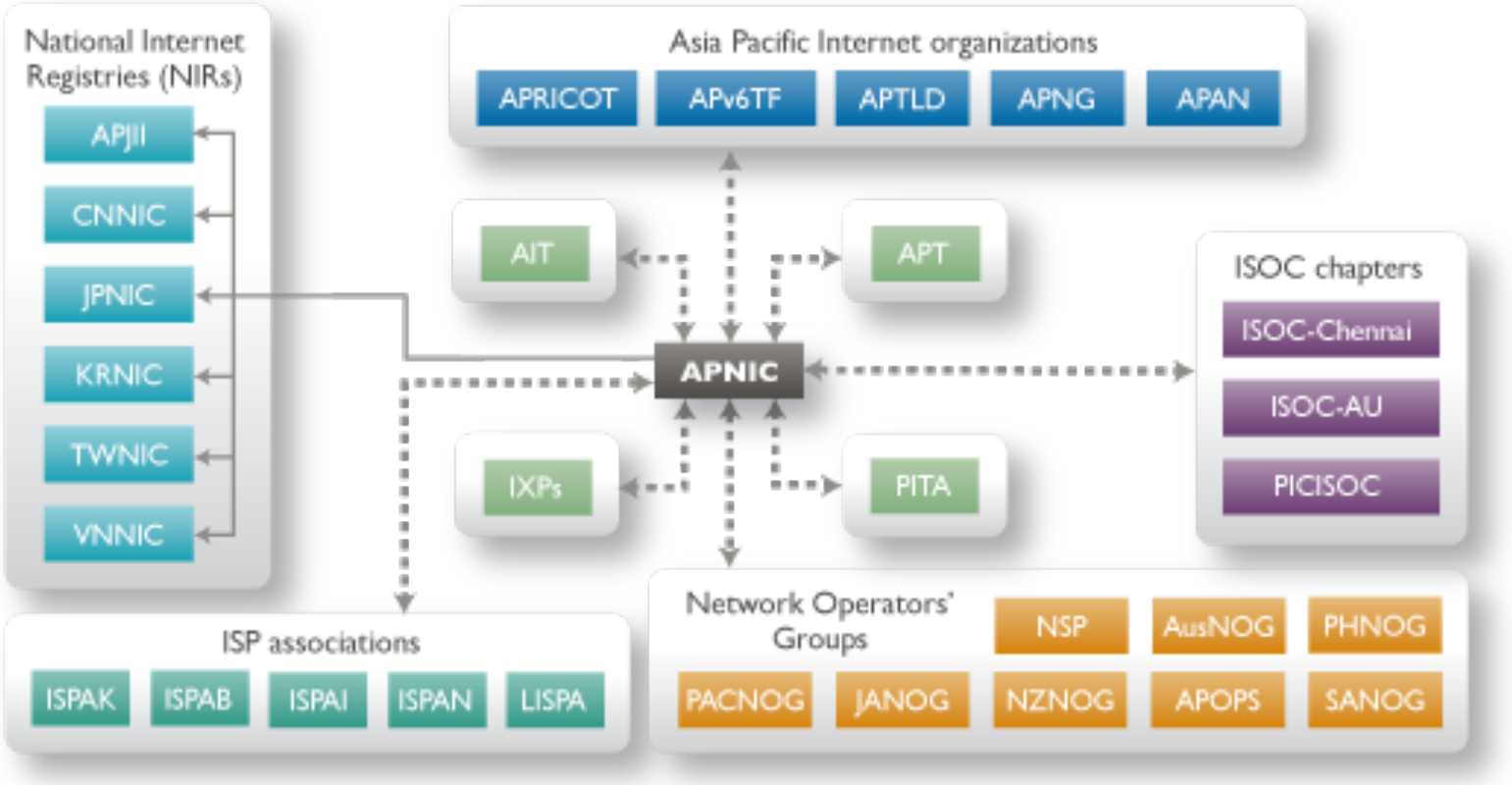
APNIC is NOT

- 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

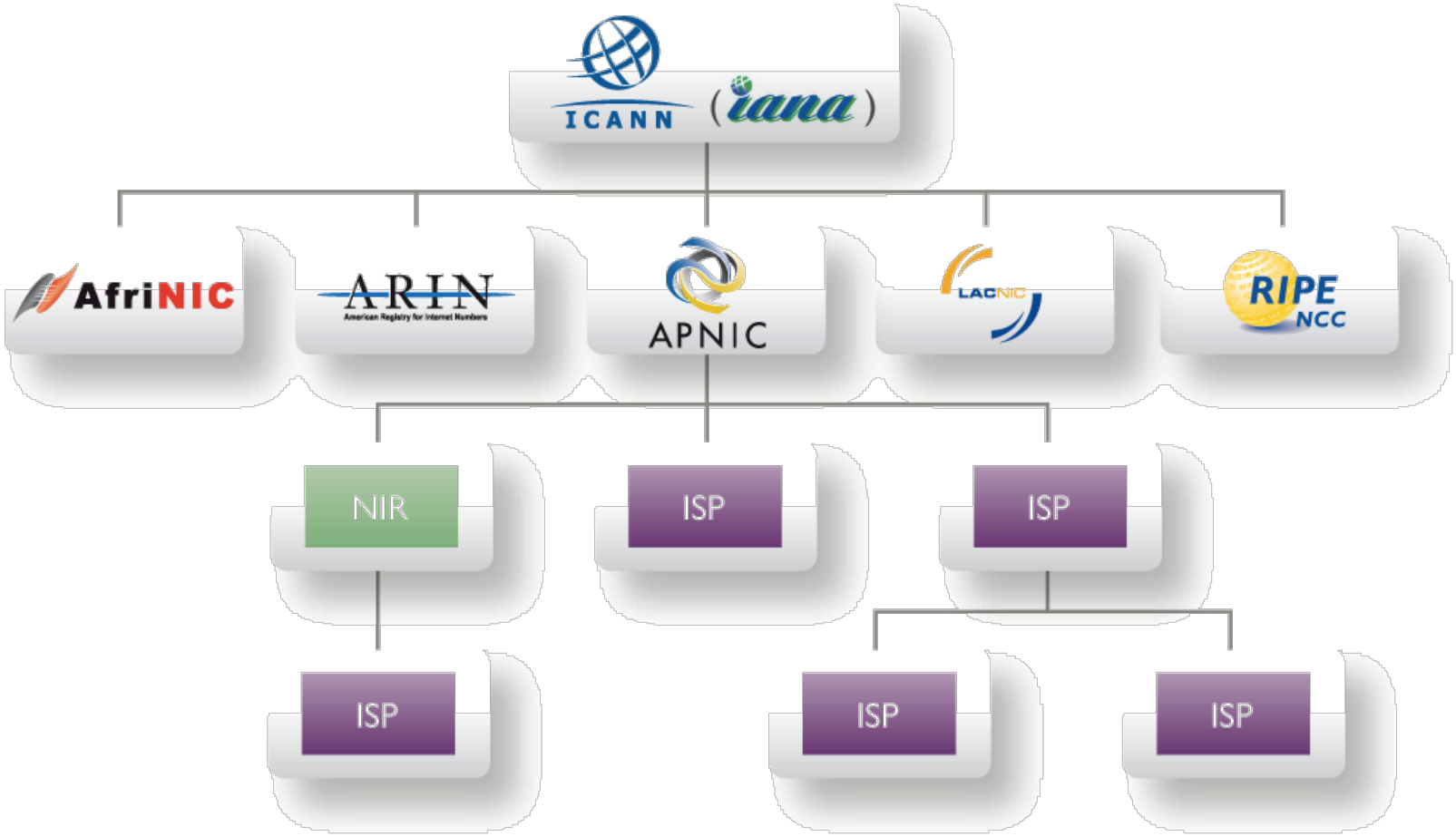
APNIC from a Global Perspective



APNIC in the Asia Pacific



Internet Registry Structure



Global Policy Coordination

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

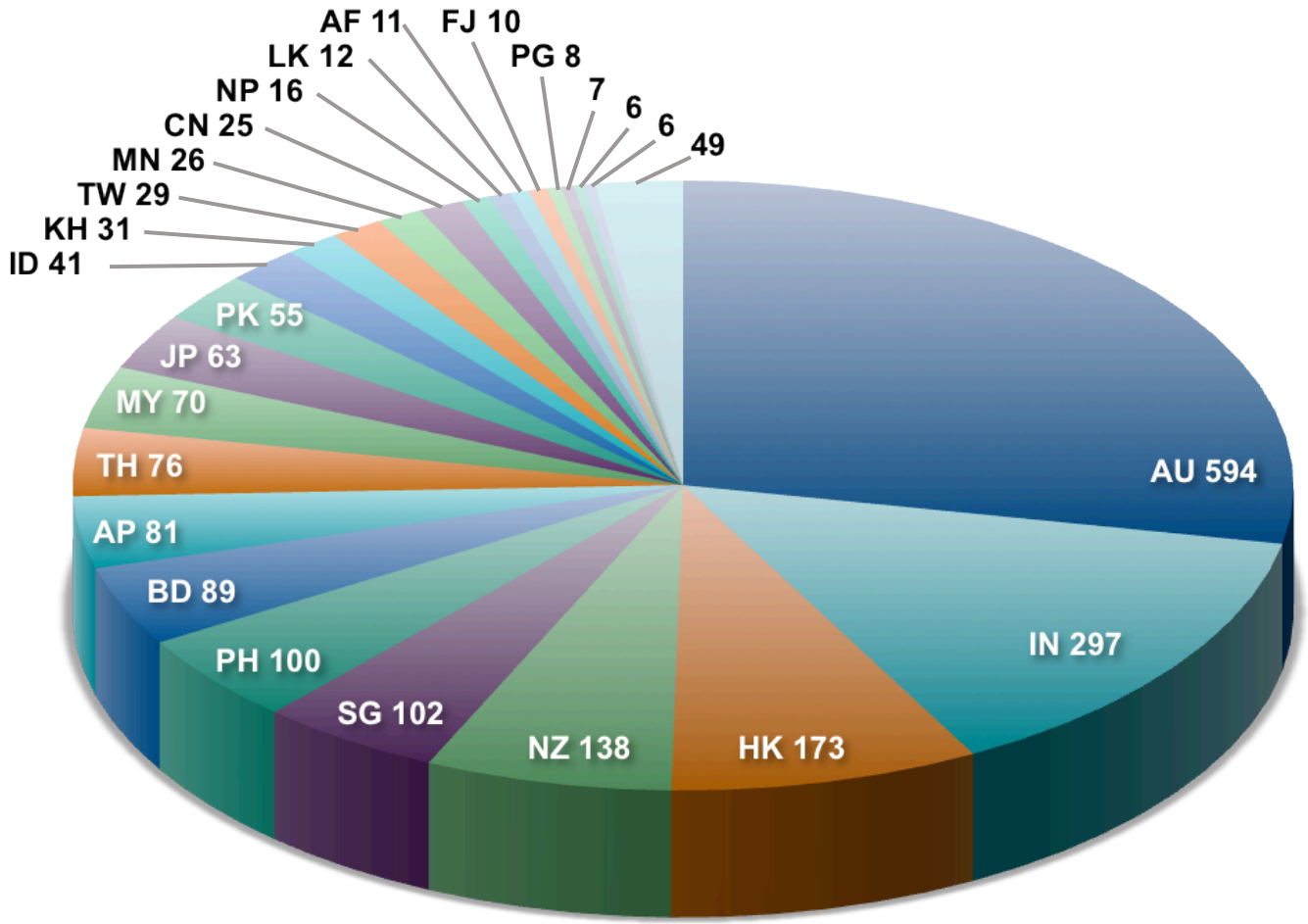
Global Policy Coordination

The main function of ASO:

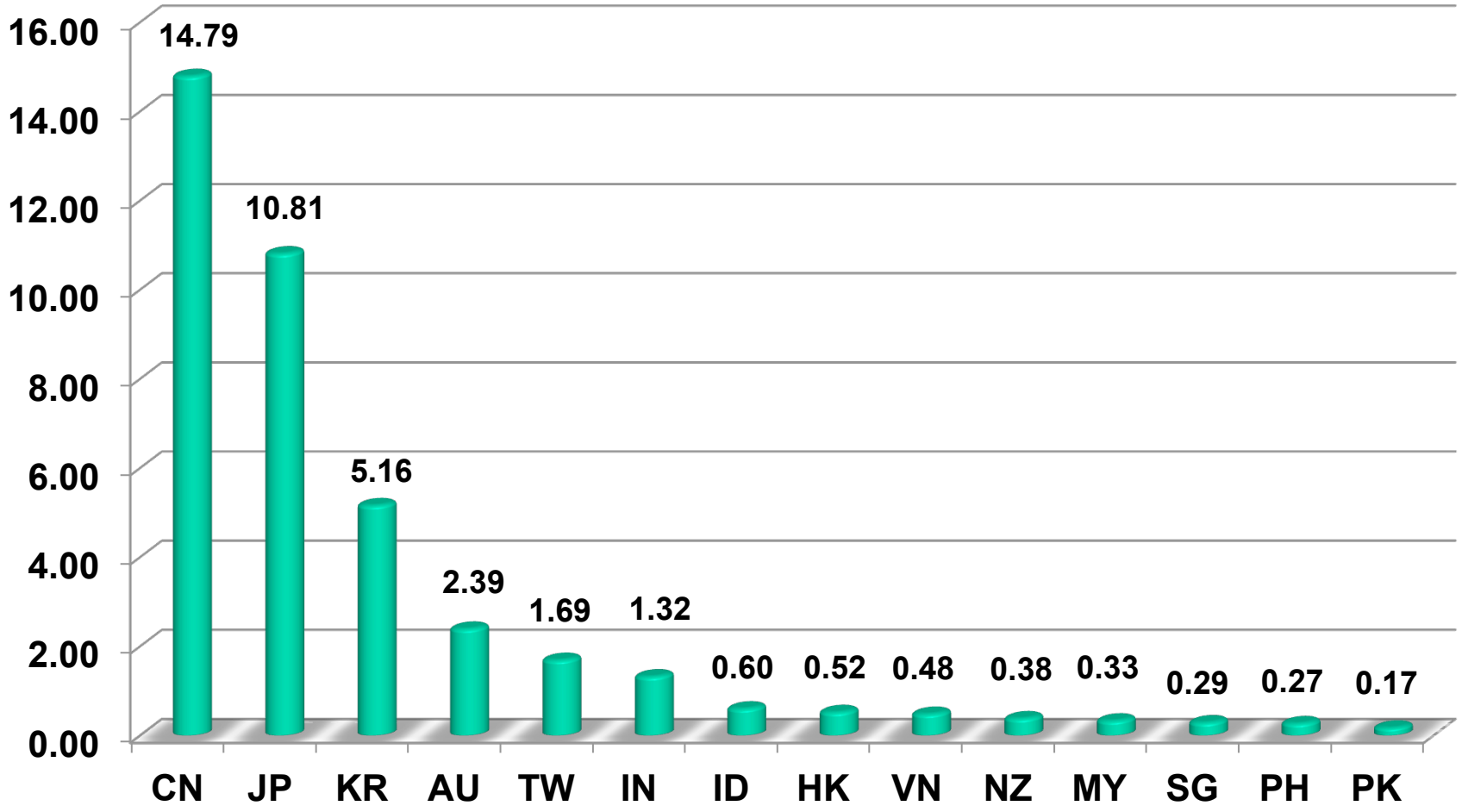
- ASO receives global policies and policy process details from the NRO
- ASO forwards global policies and policy process details to ICANN board

APNIC Membership

Numbers of members per economy



APNIC IPv4 Allocations By Economy



http://www.apnic.net/stats/o3/ as of 01/10/2009

Questions?

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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')

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

Allocation and Assignment

APNIC
Allocates
to APNIC Member

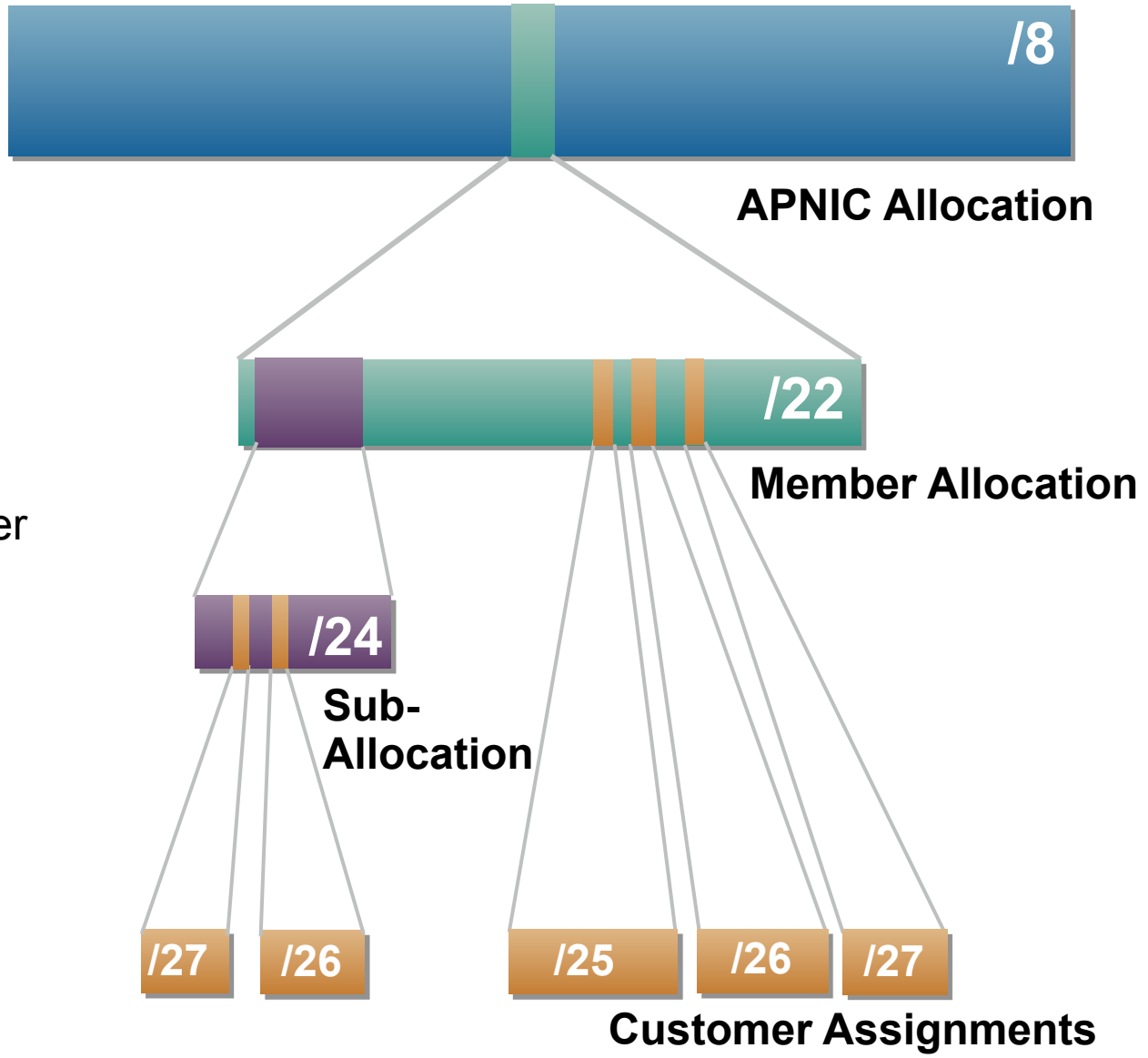
APNIC Member

Allocates
to downstream

Downstream
Assigns
to end-user

Assigns
to end-user

Customer / End User



IPv6 Allocation and Assignment

APNIC
Allocates
to APNIC Member

APNIC Member

Allocates
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Downstream
Assigns
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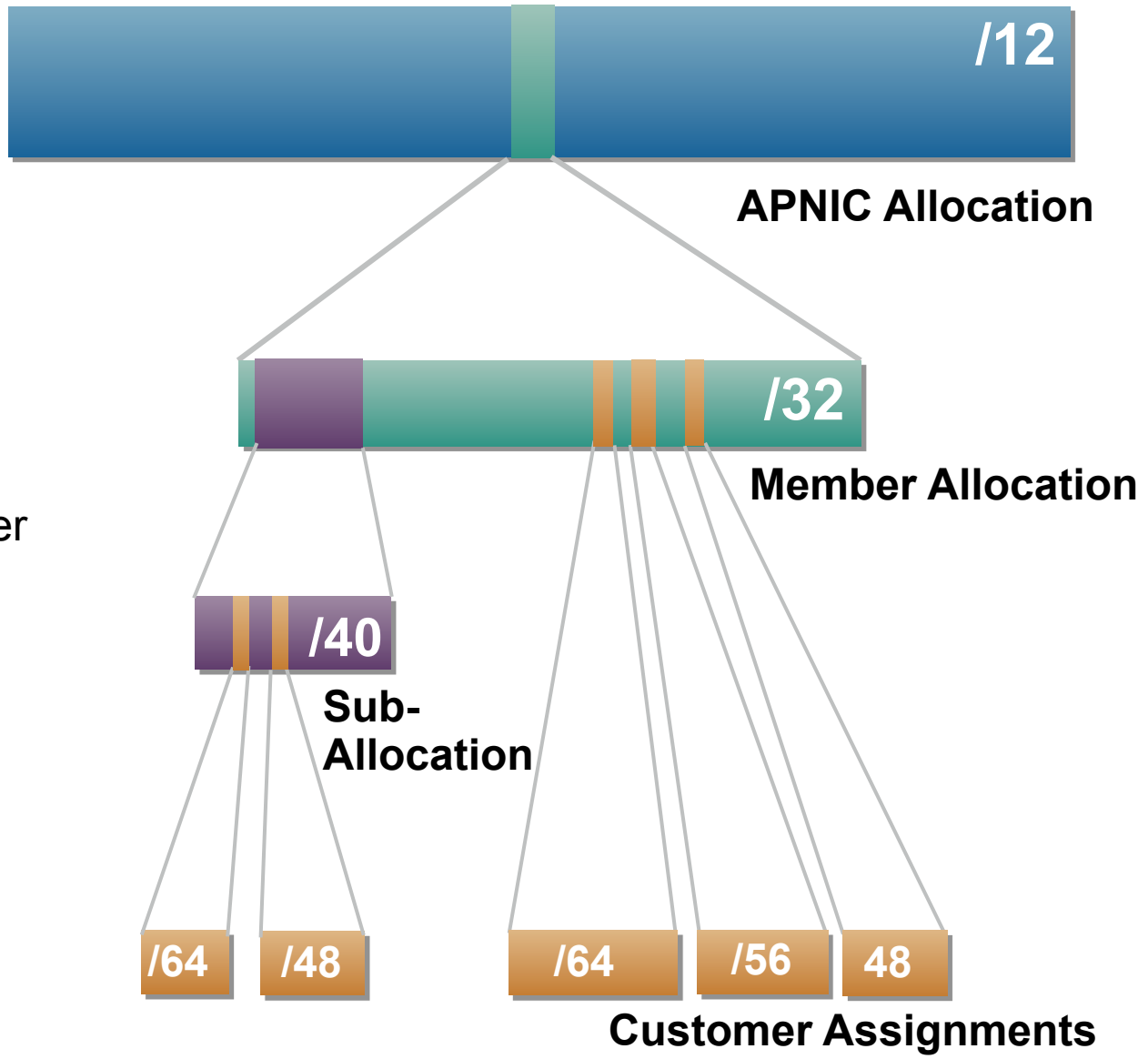
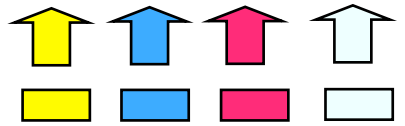
Assigns
to end-user

Customer / End User



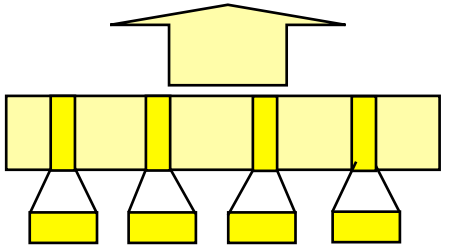
Portable & non-portable

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

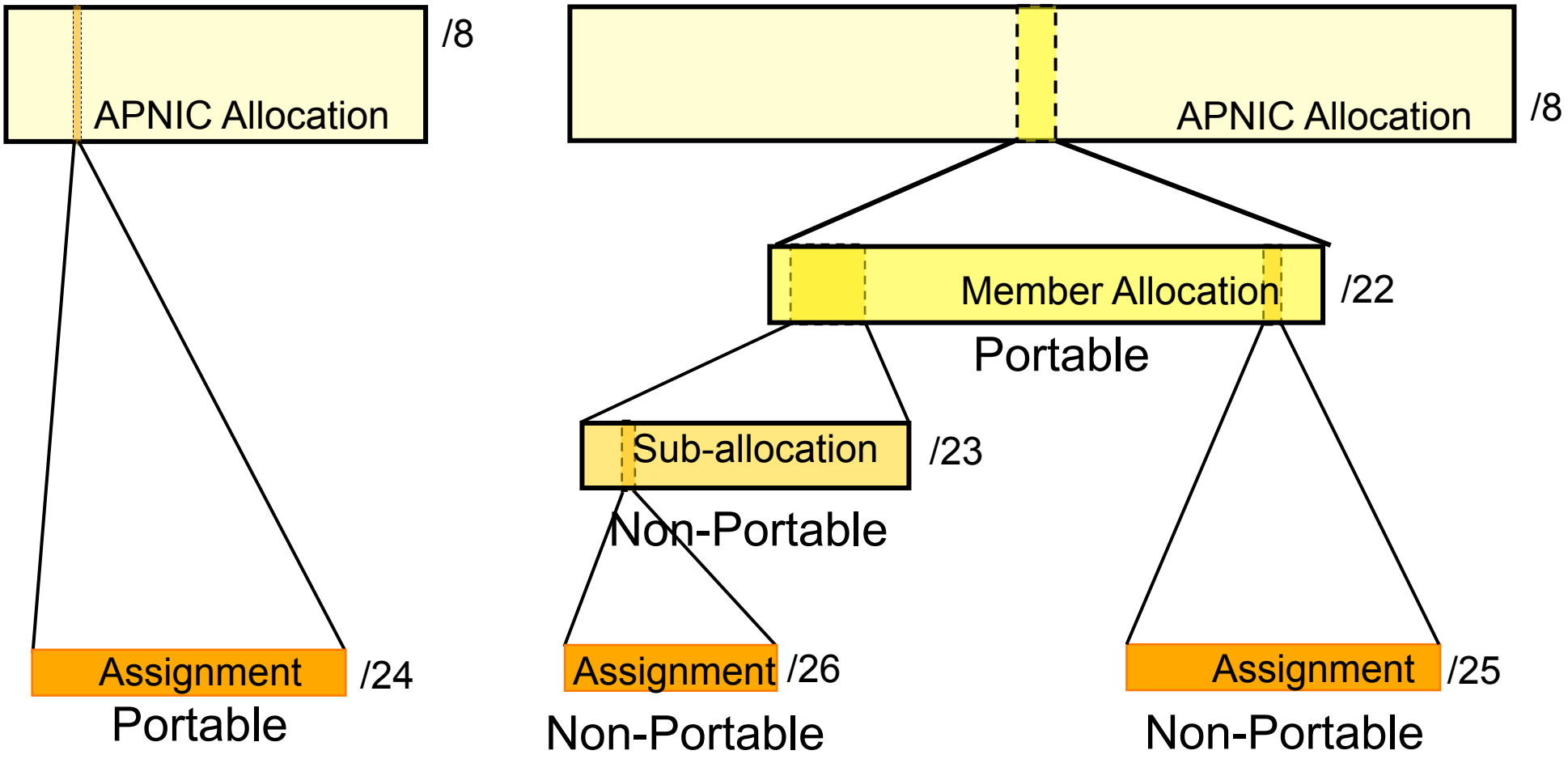


- Customer uses ISP's address space
  - Must renumber if changing ISP
- Only way to effectively scale the Internet

Portable allocations

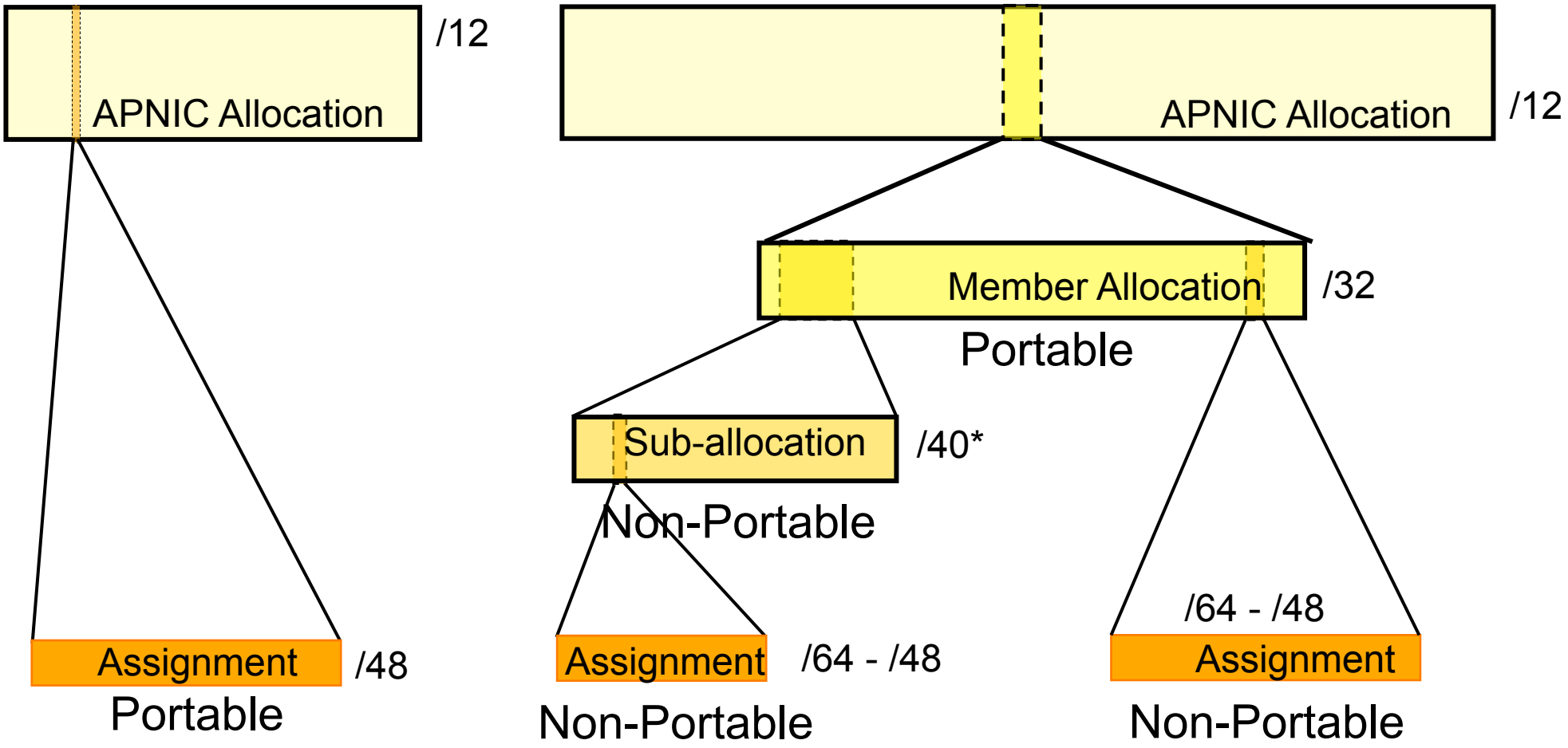
- Allocations made by APNIC/NIRs

Address Management Hierarchy



Describes “portability” of the address space

Address Management Hierarchy



Describes “portability” of the address space

Internet Resource Management Objectives

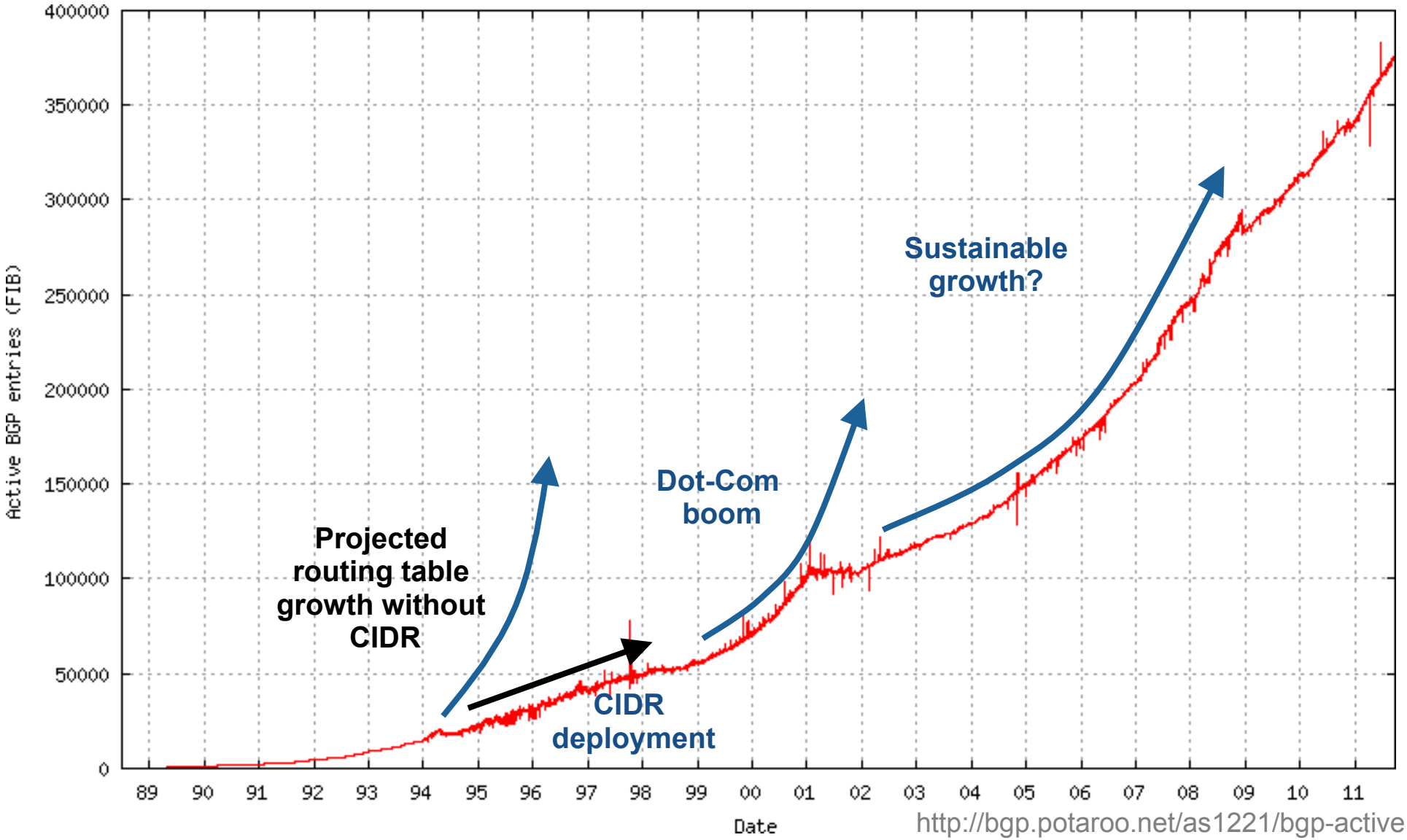
Conservation
- Efficient use of resources
- Based on demonstrated need

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

Registration
- Ensure uniqueness
- Facilitate trouble shooting

Uniqueness, fairness and consistency

Growth of the Global Routing Table



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

APNIC Policy Environment

"IP addresses not freehold property"

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

"Confidentiality & security"

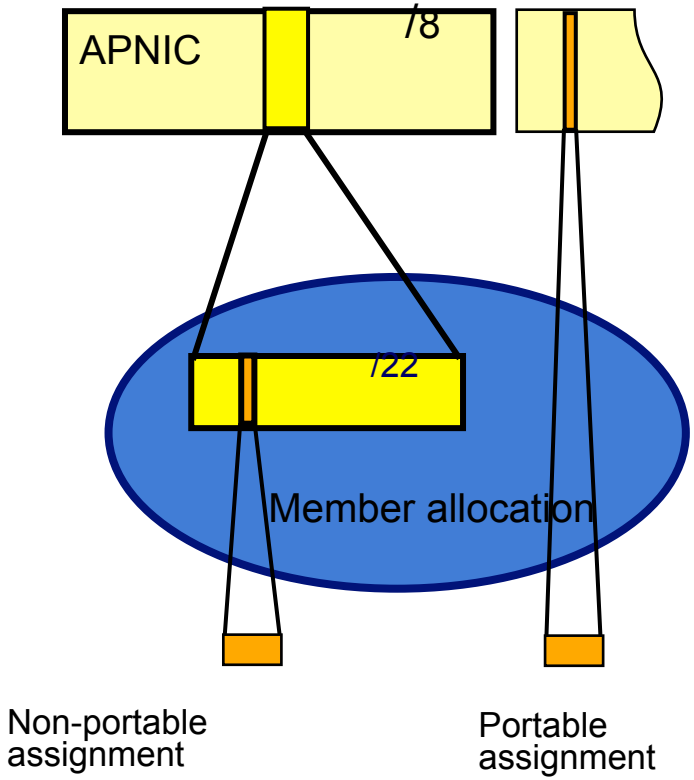
- APNIC to observe and protect trust relationship
  - Non-disclosure agreement signed by staff

APNIC Allocation Policies

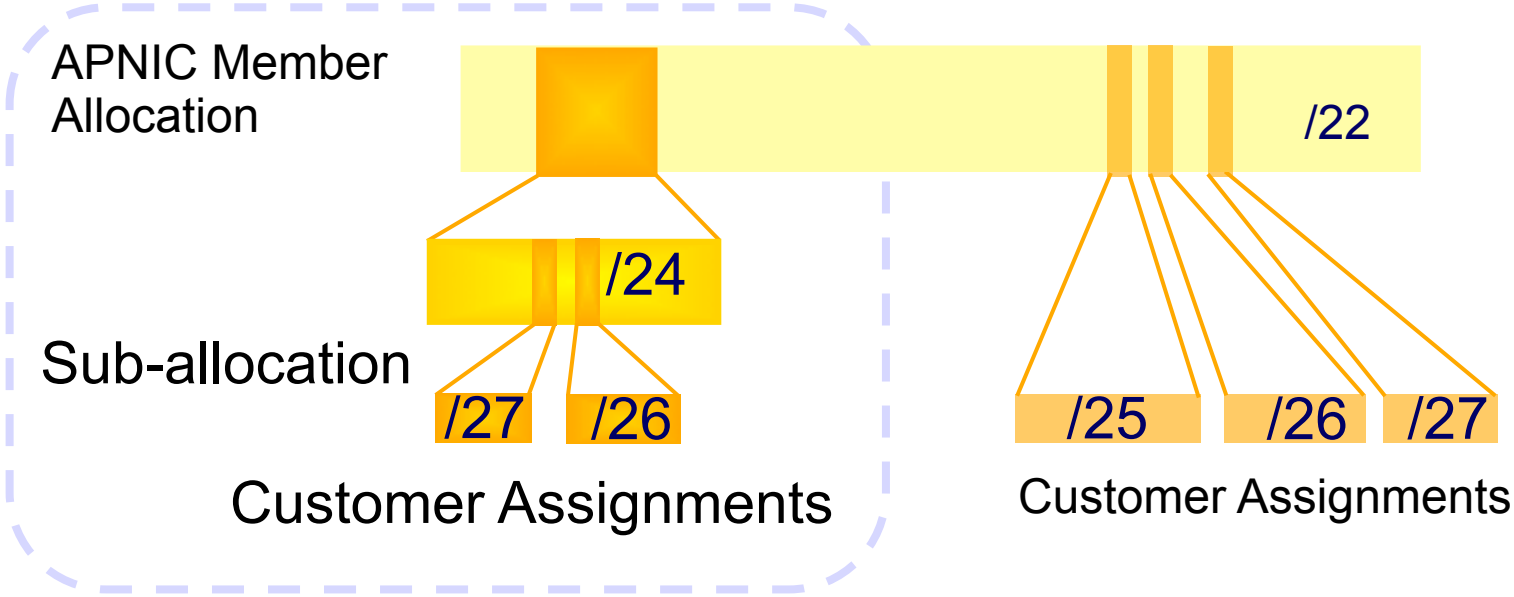
- Aggregation of allocation
  - Provider responsible for aggregation
  - Customer assignments /sub-allocations must be non-portable
- Allocations based on demonstrated need
  - Detailed documentation required
    - All address space held to be declared
  - Stockpiling not permitted

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



IPv4 Sub-allocations



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

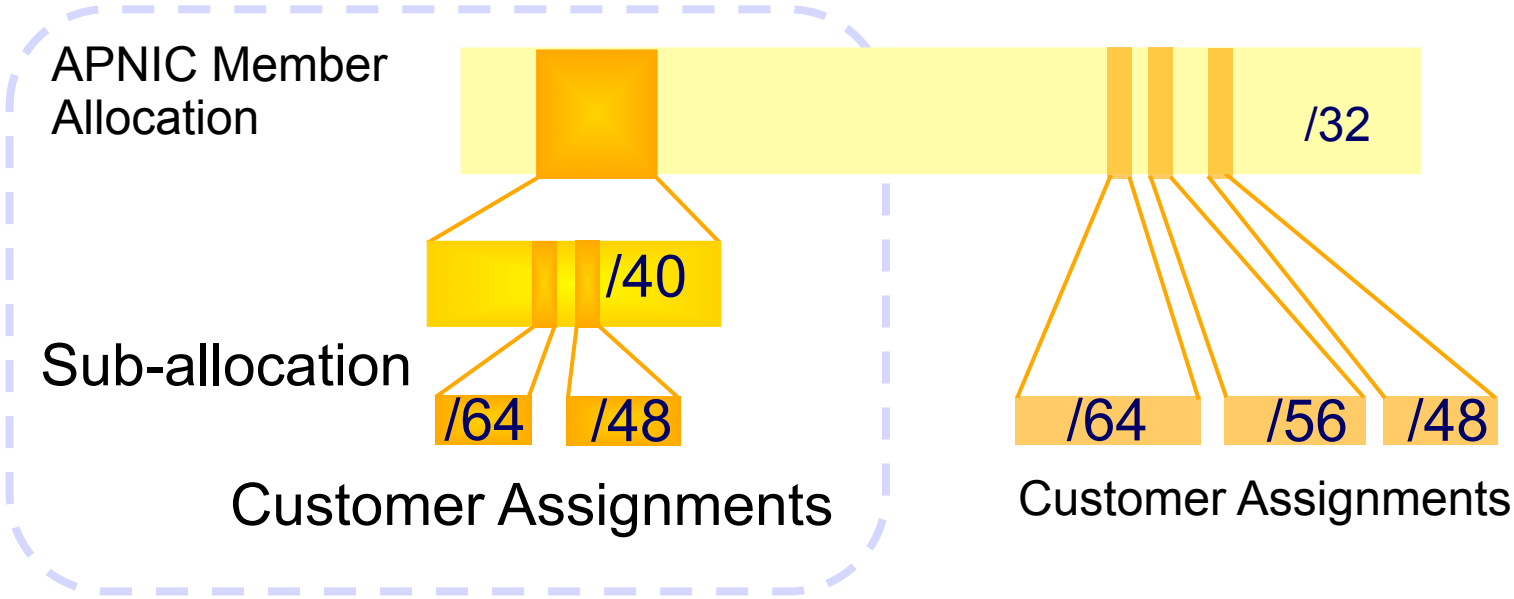
IPv6 Allocation Policies

- Initial allocation
  - /32 IPv6 block
  - larger than /32 may be justified
  - For APNIC members with existing IPv4 space
    - One-click Policy (through MyAPNIC)
  - Without existing IPv4 space
    - Must meet initial allocation criteria

IPv6 Allocation Policies

- Subsequent allocation
  - Based on HD-ratio utilization policy
  - An acceptable HD-ratio of 0.94 must be met
  - Alternative allocation criteria
    - Organization can demonstrate a valid reason for requiring the subsequent allocation, under Special Circumstances on the IPv6 Guidelines
  - Subsequent allocation = double their allocated address space
    - Where possible, it will be made from the adjacent address block.

IPv6 Sub-allocations



- No specific policy for LIRs to allocate space to subordinate ISPs
- All /48 assignments to end sites must be registered
- Second opinion
  - LIRs do not need to submit second opinion request before making sub-allocations to downstream ISPs
  - Must submit a second opinion request for assignments more than /48

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

Address Assignment Policies

Assignments based on requirements

- Demonstrated through detailed documentation
- Assignment should maximise utilisation
  - minimise wastage

Classless assignments

- showing use of VLSM

IPv6 Assignment Policy

- Assignment address space size
  - Minimum of /64 (only 1 subnet)
  - Normal maximum of /48
  - Larger end-site assignment can be justified
- 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

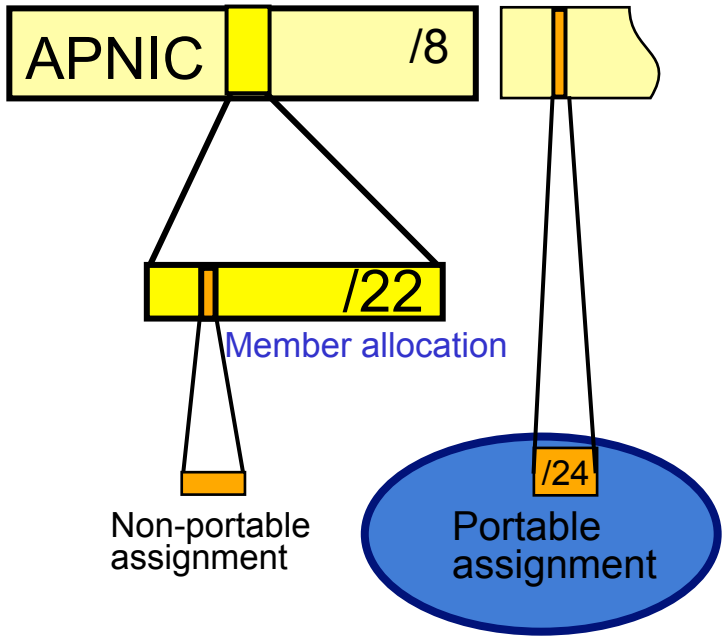
Portable assignments

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



IXP Assignments

- Criteria
  - 3 or more peers
  - Demonstrate “open peering policy”
- APNIC has a reserved block of space from which to make IXP assignments
- Assignment size:
  - IPv4: /24
  - IPv6: /48 minimum

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 (Maximum)

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
  - ISPs responsible for overall utilisation
    - Sub-allocation holders need to make efficient assignments
- Database registration (WHOIS Db)
  - Sub-allocations & assignments to be registered in the db

Historical Resource Transfer

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

Transfer of historical Internet resources

- Transfers of resources to current APNIC account holders are purely optional
- No technical review or approval
- APNIC does not review any agreements between the parties to a transfer
- Once the existing holder of the resources provides documents confirming the transfer, APNIC will transfer the resources to the APNIC member's account.

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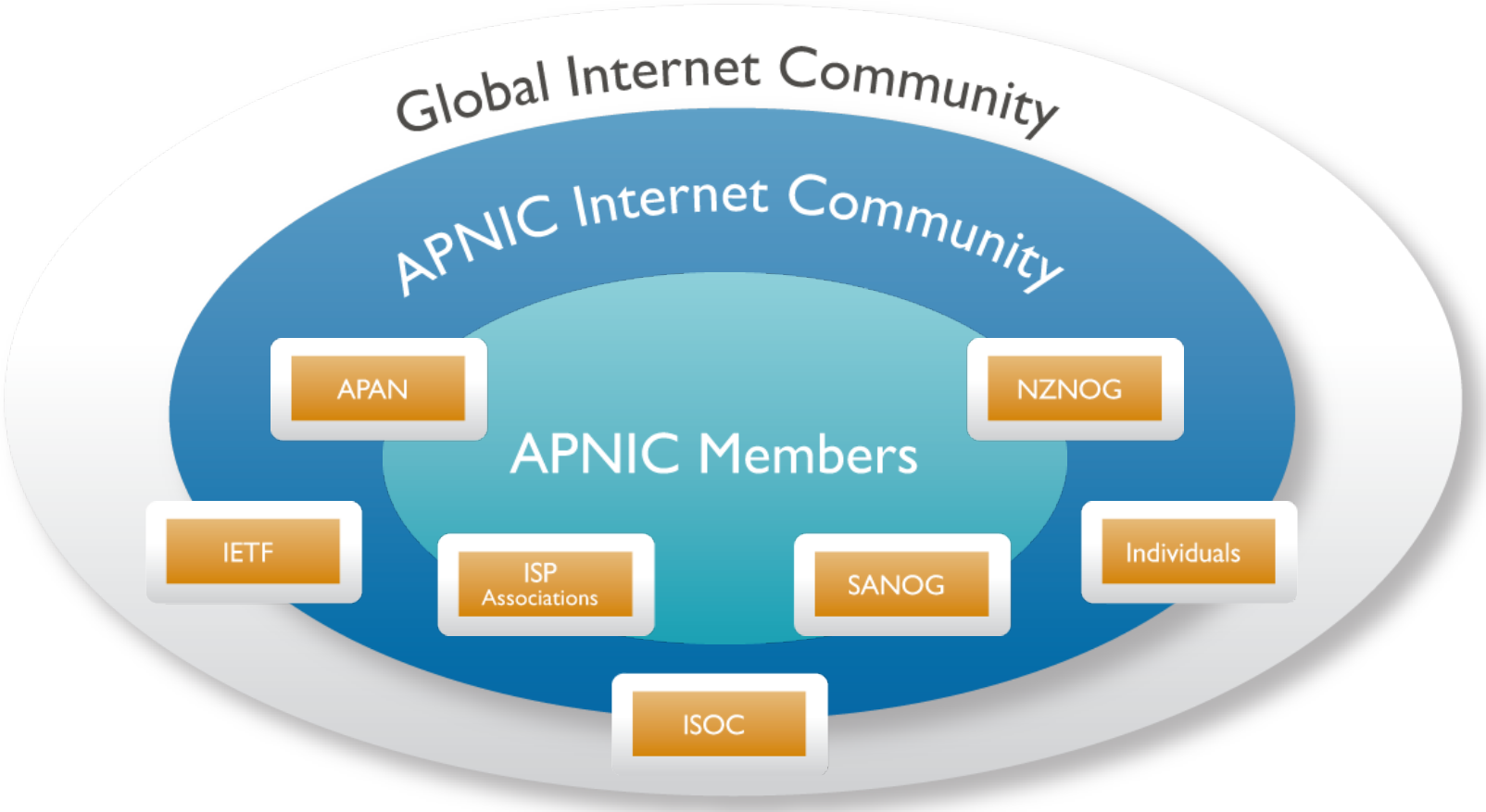
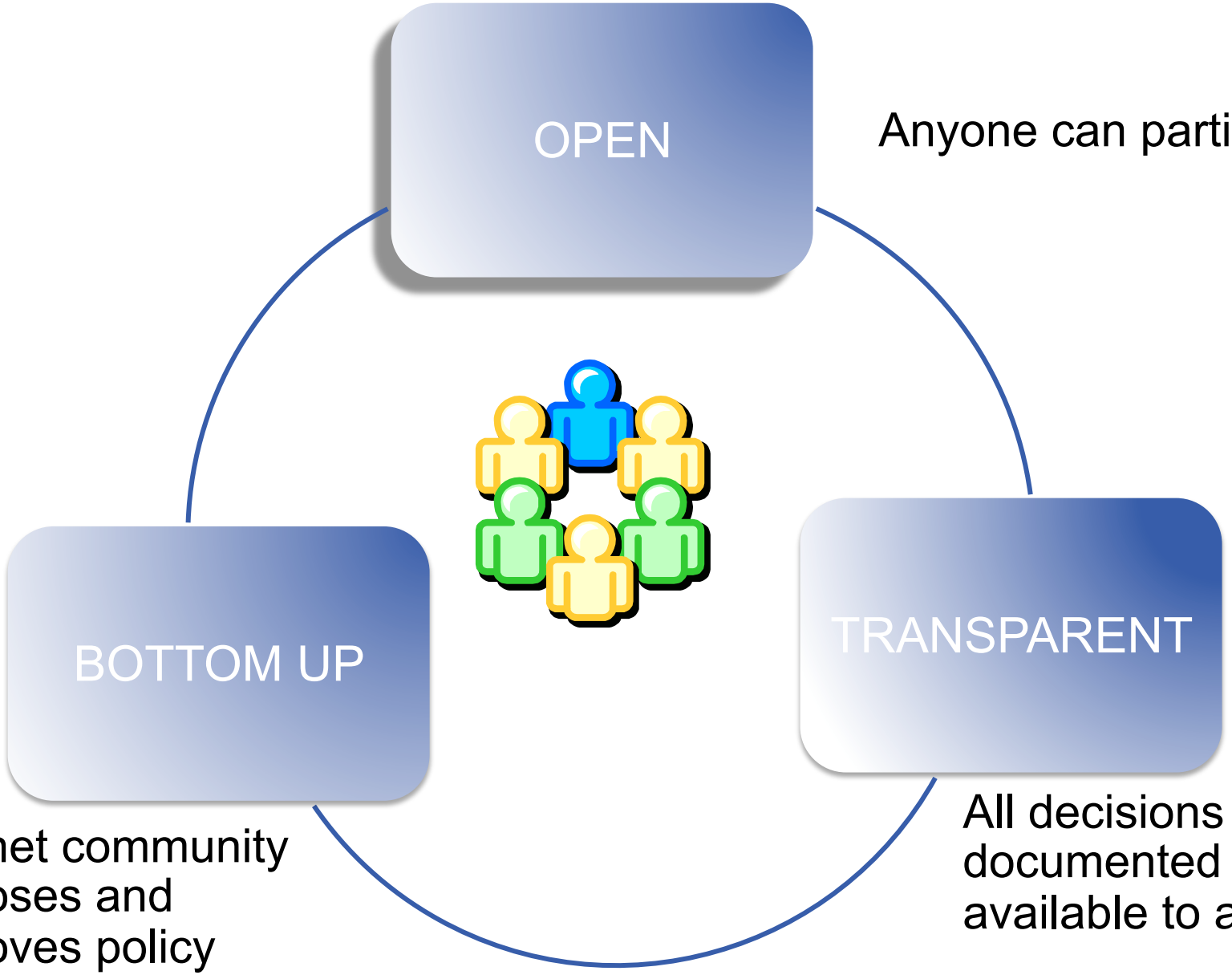
You are Part of the APNIC Community!

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



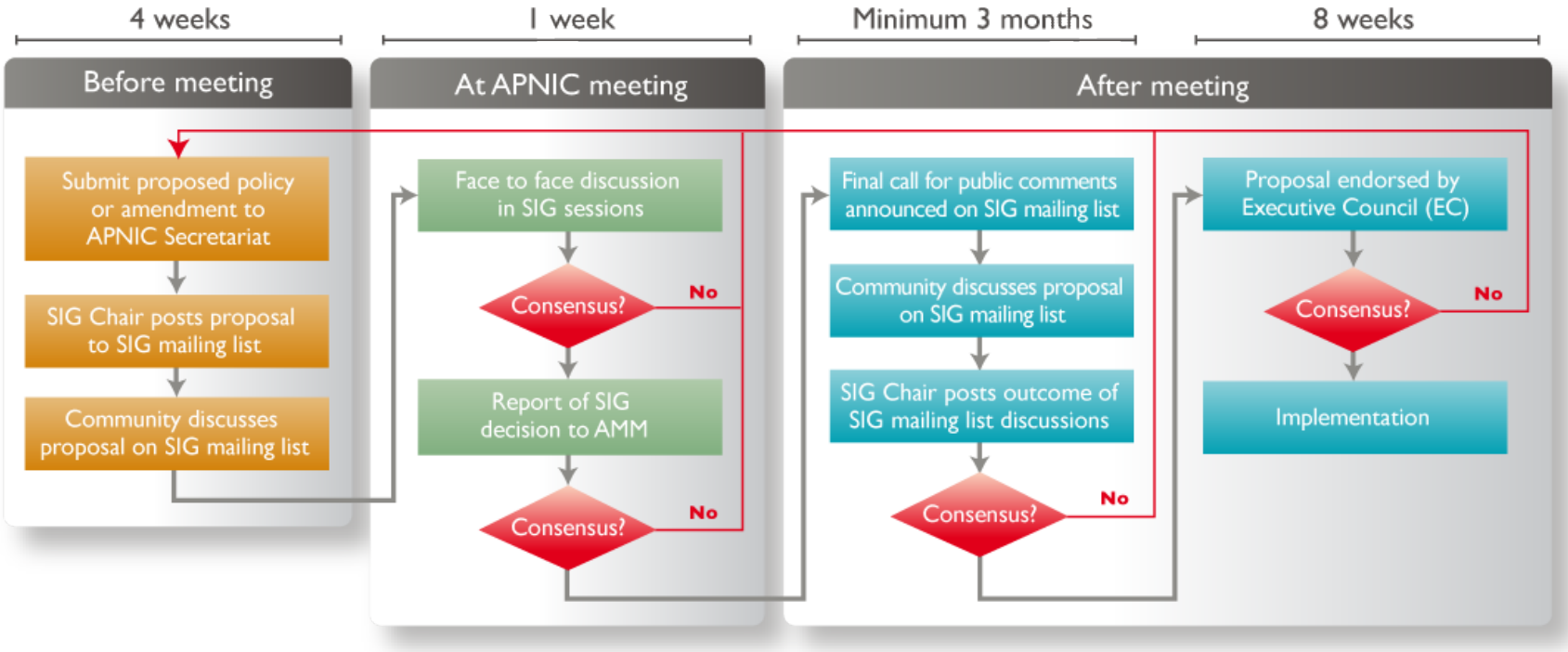
A voice in regional Internet operations through participation in APNIC

Policy Development Process



Policy Development Process

Need Discuss Consensus Implement



You can participate!

More information about policy development can be found at:

http://www.apnic.net/policy

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

How to Make Your Voice Heard

- Contribute on the public mailing lists
  - http://www.apnic.net/mailing-lists
  - Attend meetings
  - Send a representative
  - Watch webcast (video streaming) from the meeting 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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Resource Registration

- As part of your membership agreement with APNIC, all Members are required to register their resources in the APNIC database
- 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

**From 8 November 2010

New Members

If you are receiving your first allocation or assignment, APNIC will create the following objects for you:

- `role` object
- `inetnum` or inet6num object
- `maintainer` object (to protect your data)
- `aut-num` object (if you received an ASN)

Information is taken from your application for resources and membership

Person Object

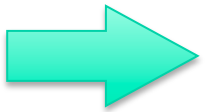
- Represents a contact person for an organization
  - Every Member must have at least one contact person registered
  - Large organizations often have several contacts for different purposes
- Is referenced in other objects
- Has a nic-hdl
  - Eg. EC17-AP

What Is A ‘nic-hdl’?

Unique identifier for a person or role

Represents a person or role object

- Referenced in objects for contact details
  - (inetnum, aut-num, domain…)
- format: <XXXX-AP>
  - Eg: EC196-AP



```
Person:  Eric Chu
address:     ExampleNet Service Provider
address:     Level 1 33 Park Road Milton
address:     Wallis and Futuna Islands
country:     WF
phone:       +680-368-0844
fax-no:      +680-367-1797
e-mail:      echu@example.com
nic-hdl:  EC196-AP
mnt-by:      MAINT-WF-EX
changed:     echu@example.com 20020731
source:      APNIC
```

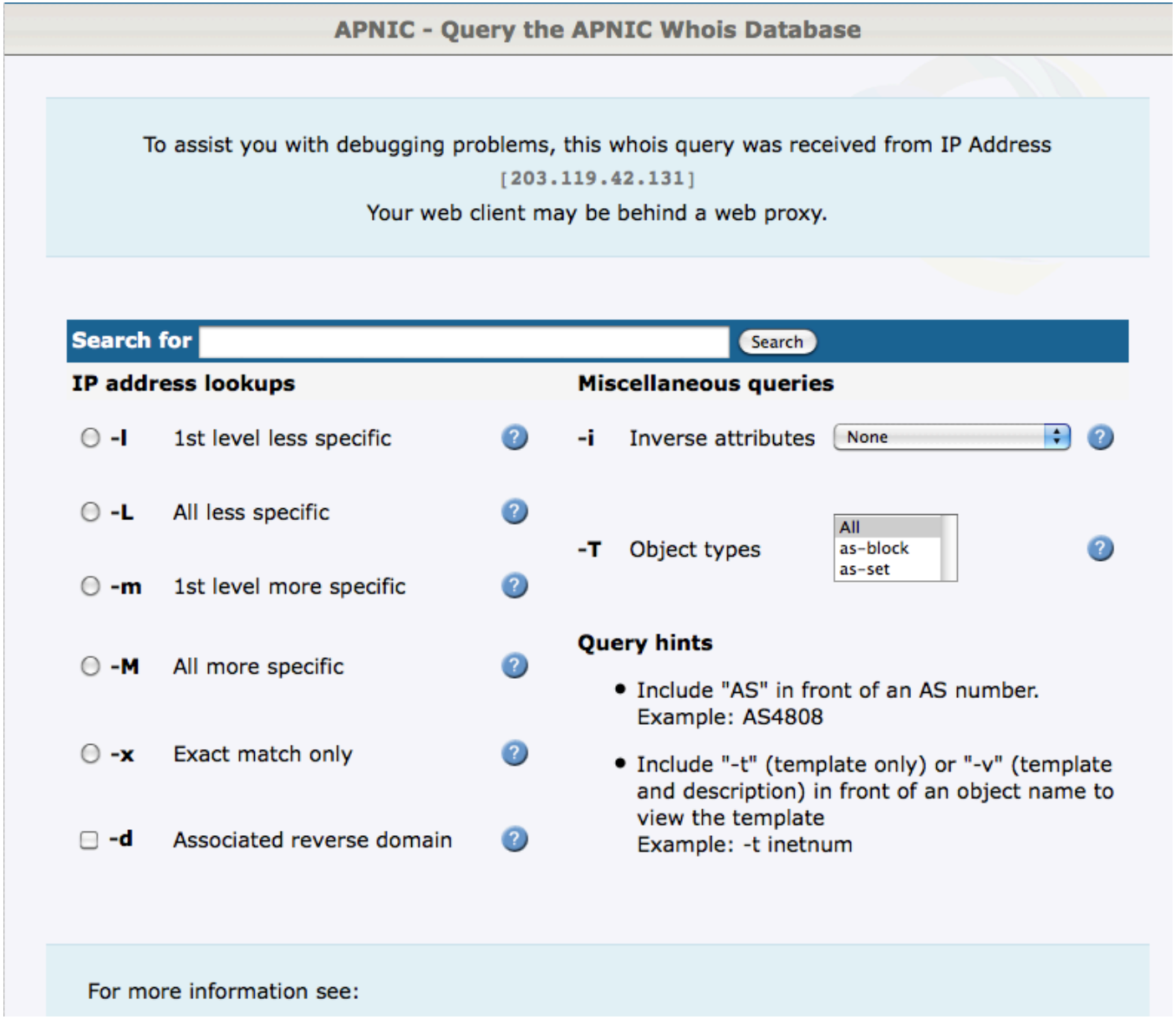
Mnt-by Attribute

- Can be used to protect any object
- Changes to protected object must satisfy authentication rules of ‘mntner’ object

Mnt-lower Attribute

- Also references mnt-by object
- Hierarchical authorization for inetnum & domain objects
- The creation of child objects must satisfy this maintainer
- Protects against unauthorized updates to an allocated range - highly recommended!

APNIC Whois Web Query



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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 trace routes etc

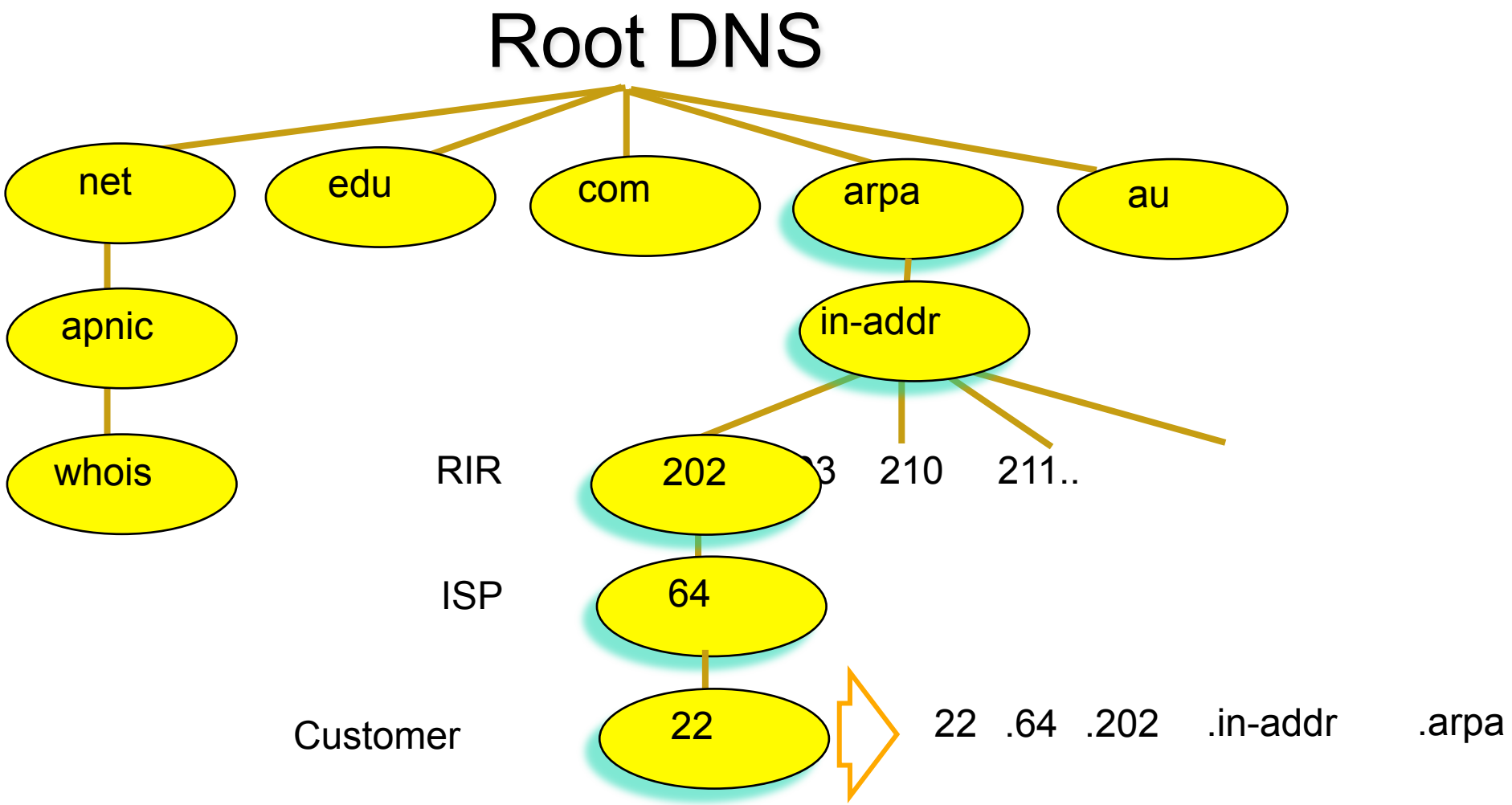
Spam identification

Registration

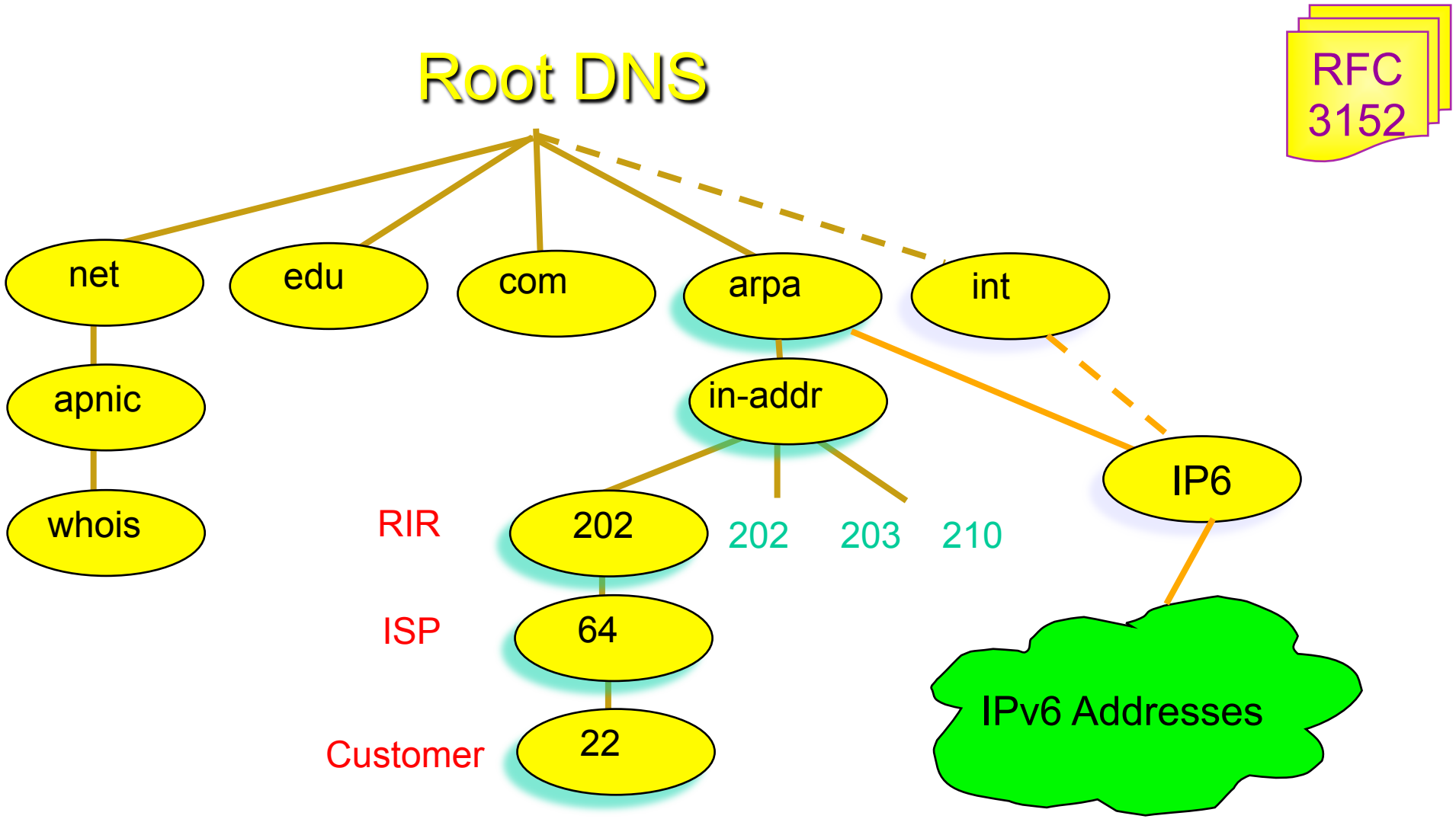
Responsibility as a member and Local IR

Principles – DNS tree

- Mapping numbers to names - 'reverse DNS'



Reverse DNS Tree – with IPv6



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

Creating reverse zones (continued)

- Files involved
  - Zone files
    - Forward zone file
      - e.g. db.domain.net
    - Reverse zone file
      - e.g. db.192.168.254
  - Config files
    - <named.conf>
  - Other
    - Hints files etc.
      - Root.hints

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.
```

or

```
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
- Recommend APNIC secondary zone

/24 Delegations

- Read “classless in-addr.arpa delegation”

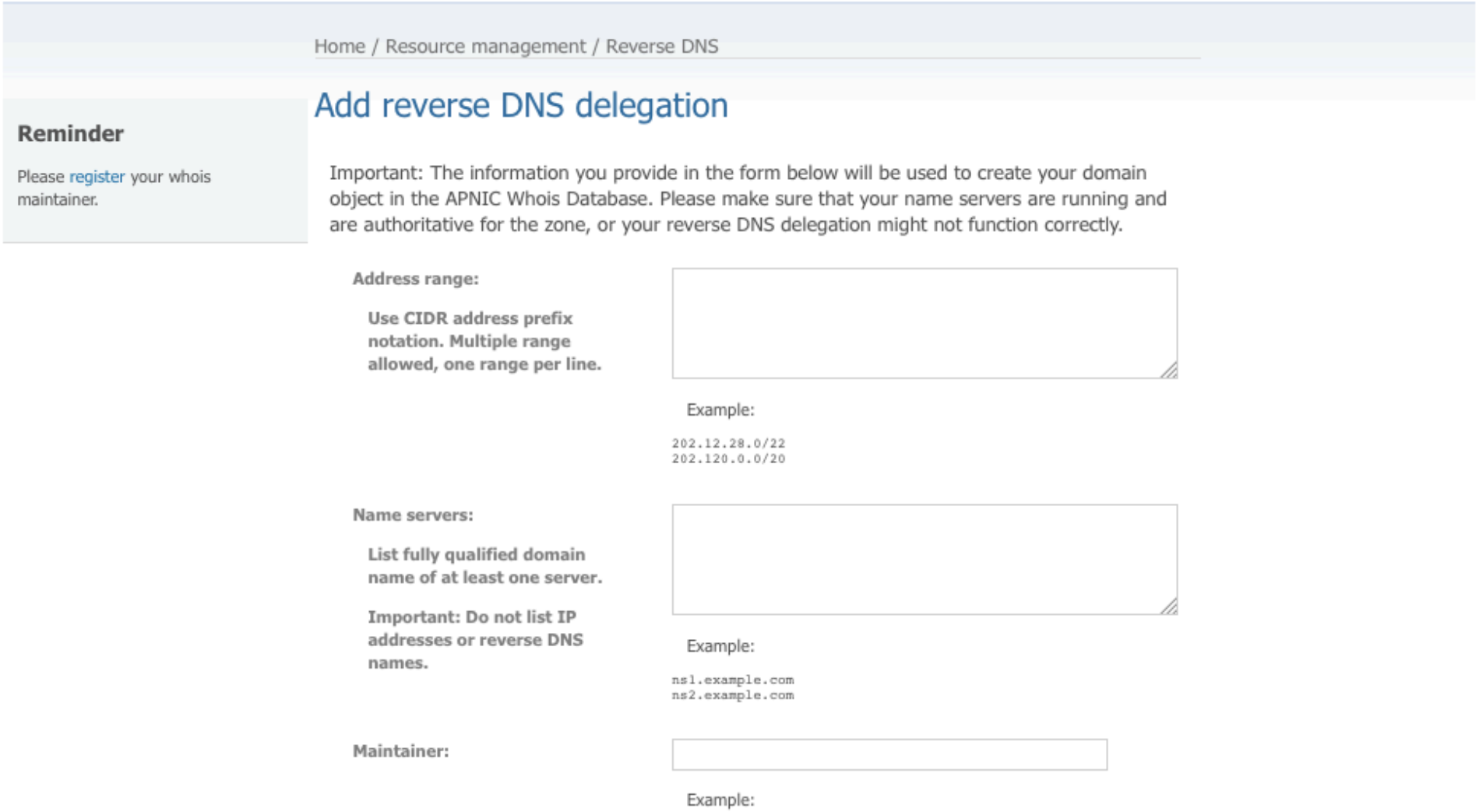
APNIC & ISPs responsibilities

- 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

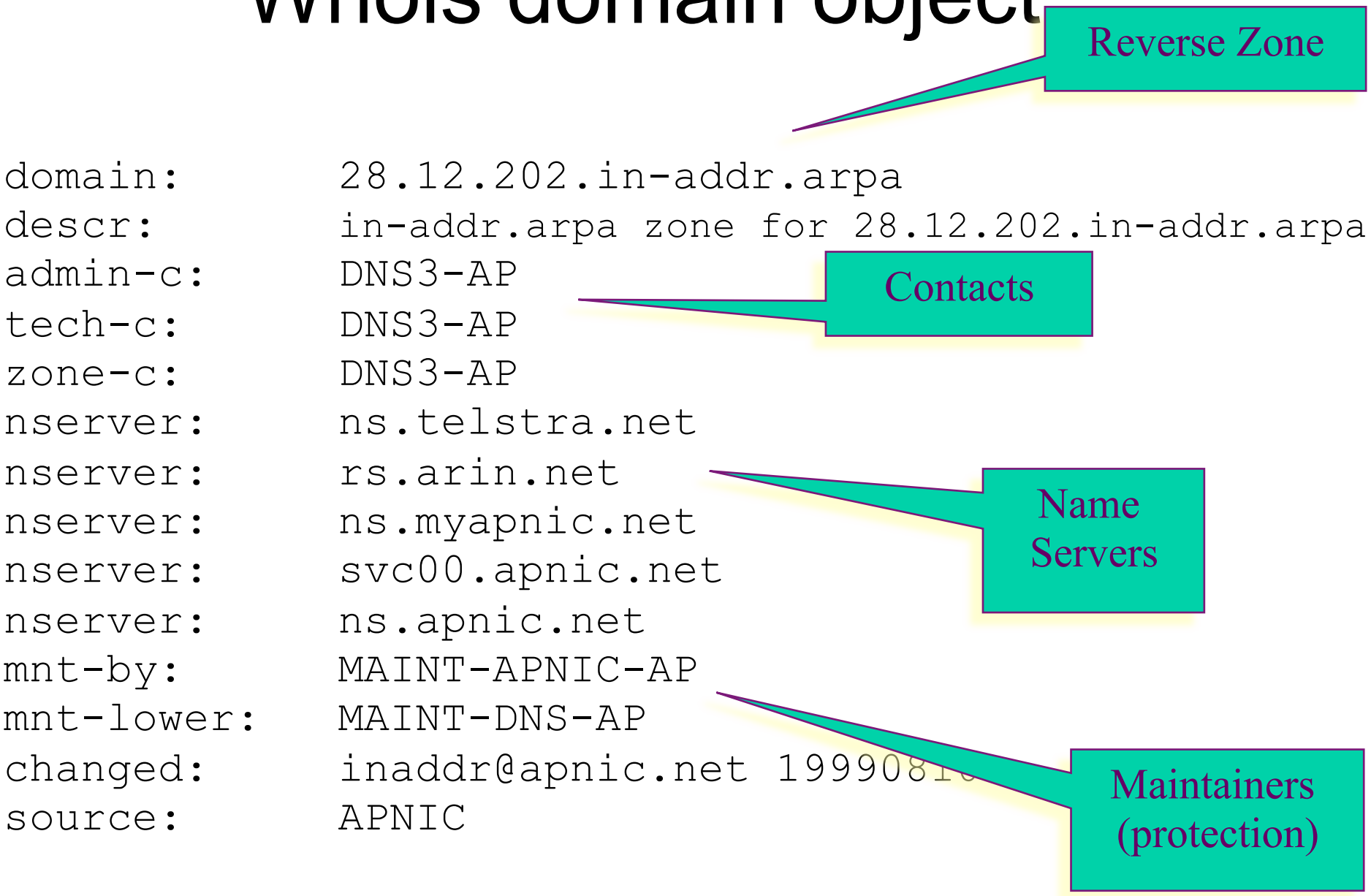
Reverse Delegation Procedures

- 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



Whois domain object



Example ‘domain’ object

domain:	124.54.202.in-addr.arpa
descr:	co-located server at mumbai
country:	PK
admin-c:	VT43-AP
tech-c:	IA15-AP
zone-c:	IA15-AP
nserver:	dns.isp.net.pk
nserver:	giasbm01.isp.net.pk
mnt-by:	MAINT-PK-isp
changed:	gps@isp.net.pk 20010612
source:	APNIC

Adding Domain Object to WHOIS

- Using My APNIC (Instant)
- Sending Domain object template to APNIC Helpdesk (1 working day)
- Name servers must be configured before submitting request

Delegation Procedures – request form

- Complete the documentation
  - ftp://ftp.apnic.net/apnic/docs/reverse-dns
- 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..

Evaluation

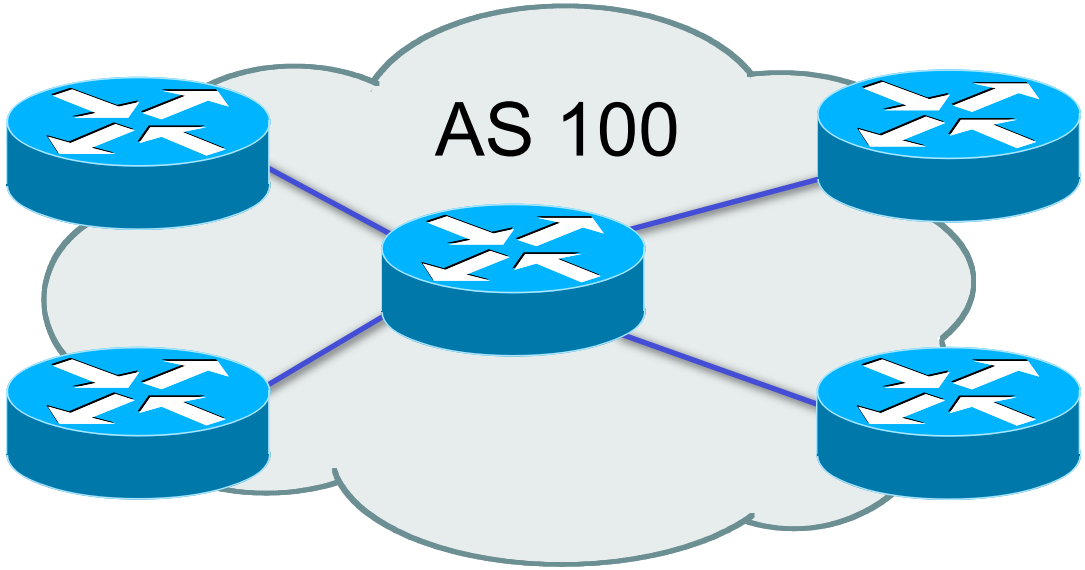
- Parser checks for
  - ‘whois’ database
    - IP address range is assigned or allocated
    - Must be in APNIC database
  - Maintainer object
    - Mandatory field of domain object
  - Nic-handles
    - zone-c, tech-c, admin-c

Questions?

Overview

- IRM
  - Introduction to APNIC
  - Internet registry policies
  - APNIC policy development process
  - APNIC whois database
  - Reverse DNS Delegation
  - **Autonomous System (AS) Number**
  - APNIC helpdesk

What is an Autonomous System?



Collection of networks with same routing policy

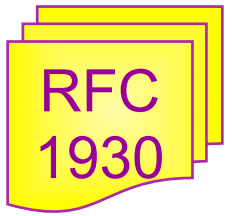
Usually under single ownership, trust or administrative control

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

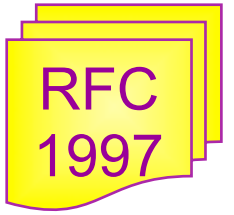
RFC1930: Guidelines for creation, selection and registration of an Autonomous System



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 AS Number

1. Requested from APNIC for own network infrastructure
   - AS number is “portable”
2. Requested from APNIC for member customer network
   - 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

Requesting an ASN

Complete the request form

Existing member:

Will send request from MyAPNIC

New Member:

Can send AS request along with membership application

Questions?

Overview

- IRM
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  - APNIC policy development process
  - APNIC whois database
  - Reverse DNS Delegation
  - Autonomous System (AS) Number
  - **APNIC helpdesk**

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

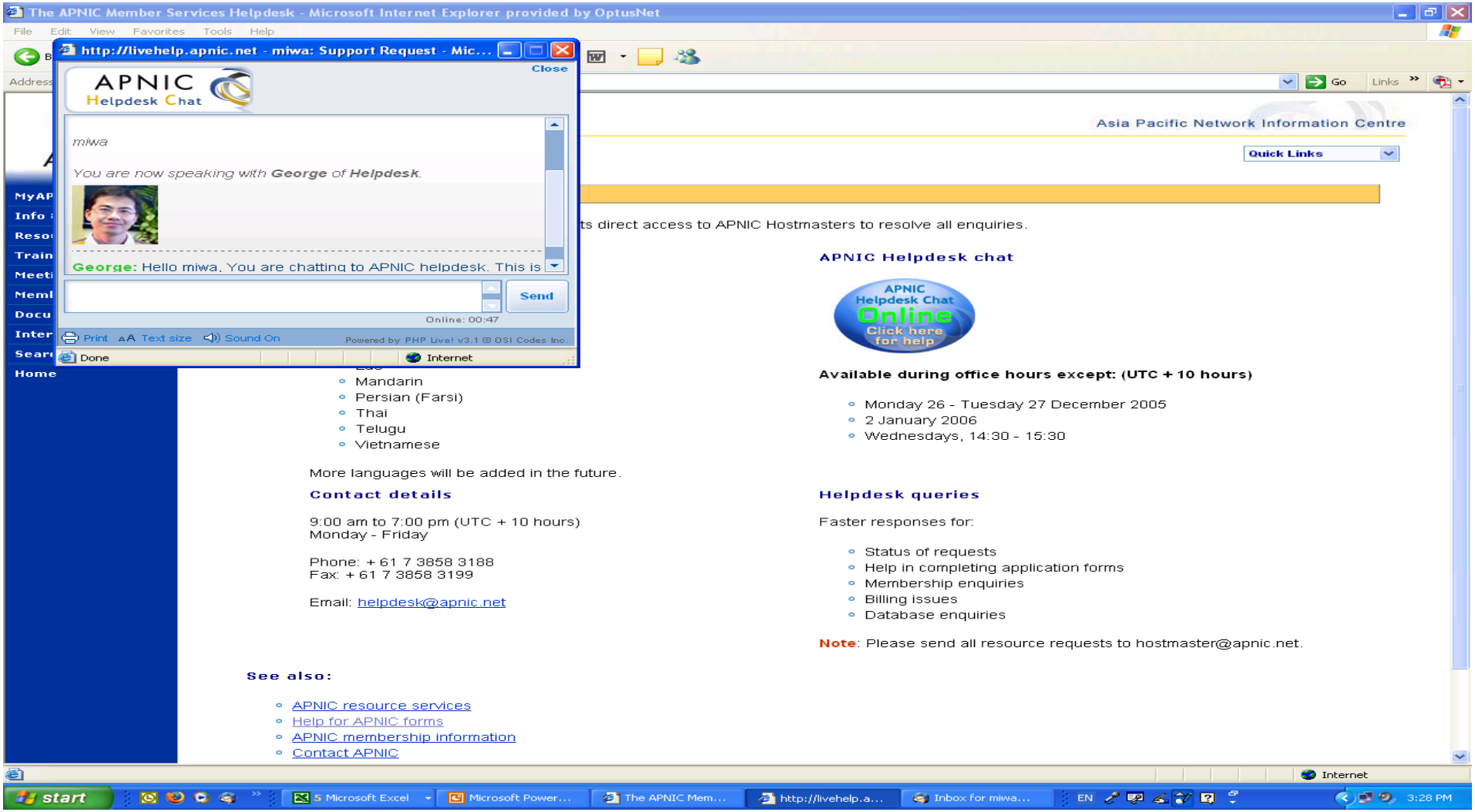
Range of languages:

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

APNIC Helpdesk chat



APNIC Website

Questions?

THANK YOU!