Asia Pacific Network Information Centre

APNIC

# APNIC Training

## Internet Resource Management

17 November 2009 – Nadi, Fiji

**Sixth PacNOG Meeting, Conference and Educational Workshop**

In conjunction with PITA

# Introduction

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# Assumptions & Objectives

## Assumptions

- Are current or prospective APNIC members
- Have not submitted many requests
- Are not familiar or up-to-date with address policies
- Are not familiar with procedures
- Are interested in address management

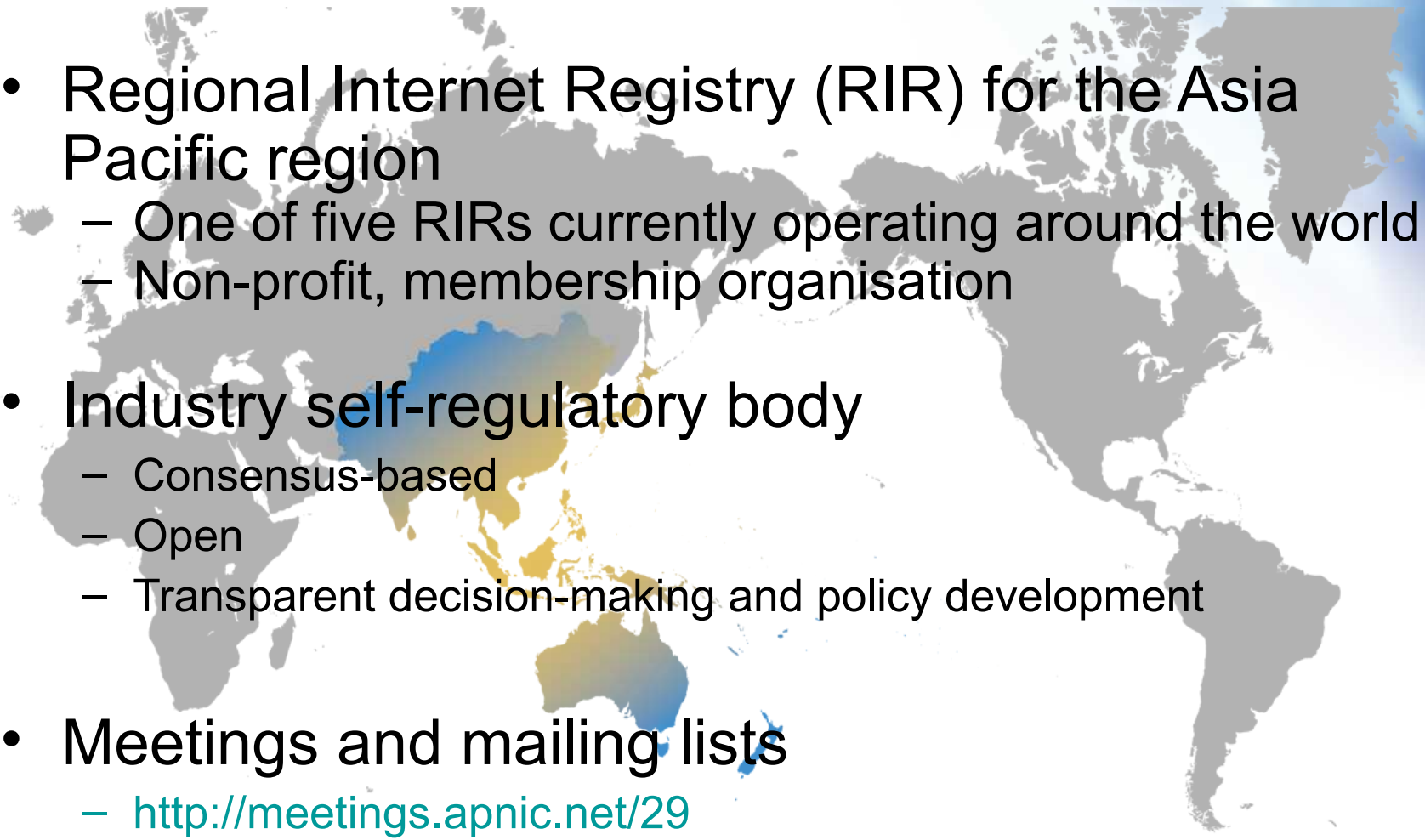
## Objectives

- To provide an understanding of address management
- To provide a working knowledge of the procedures for requesting resources from APNIC and managing these
- To keep membership up-to-date with the latest policies
- Liaise with members.

# Overview

- IRMe
  - **Introduction to APNIC**
  - APNIC policy development process
  - Internet registry policies
  - IP address request (Demo)
  - Second opinion request
  - IPv6 Overview
  - APNIC whois database
  - MyAPNIC (Demo)
  - Autonomous System Numbers
  - Reverse DNS
  - APNIC Helpdesk

# 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
  - Consensus-based
  - Open
  - Transparent decision-making and policy development
- Meetings and mailing lists
  - http://meetings.apnic.net/29
  - http://www.apnic.net/community/participate/join-discussions/sigs

# 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/lists/

## Training

- Face to Face
- Via e-learning

- Subsidised for members

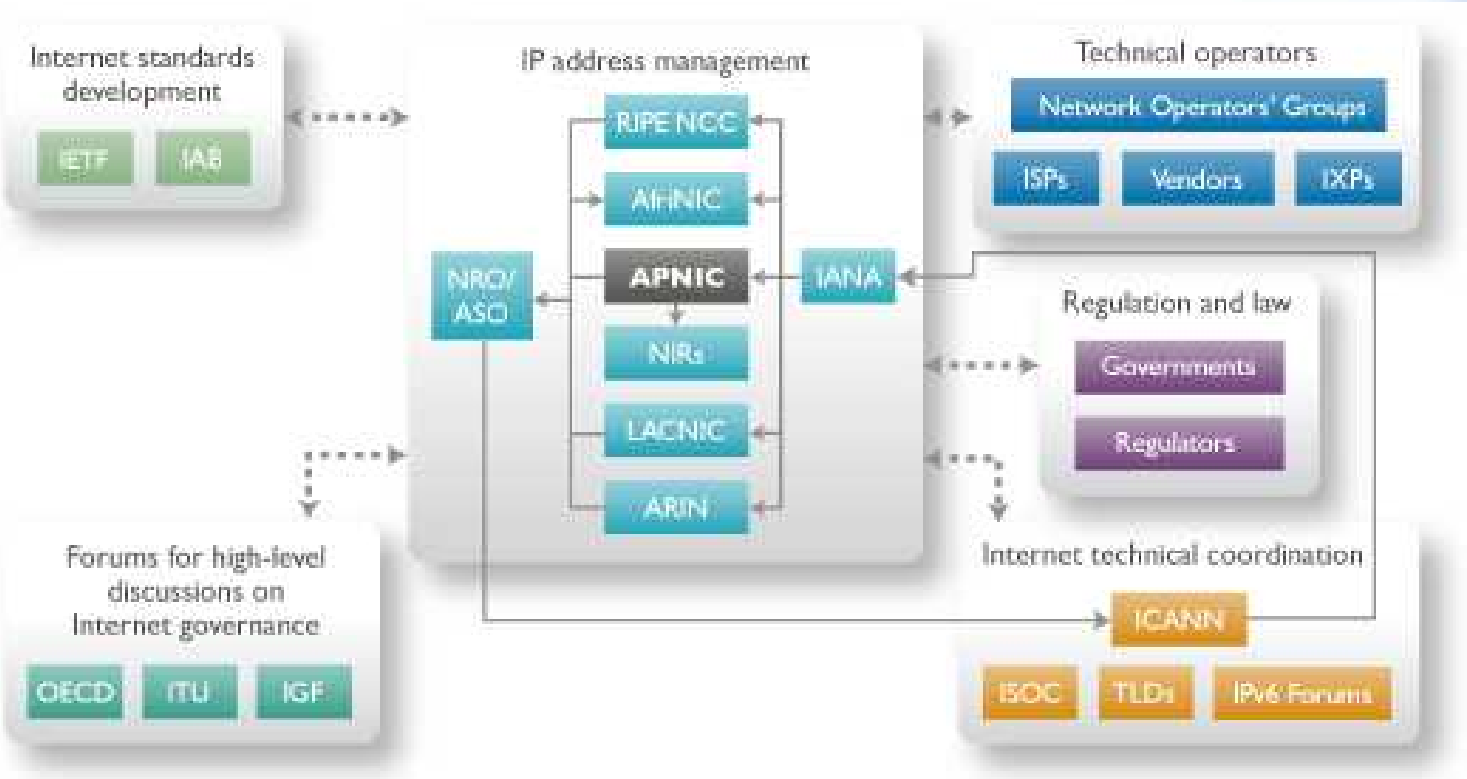
Schedule:
http://www.apnic.net/training

# Where is the APNIC region?

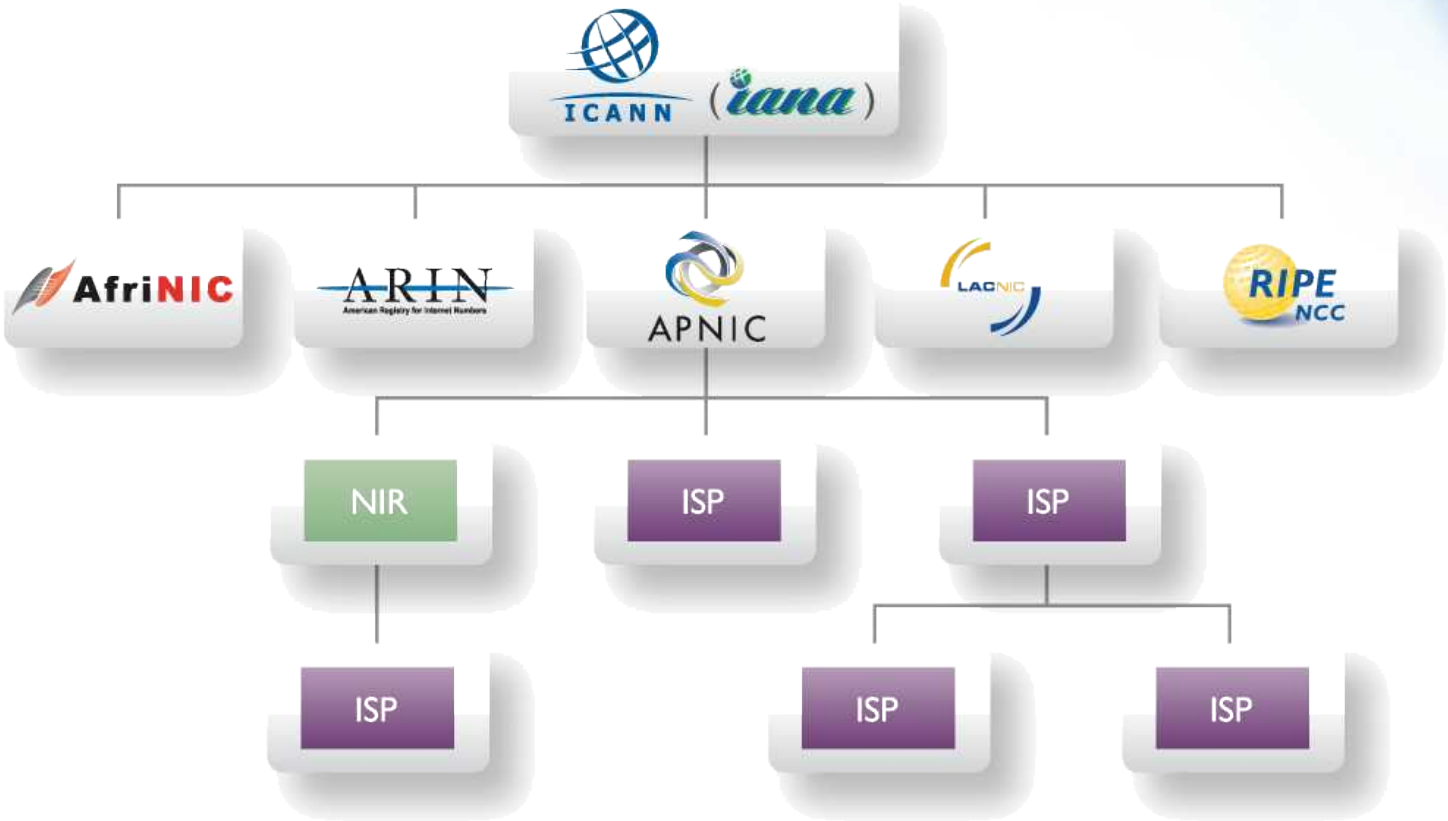
# APNIC is NOT

- 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

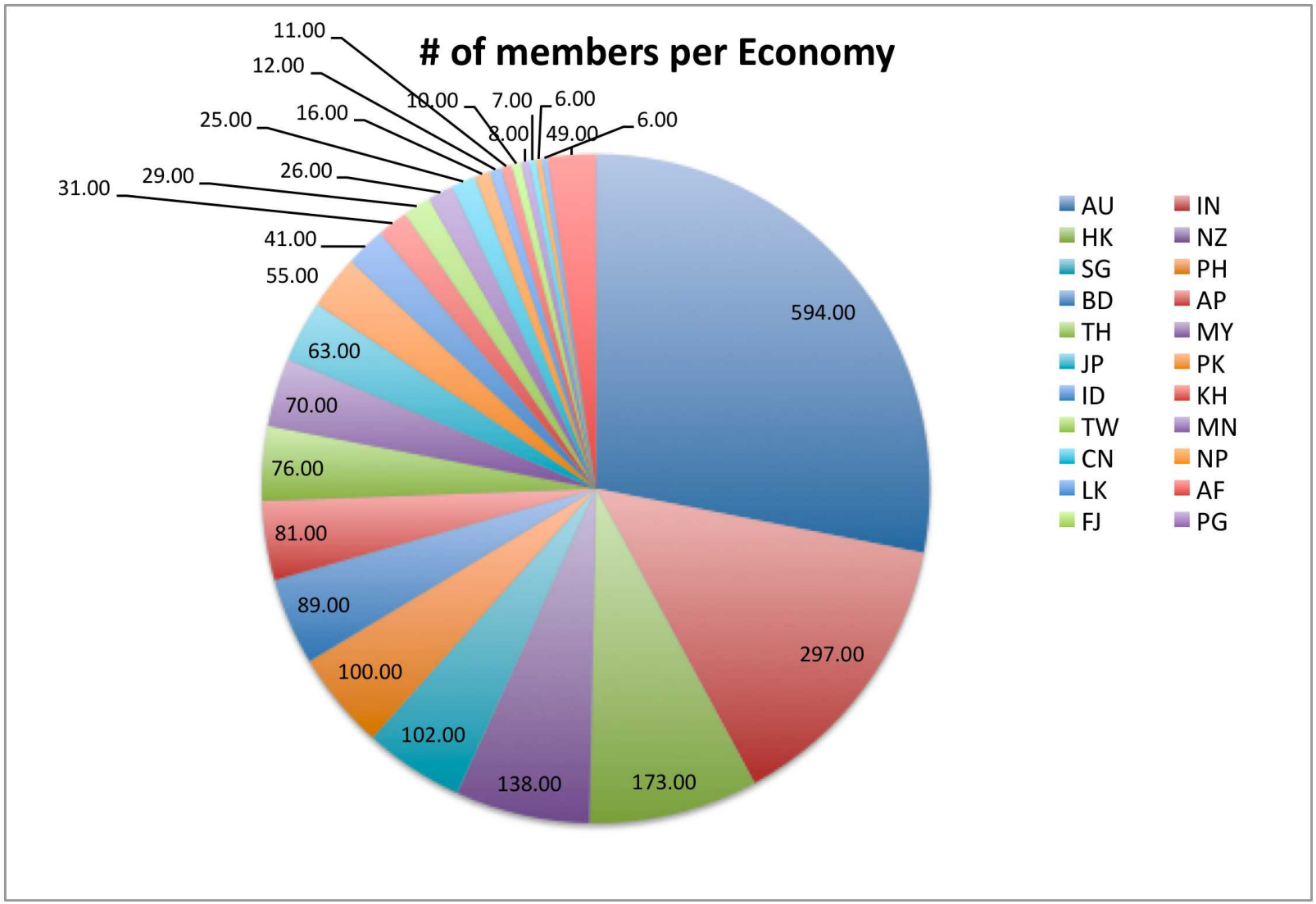
# APNIC from a Global Perspective



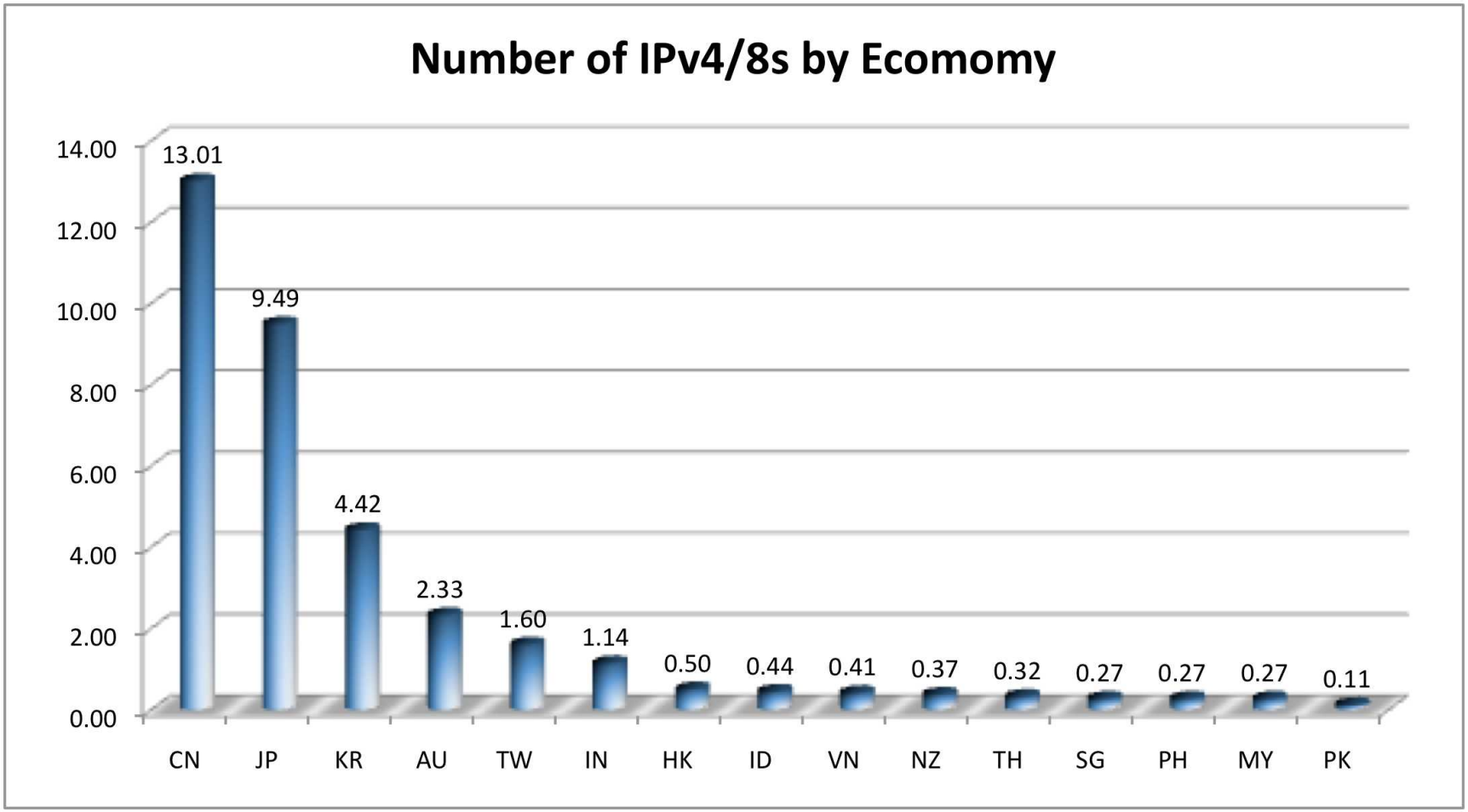
# Internet Registry Structure



# APNIC membership



# APNIC IPv4 allocations by economy




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

# 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

# Questions?

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  - MyAPNIC (Demo)
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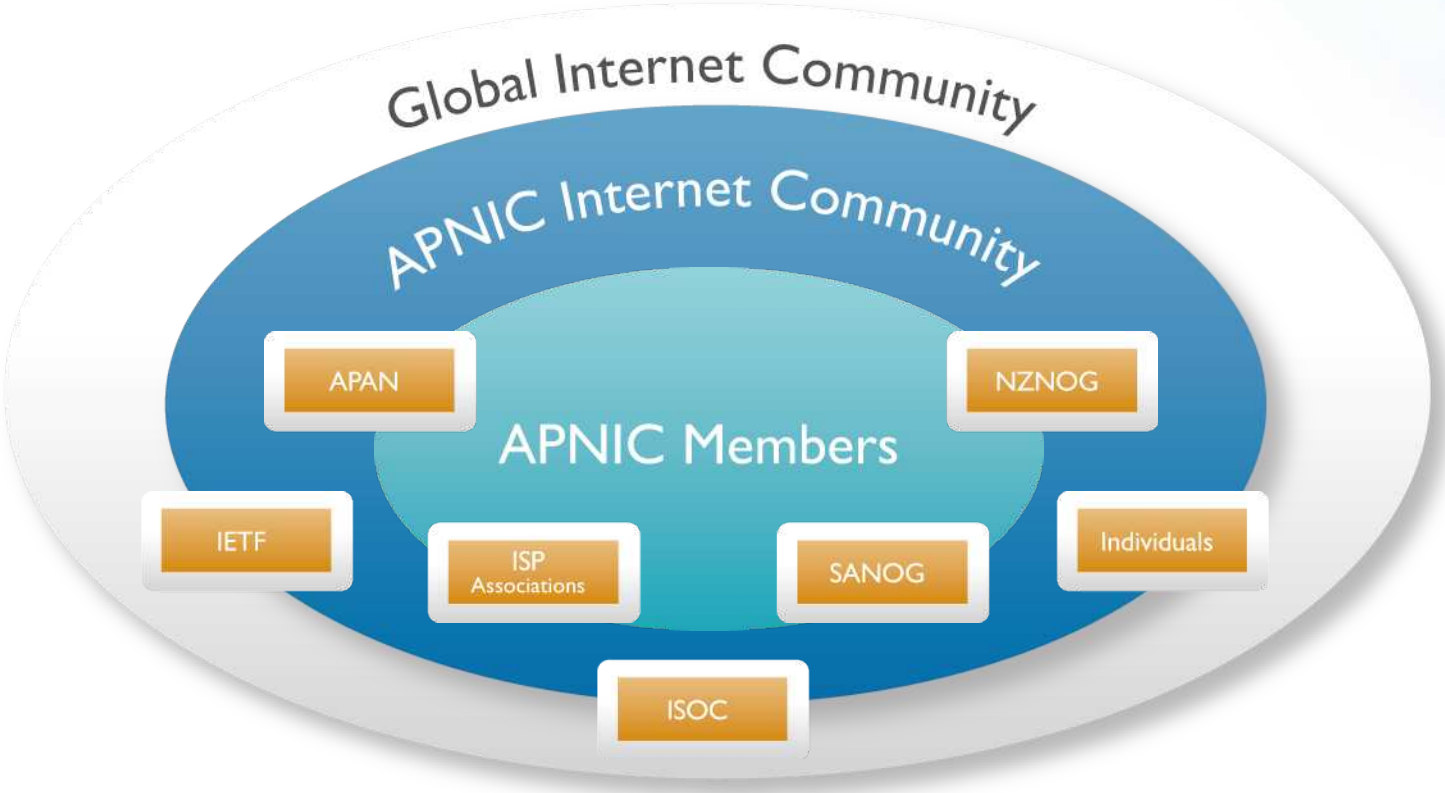
  - Reverse DNS
  - APNIC Helpdesk

# You are part of the APNIC Community!

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

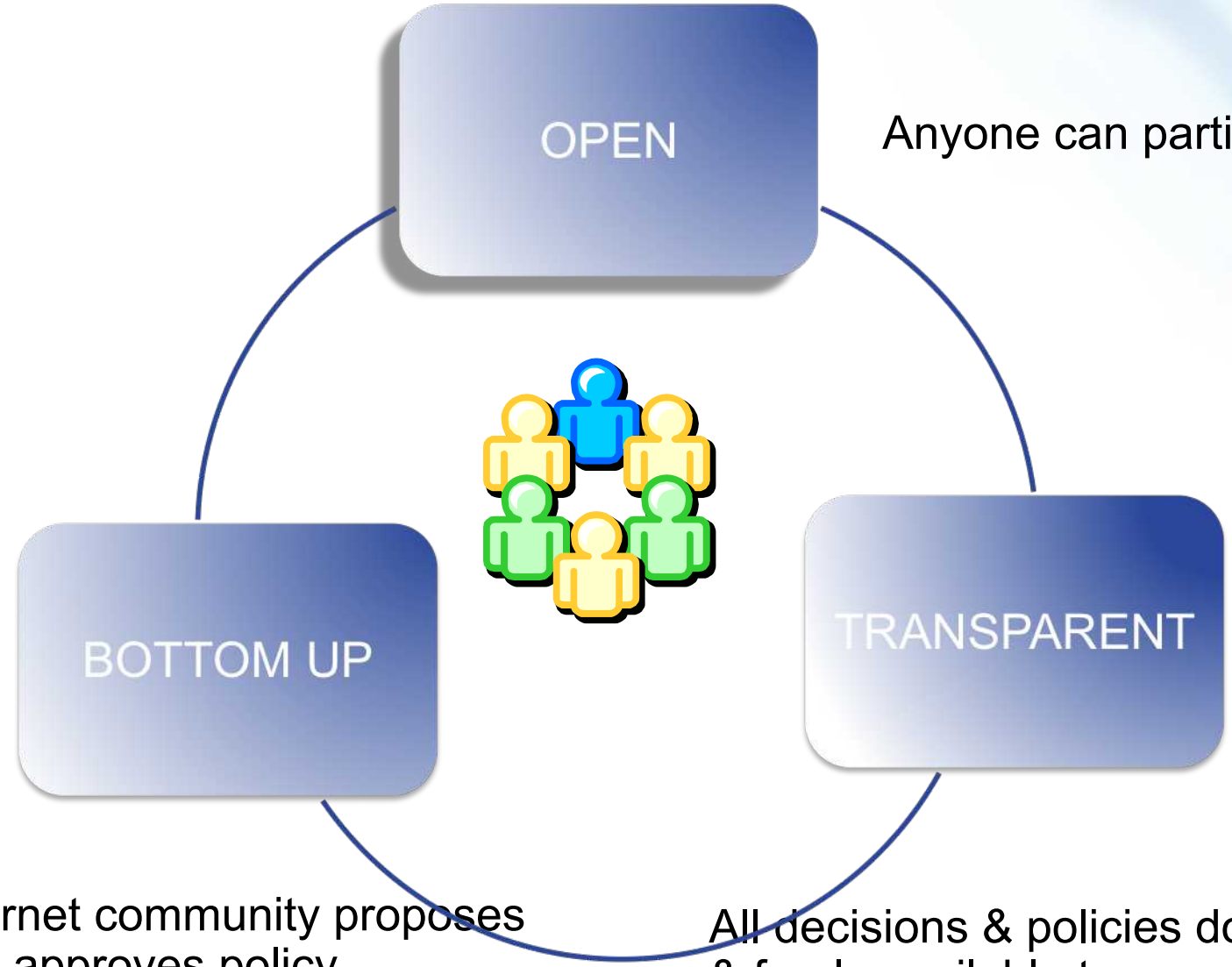



- A voice in regional Internet operations through participation in APNIC

# Participation in policy development

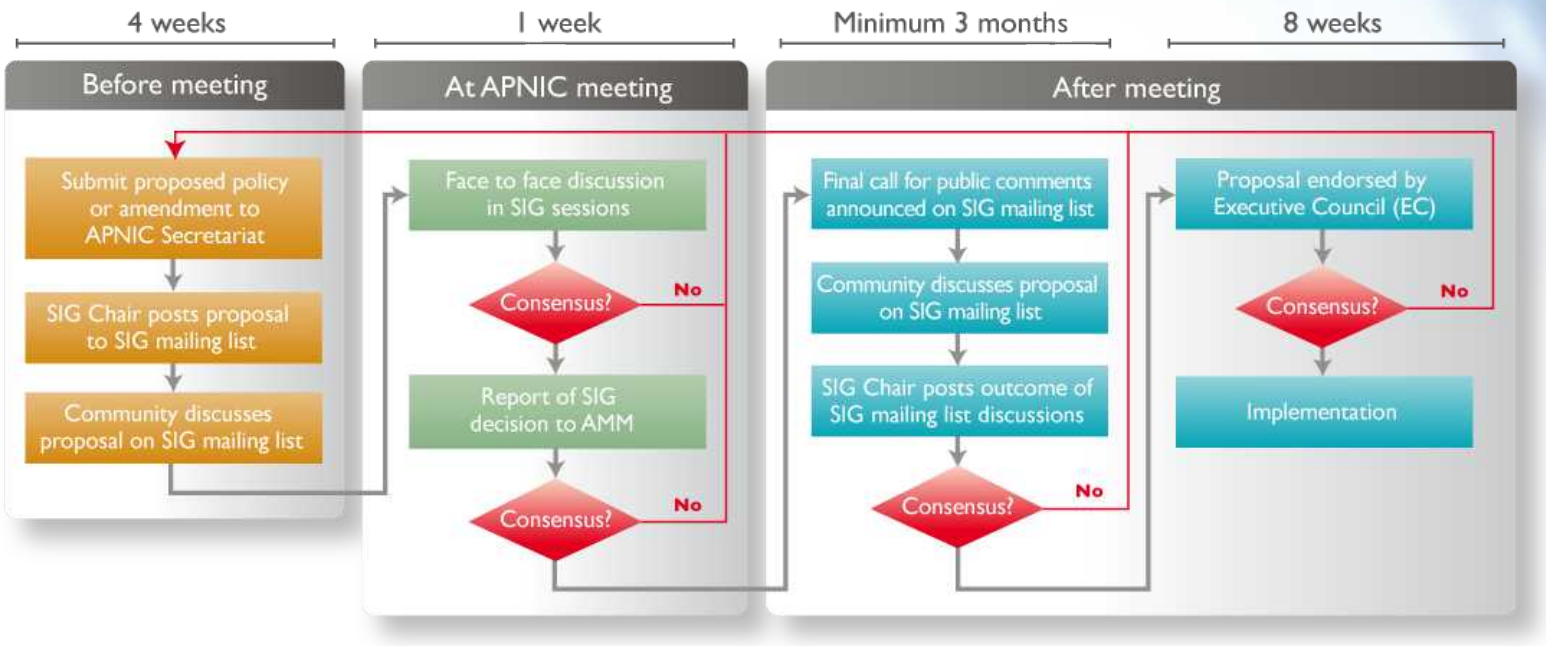
- Why should I bother?
  - Responsibility as an APNIC member
    - To be aware of the current policies for managing address space allocated to you
  - Business reasons
    - Policies affect your business operating environment and are constantly changing
    - Ensure your ‘needs’ are met
  - Educational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

# Policy Development Process



# The Policy Development Process

## Need Discuss Consensus Implement




## You can participate!

More information about policy development can be found at:

http://www.apnic.net/community/policy

# How to Make Your Voice Heard

- Contribute on the public mailing lists
  - http://www.apnic.net/community/participate/join-discussi
  - Attend meetings
  - Or 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

# Questions?

# Overview

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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

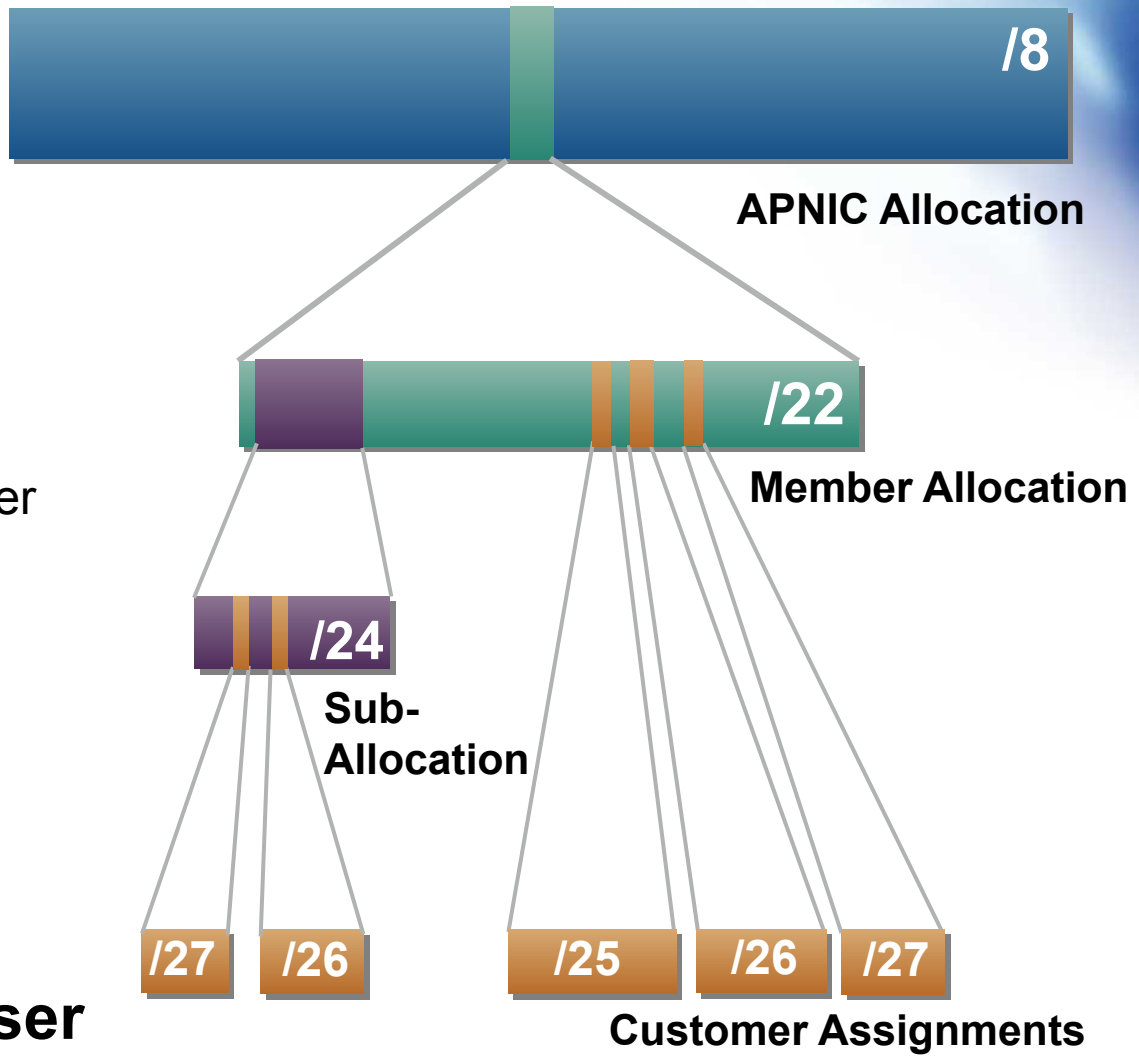
**APNIC Member**

*Allocates*
to downstream

*Assigns*
to end-user

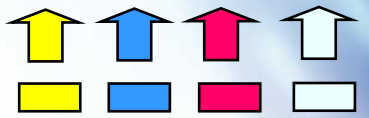
**Downstream**
*Assigns*
to end-user

**Customer / End User**



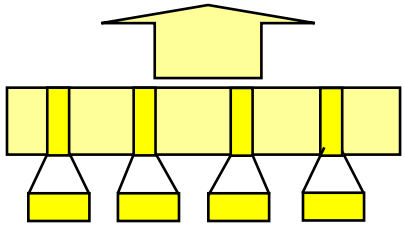
# Portable & non-portable

## 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

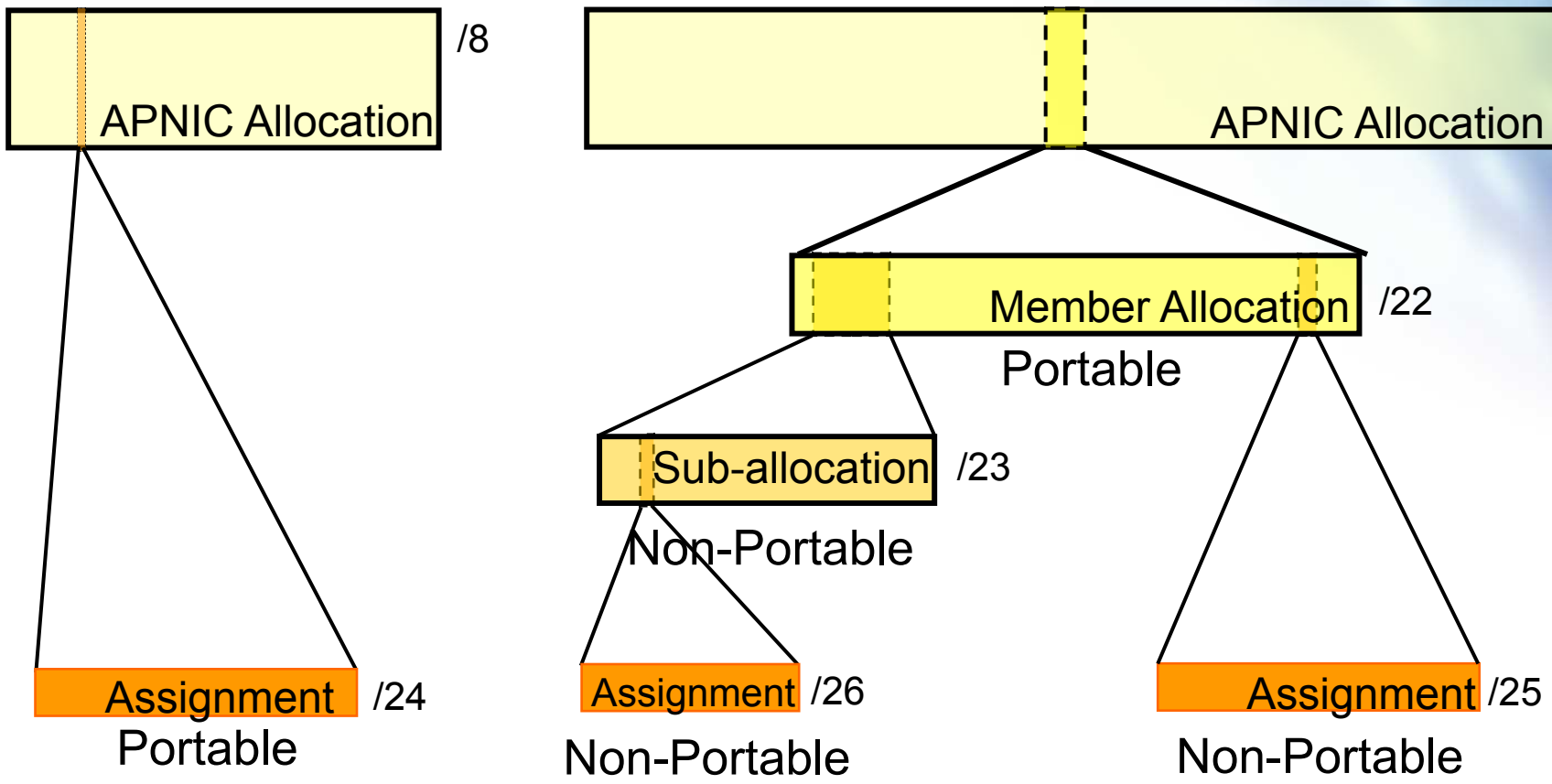


- Customer uses ISP's address space
  - Must renumber if changing ISP
- Only way to effectively scale the Internet

## Portable allocations

- Allocations made by APNIC/NIRs

# Address Management Hierarchy




- Describes “portability” of the address space

# Internet Resource Management Objectives

## Conservation

- Efficient use of resources
- Based on demonstrated need

## Aggregation

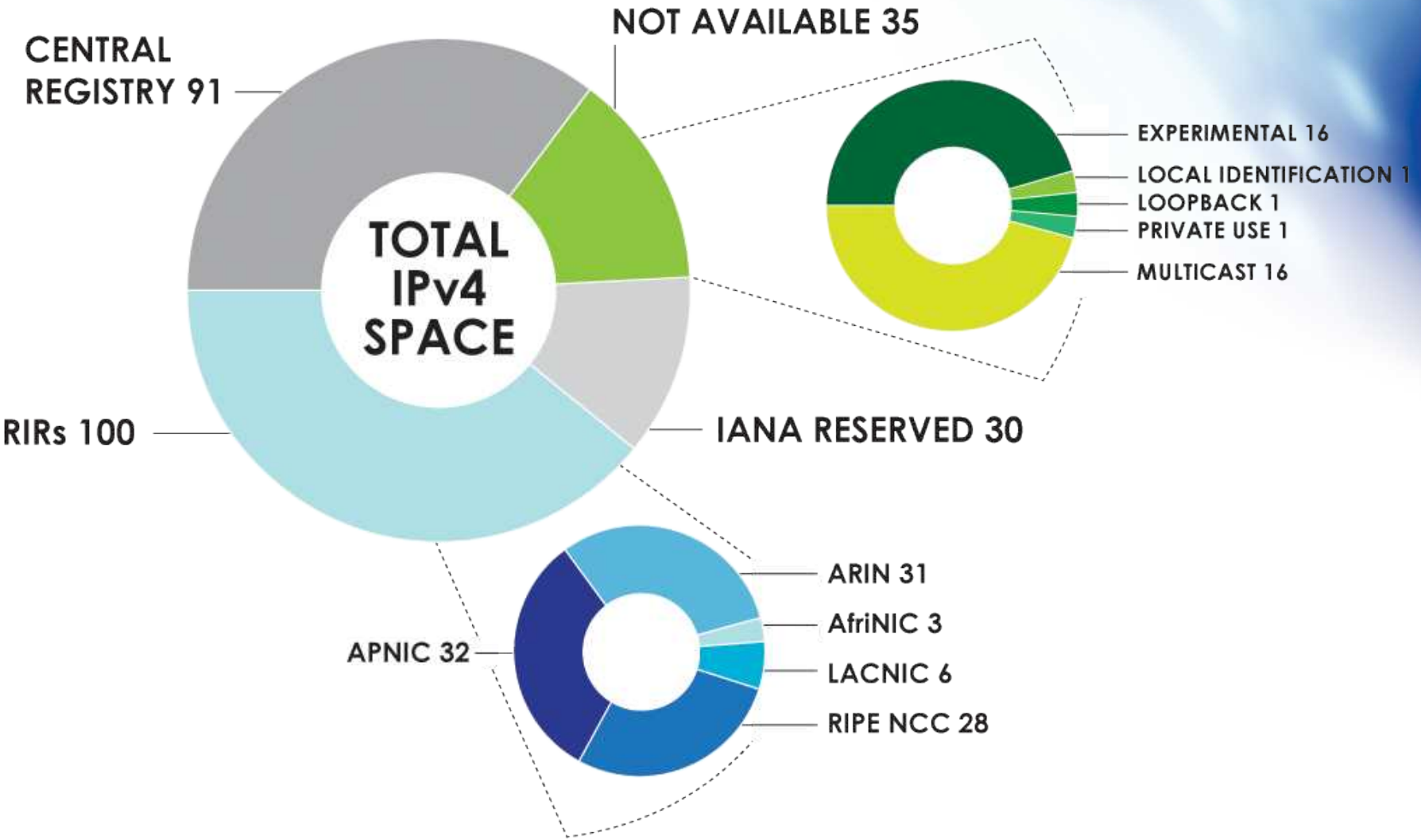
- Limit routing table growth
- Support provider-based routing

## Registration

- Ensure uniqueness
- Facilitate trouble shooting

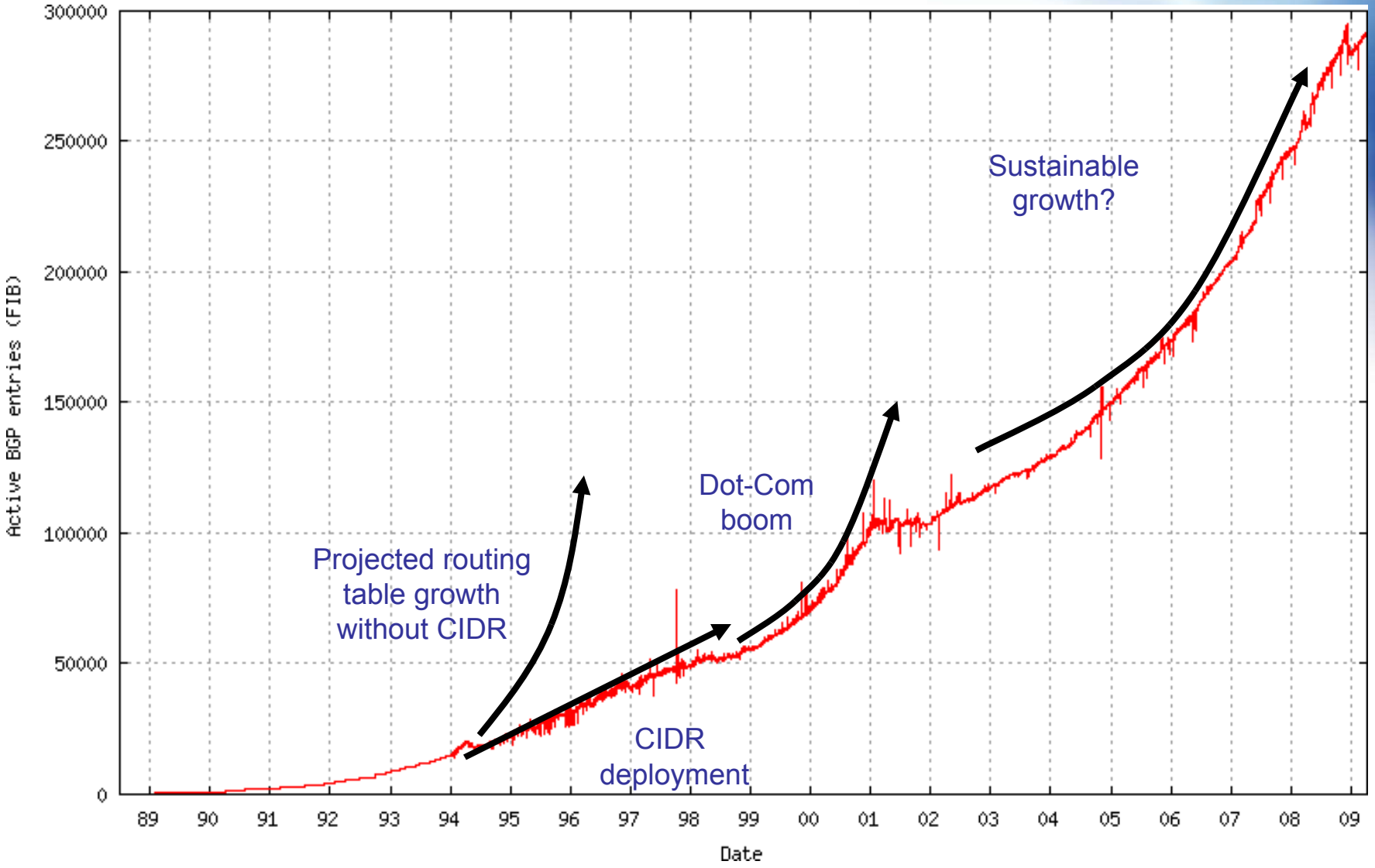
Uniqueness, fairness and consistency

# Why do we Need Policies?
# - Global IPv4 Delegations (in /8)




Source : Internet Number Resource Report - Number Resource Organization (NRO)

# 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*"

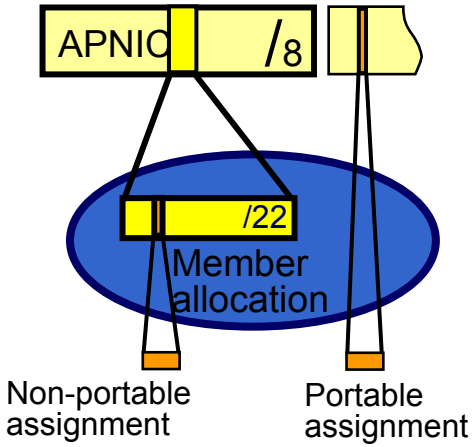
- APNIC to observe and protect trust relationship
  - Non-disclosure agreement signed by staff

# 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
  - Address space to be obtained from one source
    - routing considerations may apply
  - Stockpiling not permitted

# Initial IPv4 Allocation

- APNIC minimum IPv4 allocation size /22
  - Two of the criteria for an initial allocation have been updated to show:
    - An ISP must have used a /24 from their upstream provider or demonstrate an immediate need for a /24
    - An ISP must demonstrate a detailed plan for use of a /23 within a 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

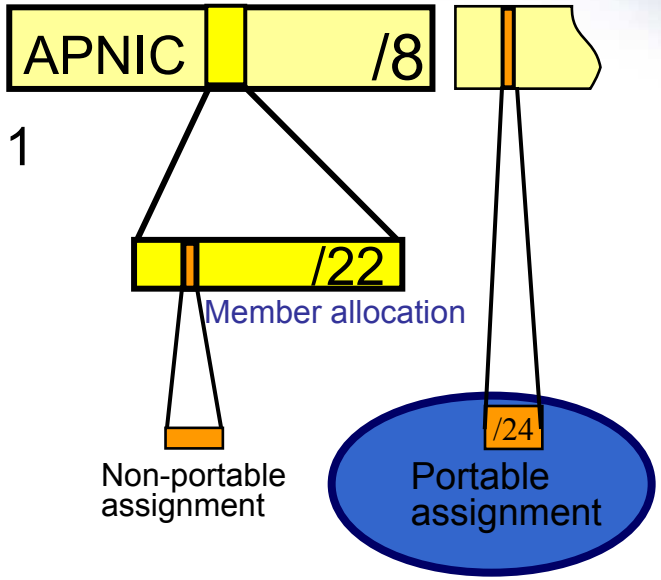
1a. Applicants currently multihomed

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*



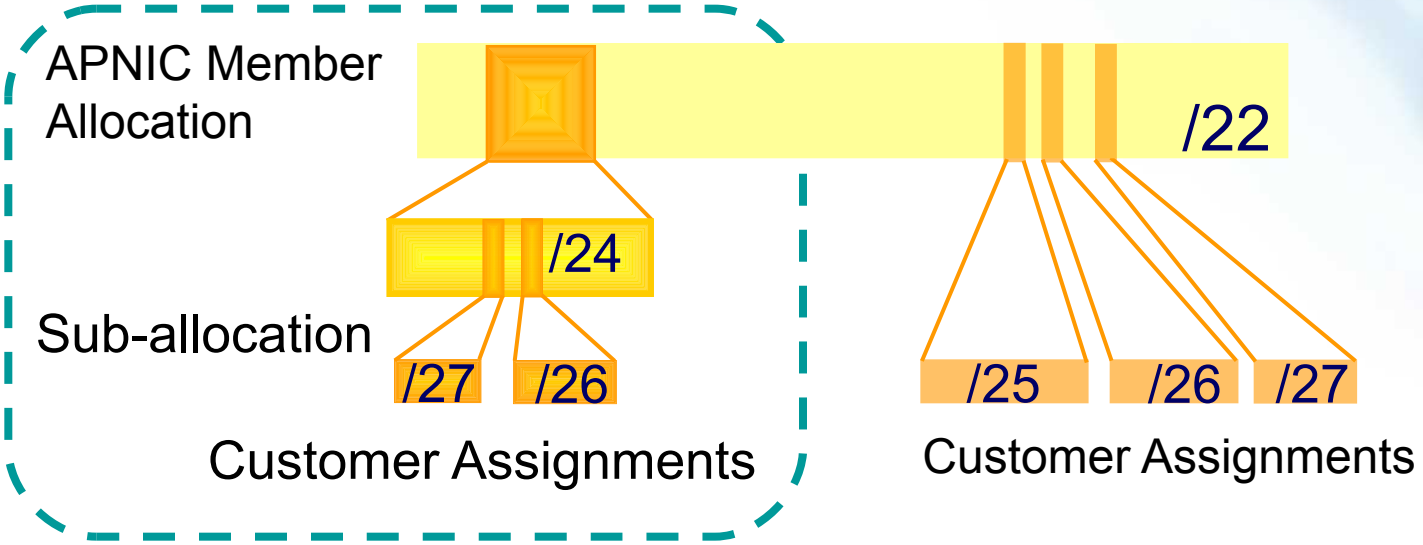
# Policy for IXP Assignments

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

# 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

# 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

# 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

# Supporting Historical Resource Transfer

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

# Questions?

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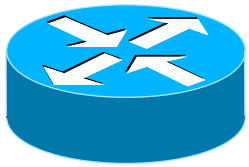
# Address Plan Example

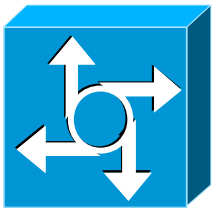
# Addressing Plan

- 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 )

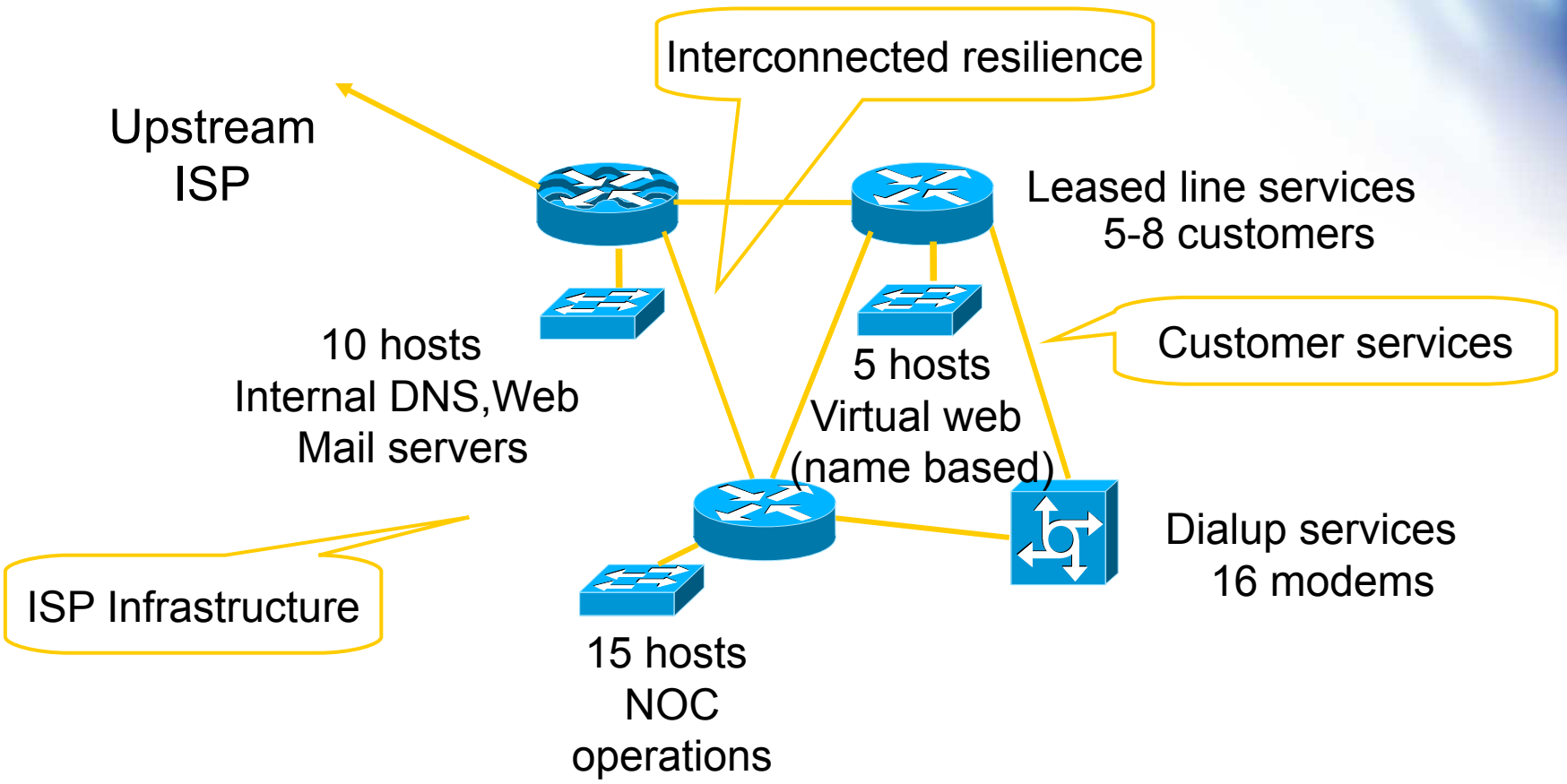
Ethernet switch
(layer 2, packet forwarding)

# Addressing Plan

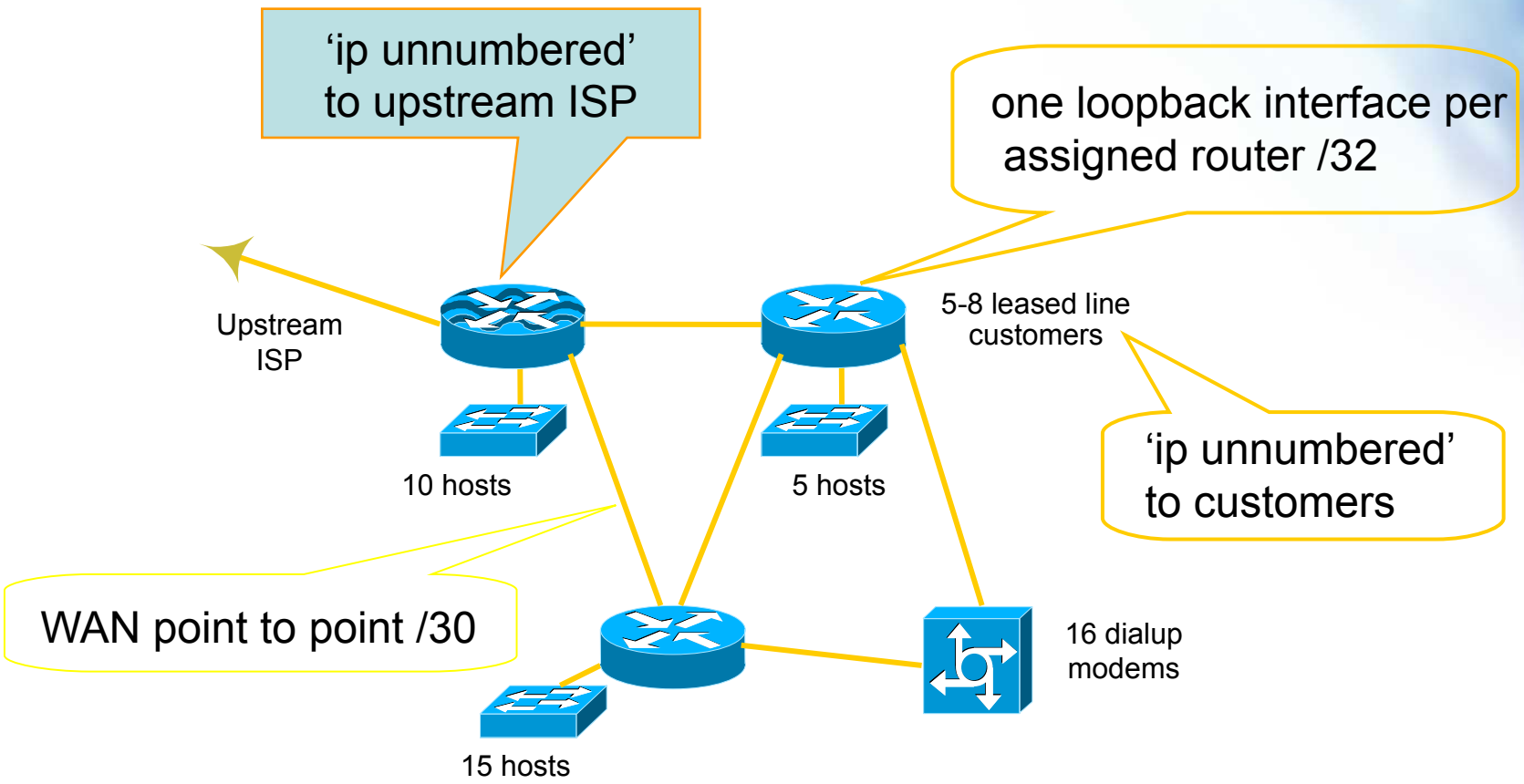
- Identify components of network
  - Customer services
  - ISP internal infrastructure
- Identify phases of deployment
  - Starting off, 6 months, 12 months
- Identify equipment and topology changes
  - Need for redundancy
  - Need for increased scale

# Network Plan

- Starting off



# Network Plan



# Addressing Plan

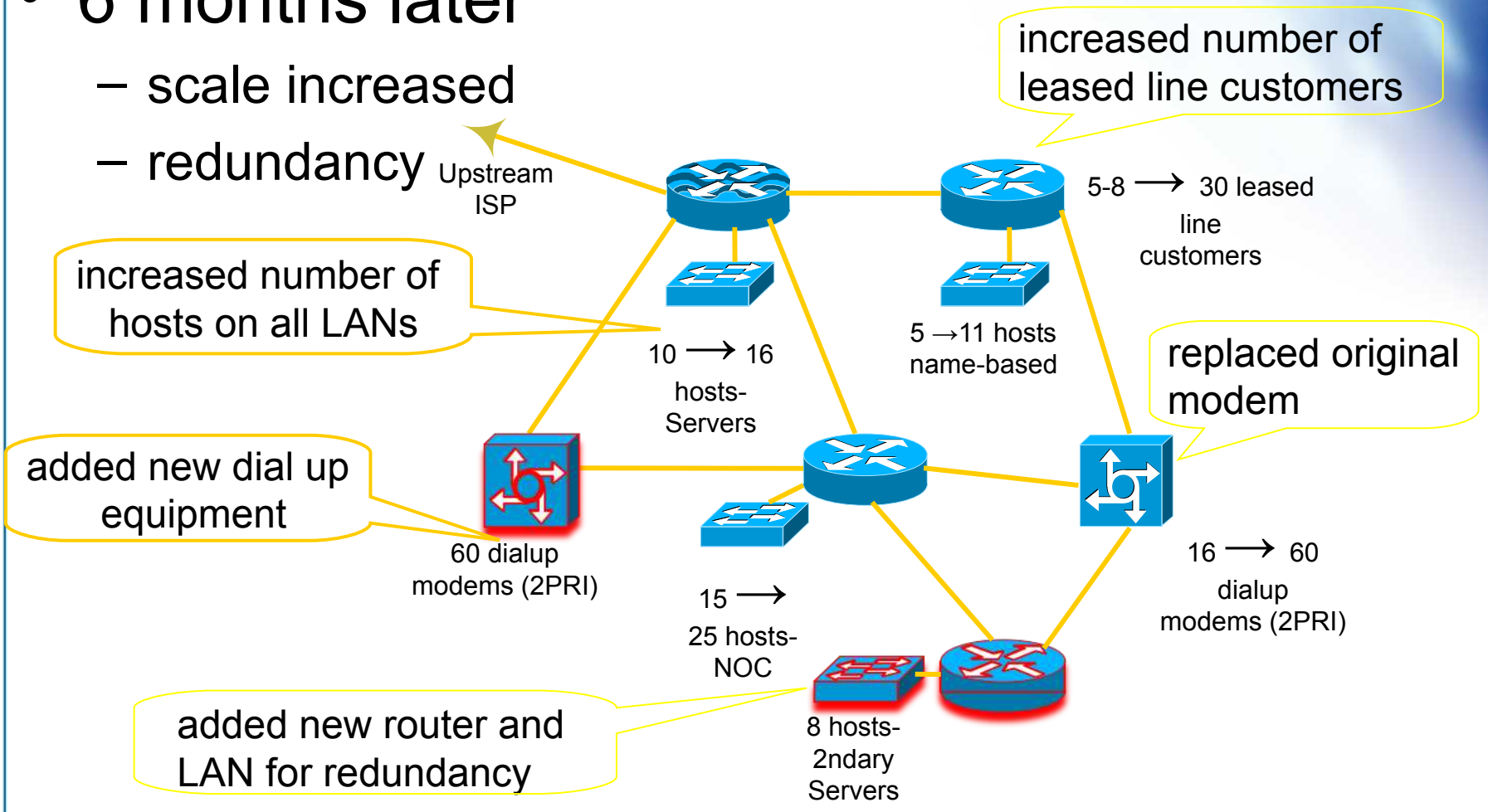
- Initial addressing plan

- numbers of host addresses (interfaces)

| | | |
|---|---|---|
| network-plan: | 16 | analogue dialup modems, vendor ‘x’ |
| network-plan: | 5 | LAN -web hosting (Name-based hosting) |
| network-plan: | 128 | 5-8 leased line customers (/28) |
| network-plan: | 15 | LAN -NOC and Ops management |
| network-plan: | 10 | LAN -mail,DNS, web servers internal |
| network-plan: | 4 | loopback router interfaces |
| network-plan: | 10 | router WAN ports (x 5 lines) |

# Network Plan

- 6 months later
  - scale increased
  - redundancy



# Addressing Plan

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

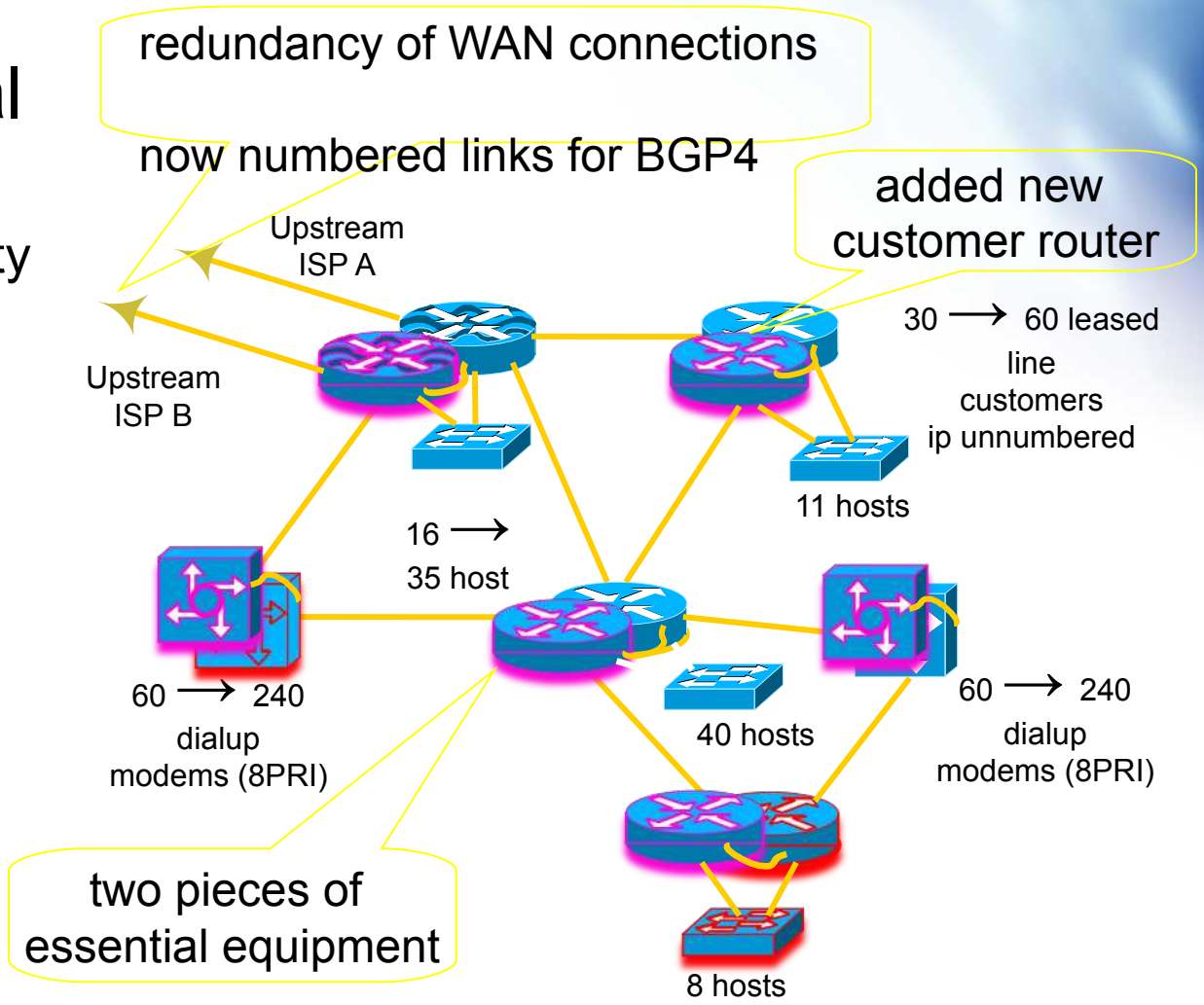
Changed description

| | | | |
|---|---|---|---|
| network-plan: | 16/ | 60 | 2 PRI dialup modems, vendor ‘y’ |
| network-plan: | 5/ | 11 | LAN -web hosting (Name-based hosting) |
| network-plan: | 128/ | 480 | 30 leased line customers (pool) |
| network-plan: | 15/ | 25 | LAN -NOC and Ops management |
| network-plan: | 10/ | 16 | LAN -mail,DNS, web servers internal |
| network-plan: | 4/ | 6 | loopback router interfaces |
| network-plan: | 10/ | 16 | router WAN ports (x 8 lines) |
| network-plan: | 0/ | 60 | 2 PRI dialup modems |
| network-plan: | 0/ | 8 | LAN-secondary servers |

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

| | | | |
|---|---|---|---|
| network-plan: | 16/60/ | 240 | 8 PRI dialup modems, vendor x |
| network-plan: | 0/60/ | 240 | 8 PRI dialup modems, vendor y |
| network-plan: | 5/11/ | 11 | LAN -web hosting (Name-based hosting) |
| network-plan: | 128/480/ | 960 | 60 leased line customers (pool) |
| network-plan: | 15/25/ | 40 | LAN -NOC and Ops management |
| network-plan: | 10/16/ | 35 | LAN -mail,DNS, web servers internal |
| network-plan: | 0/8/ | 8 | LAN-secondary servers |
| network-plan: | 10/16/ | 16 | router WAN ports (x 8 lines) |
| network-plan: | 4/6 | 12 | loopback router interfaces |

# Addressing Plan

- Can now determine subnet sizes

| | | | |
|---|---|---|---|
| network-plan: | 256 | 16/60/240 | 8 PRI dialup modems, vendor x |
| network-plan: | 256 | 0/60/240 | 8 PRI dialup modems, vendor y |
| network-plan: | 16 | 5/11/11 | LAN -web hosting (Name-based hosting) |
| network-plan: | 1024 | 128/480/960 | 60 leased line customers (pool) |
| network-plan: | 64 | 15/25/40 | LAN -NOC and Ops management |
| network-plan: | 64 | 10/16/35 | LAN -mail,DNS, web servers internal |
| network-plan: | 16 | 0/8/8 | LAN-secondary servers |
| network-plan: | 32 | 10/16/16 | router WAN ports (x 8 lines) |
| network-plan: | 16 | 4/6/12 | loopback router interfaces |

# Addressing Plan

- Addressing plan for network-plan
  - re-ordered **large to small** according to relative subnet size
  - determination of relative subnet addresses

| | | | | |
|---|---|---|---|---|
| network-plan: | **0.0.0.0** | 1024 | 128/480/960 | 60 leased line customers (pool) |
| network-plan: | **0.0.4.0** | 256 | 16/60/240 | 8 PRI dial up modems, vendor x |
| network-plan: | **0.0.5.0** | 256 | 0/60/240 | 8 PRI dial up modems, vendor y |
| network-plan: | **0.0.6.0** | 64 | 10/16/35 | LAN -mail,DNS, web internal |
| network-plan: | **0.0.6.64** | 64 | 15/25/40 | LAN -NOC and Ops management |
| network-plan: | **0.0.6.128** | 32 | 10/16/16 | router WAN ports (x8) |
| network-plan: | **0.0.6.160** | 16 | 5/11/11 | LAN -web hosting (Name-based hosting) |
| network-plan: | **0.0.6.176** | 16 | 0/8/8 | LAN -secondary servers |
| network-plan: | **0.0.6.192** | 16 | 4/6/12 | loopback router interfaces |

  - cumulative total 0.0.6.208

# Addressing Plan

- Addressing plan for network-plan
  - connect to the Internet (full-time, part-time)?

| | | | | | | |
|---|---|---|---|---|---|---|
| network-plan: | 0.0.0.0 | 255.255.252.0 | **YES** | 1024 | 128/480/960 | 60 leased customers |
| network-plan: | 0.0.4.0 | 255.255.255.0 | **PART** | 256 | 16/60/240 | 8 PRI dial up modems.. |
| network-plan: | 0.0.5.0 | 255.255.255.0 | **PART** | 256 | 0/60/240 | 8 PRI dial up modems.. |
| network-plan: | 0.0.6.0 | 255.255.255.192 | **YES** | 64 | 10/16/35 | LAN -mail,DNS, web internal |
| network-plan: | 0.0.6.64 | 255.255.255.192 | **YES** | 64 | 15/25/40 | LAN -NOC & Ops mgmt |
| network-plan: | 0.0.6.128 | 255.255.255.224 | **YES** | 32 | 10/16/16 | Router WAN ports (x8) |
| network-plan: | 0.0.6.160 | 255.255.255.240 | **YES** | 16 | 5/11/11 | LAN -web hosting (Name-based) |
| network-plan: | 0.0.6.176 | 255.255.255.240 | **YES** | 16 | 0/8/8 | LAN -secondary servers |
| network-plan: | 0.0.6.192 | 255.255.255.240 | **YES** | 16 | 4/6/12 | loopback router interfaces |

# Addressing Plan

- Addressing plan complete
  - total planned for customer assignments /22
  - total planned for ISP infrastructure /24 + /23

| | | | | | | |
|---|---|---|---|---|---|---|
| network-plan: | 0.0.0.0 | 255.255.252.0 | YES | 1024 | 128/480/960 | 60 leased line customers |
| network-plan: | 0.0.4.0 | 255.255.255.0 | PART | 256 | 16/60/240 | 8 PRI dial up modems.. |
| network-plan: | 0.0.5.0 | 255.255.255.0 | PART | 256 | 0/60/240 | 8 PRI dial up modems.. |
| network-plan: | 0.0.6.0 | 255.255.255.192 | YES | 64 | 10/16/35 | LAN -mail,DNS, web internal |
| network-plan: | 0.0.6.64 | 255.255.255.192 | YES | 64 | 15/25/40 | LAN -NOC & Ops mgmnt |
| network-plan: | 0.0.6.128 | 255.255.255.224 | YES | 32 | 10/16/16 | Router WAN ports (x 8 lines |
| network-plan: | 0.0.6.160 | 255.255.255.240 | YES | 16 | 5/11/11 | LAN -web hosting (Name-based) |
| network-plan: | 0.0.6.176 | 255.255.255.240 | YES | 16 | 0/8/8 | LAN -secondary servers |
| network-plan: | 0.0.6.192 | 255.255.255.240 | YES | 16 | 4/6/12 | Loopback router interfaces |

- detailed, efficient and accurate

# Requesting IP Resources

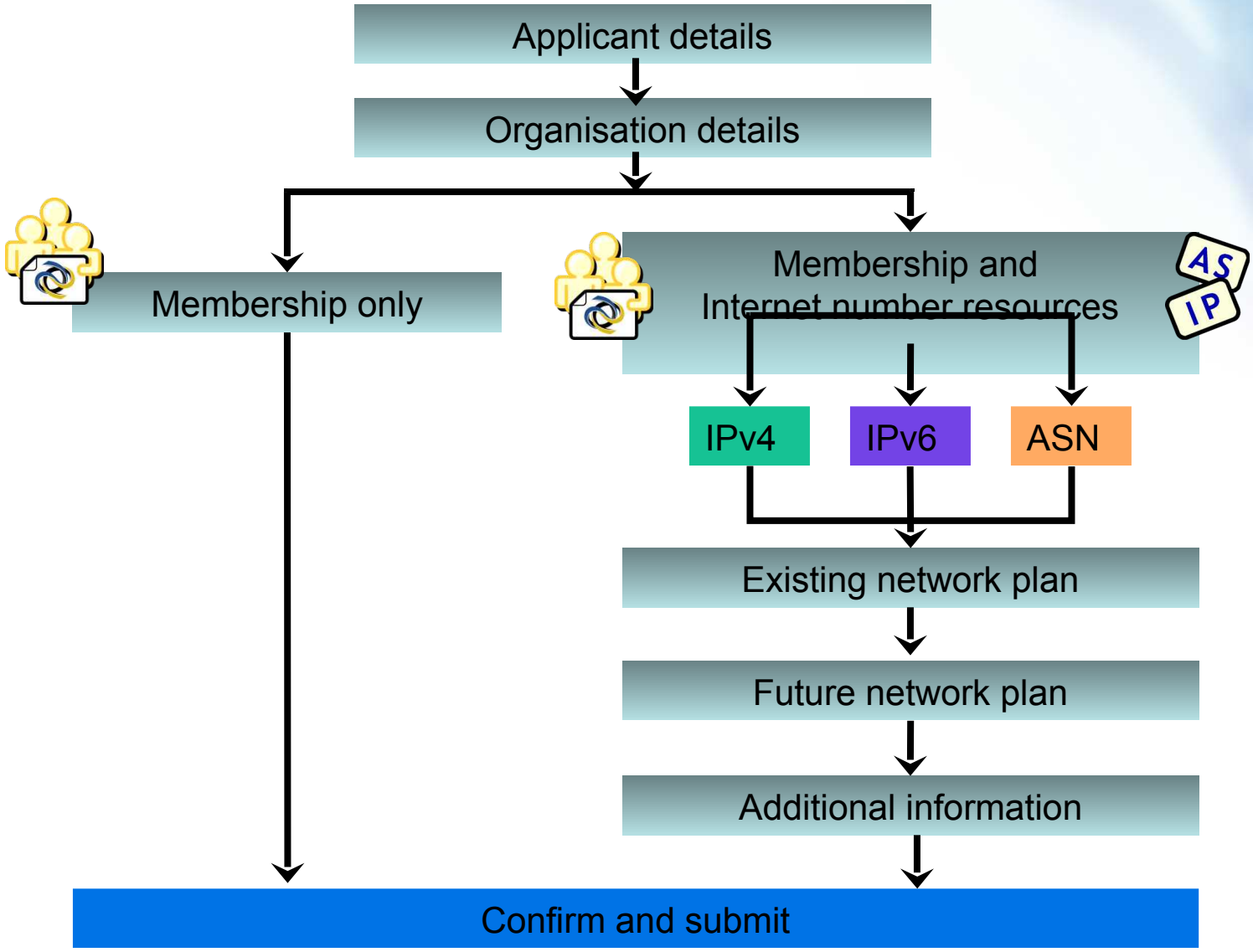
# IP Address Request

- 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-mer

# ISP Address Request - Overview

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

# Streamline Processes



# ISP Address Request

members only

- Hostmaster Administration
  - <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 Instructions

- Complete the documentation
  - ISP Address Request Form
    - Web Form:
      - http://www.apnic.net/services/become-a-member
      - 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.htm

# 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

# 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

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

# 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 services will be implemented
    - 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

- ‘Historical prefix exchange’ policy
  - swap 3 or more discontiguous prefixes for single prefix.
  - Need to contact admin@apnic.net

# 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 /22 ‘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?

# Overview

- IRMe
  - Introduction to APNIC
  - APNIC policy development process
  - Internet registry policies
  - IP address request (Demo)
  - **Second opinion request**
  - IPv6 Overview
  - APNIC whois database
  - MyAPNIC (Demo)
  - Autonomous System Numbers
  - Reverse DNS
  - APNIC Helpdesk

# What is an Assignment Window?

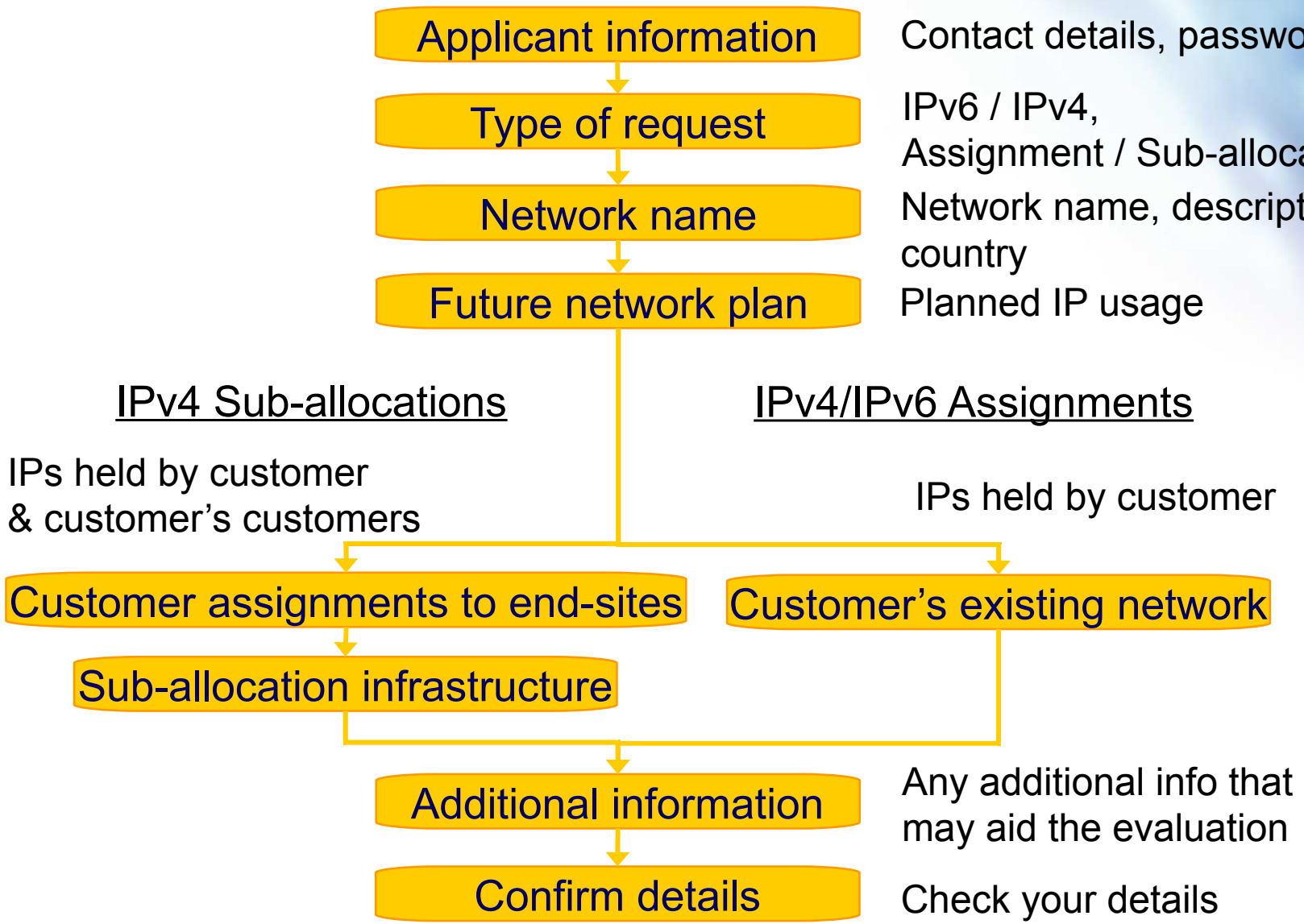
*"The amount of address space a member may assign without a 'second opinion'"*

- 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

# Overview of 2nd Opinion Form



# 2nd Opinion Evaluation (policy)

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

# 2nd Opinion Evaluation

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

# 2nd Opinion Request Approval

Dear XXXXXXX,

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

[netname]

[address/prefix]

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

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

Important:

Unregistered assignments are considered as "unused"

# Customer Assignment

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

# Questions?

# Overview

- IRMe
  - Introduction to APNIC
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  - Internet registry policies
  - IP address request (Demo)
  - Second opinion request
  - **IPv6 Overview**
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  - MyAPNIC (Demo)
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  - APNIC Helpdesk

# Rationale

- Address depletion concerns
  - Squeeze on available addresses space
    - Probably will never run out, but will be harder to obtain
  - End to end connectivity no longer visible
    - Widespread use of NAT

➡ IPv6 provides much larger IP address space than IPv4

# Main IPv6 Benefits

- Expanded addressing capabilities
- Server-less autoconfiguration (“plug-n-play”) and reconfiguration
- More efficient and robust mobility mechanisms
- Built-in, strong IP-layer encryption and authentication
- Streamlined header format and flow identification
- Improved support for options / extensions

# IPv6 Addressing

- 128 bits of address space
- 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

    →4EED:23:0:0:0:36E:1250:2B00

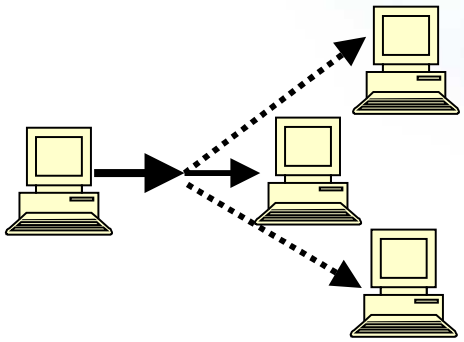
    →4EED:23::36E:1250:2B00

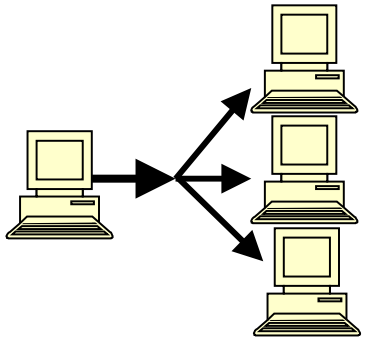
    (Null value can be used only once)

# IPv6 Addressing Model

- **IPv6 Address type**
  - Unicast
    - An identifier for a single interface
  - Anycast
    - An identifier for a set of interfaces
  - Multicast
    - An identifier for a group of nodes

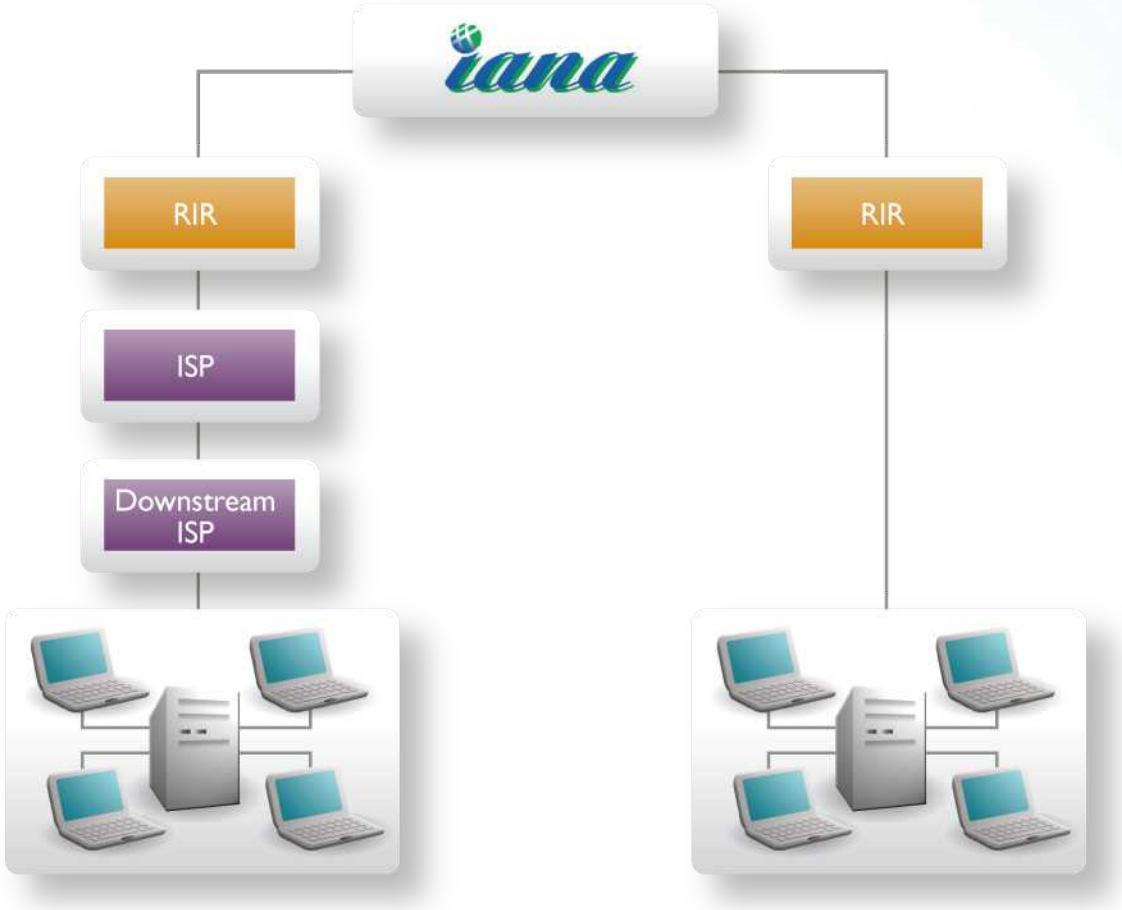
RFC 4291





# IPv6 Policies 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

# IPv6 Initial Allocation

- To qualify for an initial allocation of IPv6 address space, an organization must:
  - 1. Not be an end site (must provide downstream services)
  - 2. Plan to provide IPv6 connectivity to organizations to which it will make assignments, by advertising that connectivity through its single aggregated address allocation
  - 3. 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

# IPv6 Initial Allocation

- Private networks (those not connected to the public Internet) may also be eligible for an IPv6 address space allocation provided they meet equivalent criteria to those listed above.

- Initial allocation size is /32
  - Default allocation (“slow start”)

# IPv6 Initial Allocation

- Initial allocations larger than /32 may be justified if:
  - 1. The organization provides comprehensive documentation of planned IPv6 infrastructure which would require a larger allocation; or
  - 2. The organization provides comprehensive documentation of all of the following:
    - its existing IPv4 infrastructure and customer base,
    - its intention to provide its existing IPv4 services via IPv6, and
    - its intention to move some of its existing IPv4 customers to IPv6 within two years

# End Site Assignment Policy for IPv6

- Any size longer than /48
  - Decision is up to ISPs 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

# 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

# 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

# IPv6 Assignment and Utilisation Requirement

- IPv6 assignment and utilisation requirement policy
  - HD ratio: 0.94
  - Measurement unit: /56

- The HD ratio threshold is
  - HD=log(/56 units assigned) / log (16,777,216)
  - 0.94 = 6,183,533 x /56 units

- Calculation of the HD ratio
  - Convert the assignment size into equivalent /56 units
    - Each /48 end site = 256 x /56 units
    - Each /52 end site = 16 x /56 units
    - Each /56 end site = 1 x /56 units
    - Each /60 end site = 1/16 x /56 units
    - Each /64 end site = 1/256 x /56 units

# 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."

# 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 Multi-homing

- 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 3 months
  - Assignment from a specified block separately from portable allocations address space

# How do I Apply for IPv6 Addresses?

Check your eligibility for IPv6 addresses

↓

Read IPv6 policies
http://www.apnic.net/policy/ipv6-address-policy

Read IPv6 guideline
http://www.apnic.net/publications/media-library/corporate-documents/resource-guidelines/ipv6-guidelines

↓

Do you have an APNIC account?

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

↓

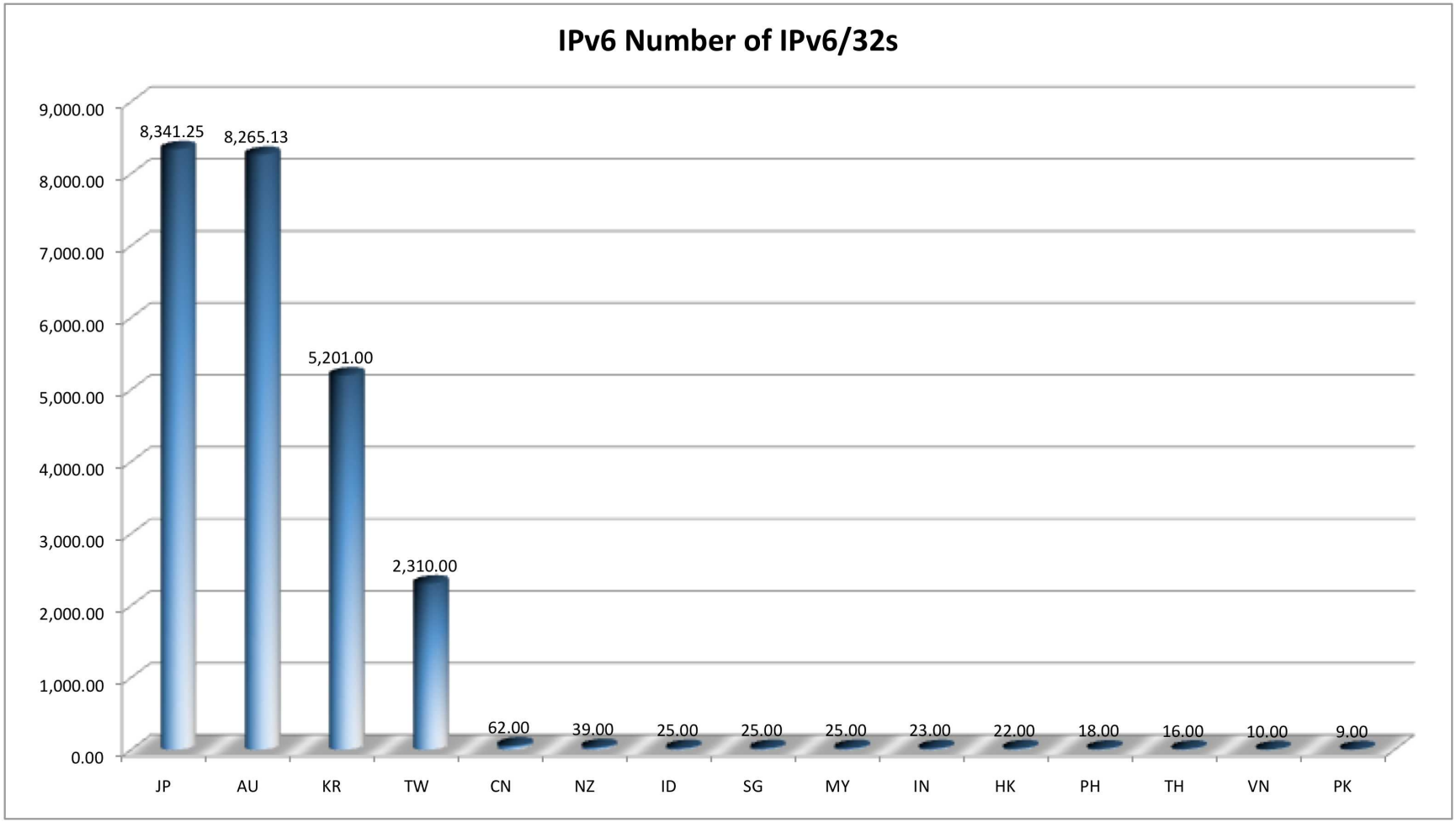
Complete an IPv6 address request form

↓

Submit the form hostmaster@apnic.net

**Questions:**
email: helpdesk@apnic.net
Helpdesk chat: http://www.apnic.net/helpdesk

# APNIC IPv6 Delegation by Economy




No of delegations (/35, /32)

http://www.apnic.net/stats/o3/ as of 26/03/2009

# Questions?

# Overview

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  - Internet registry policies
  - IP address request (Demo)
  - Second opinion request
  - IPv6 Overview
  - **APNIC whois database**
  - MyAPNIC (Demo)
  - Autonomous System Numbers
  - Reverse DNS
  - APNIC Helpdesk

# 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

# Whois Database Query - Clients

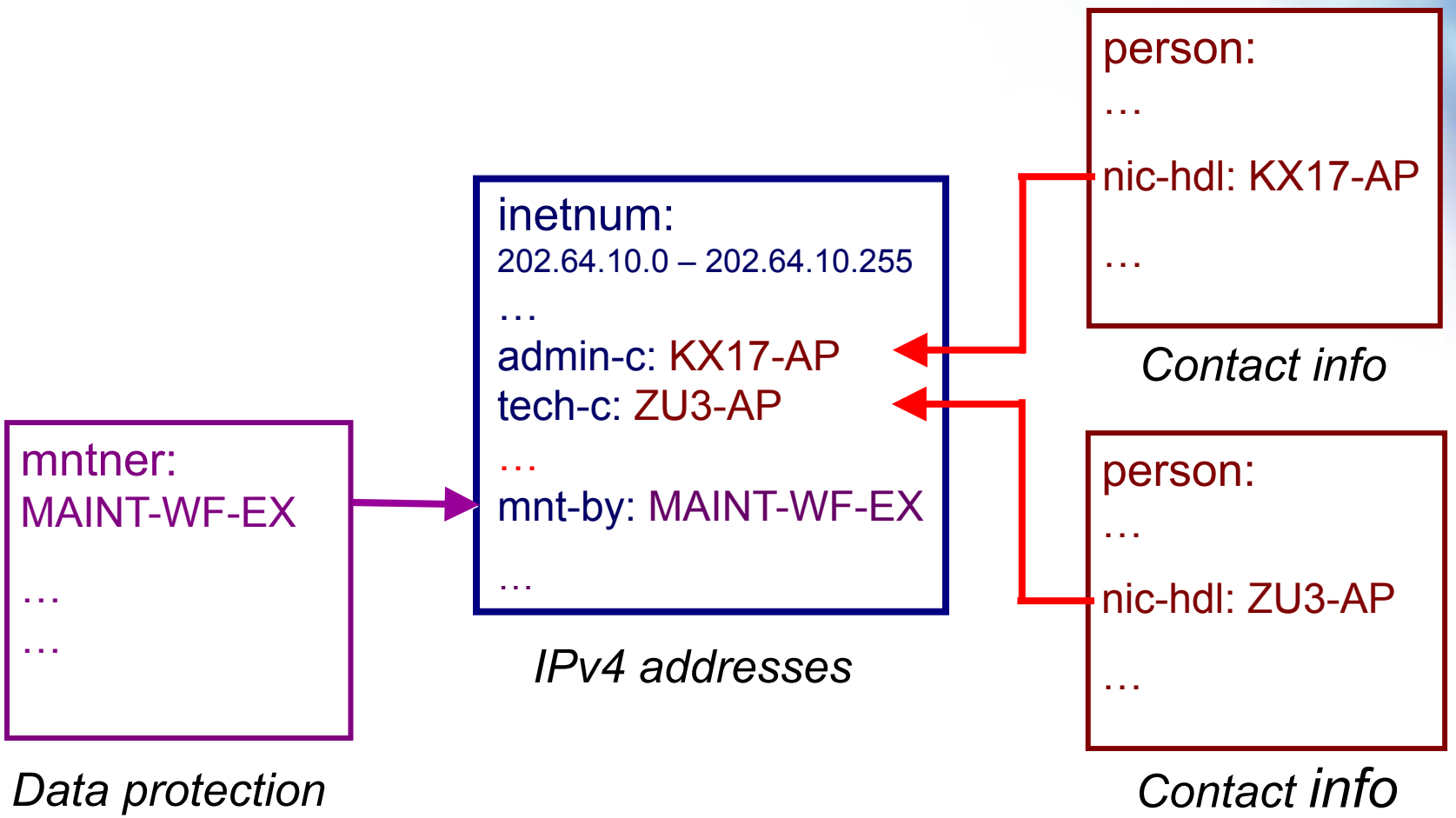
- Standard whois client
  - Included with many Unix distributions
  - RIPE extended whois client
    - http://ftp.apnic.net/apnic/dbase/tools/ripe-dbase-client.tar.gz
- Query via the APNIC website
  - http://www.apnic.net/apnic-bin/whois2.pl
- Query clients - MS-Windows etc
  - Many available

# Object Types

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

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

# Inter-related Objects



# Database Query – Look-up Keys

| OBJECT TYPE | ATTRIBUTES – LOOK-UP KEYS |
|---|---|
| person | name, nic-hdl, e-mail |
| role | name, nic-hdl, e-mail |
| mntner | maintainer name |
| inetnum | network number, name |
| domain | domain name |
| aut-num | as number |
| as-macro | as-macro name |
| route | route value |
| inet6num | network number, name |

* Whois supports queries on any of these objects/keys

# Object Templates

To obtain template structure*, use :

whois -t <object type>

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

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

*Recognised by the RIPE whois client/server

# Person Object Example

– Person objects contain contact information

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

# What is a nic-hdl?

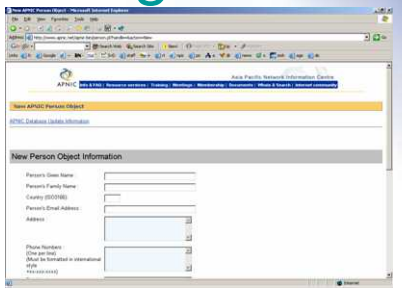
- Unique identifier for a person
- Represents a person object
  - Referenced in objects for contact details
    - (inetnum, aut-num, domain…)
  - format: <XXXX-AP>
    - Eg: KX17-AP

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

# Creating a Person Object

**Creating objects in Whois:**

http://www.apnic.net/apnic-info/whois_search2/using-whois/up




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

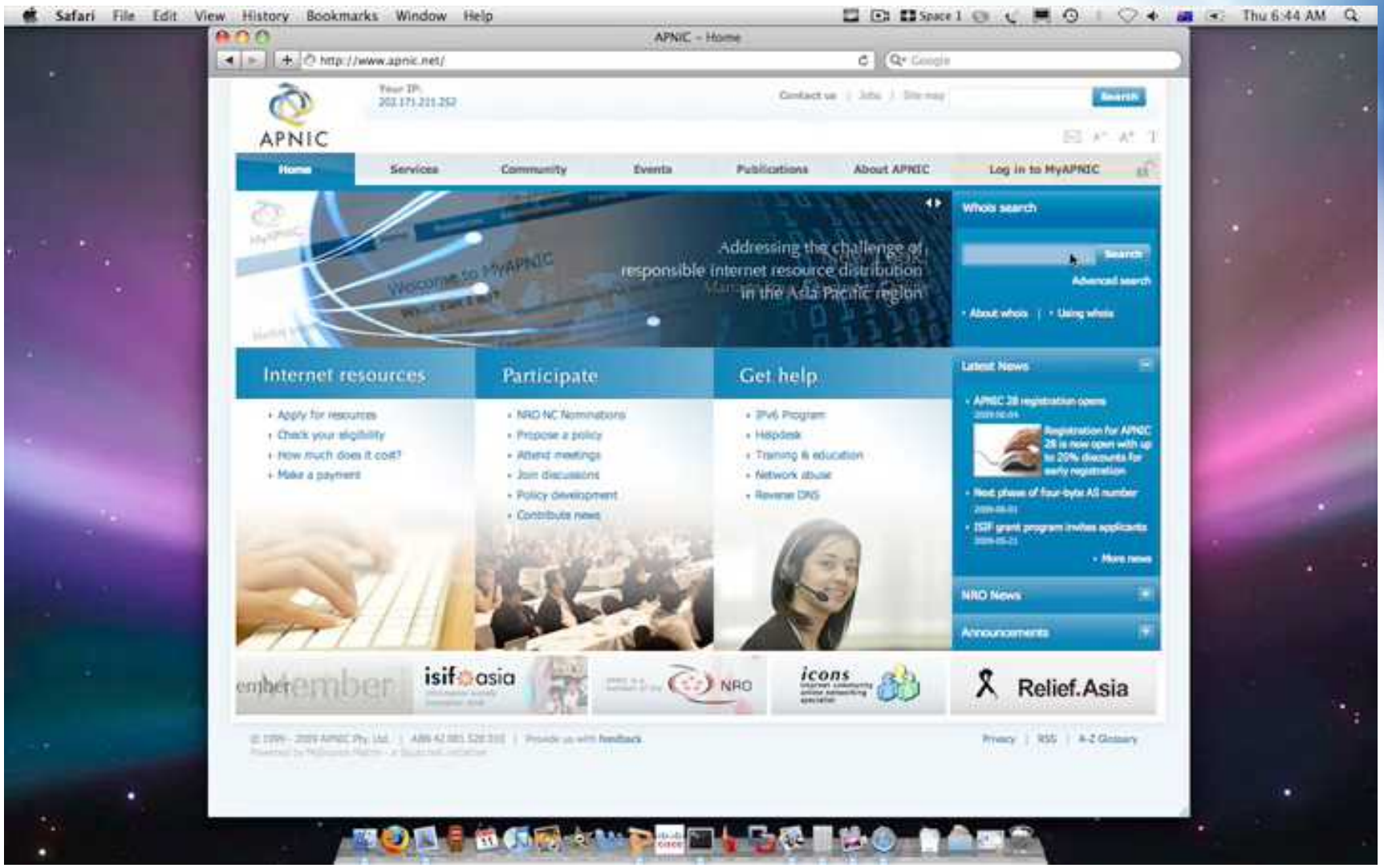
| Attributes | Values |
|---|---|
| inetnum: | 202.51.64.0 - 202.51.95.255 |
| netname: | CCNEP-NP-AP |
| descr: | Communication & Communicate Nepal Ltd |
| descr: | VSAT Service Provider, Kathmandu |
| country: | NP |
| admin-c: | AS75-AP |
| tech-c: | AS75-AP |
| mnt-by: | APNIC-HM |
| mnt-lower: |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

# Whois Database Query - UNIX

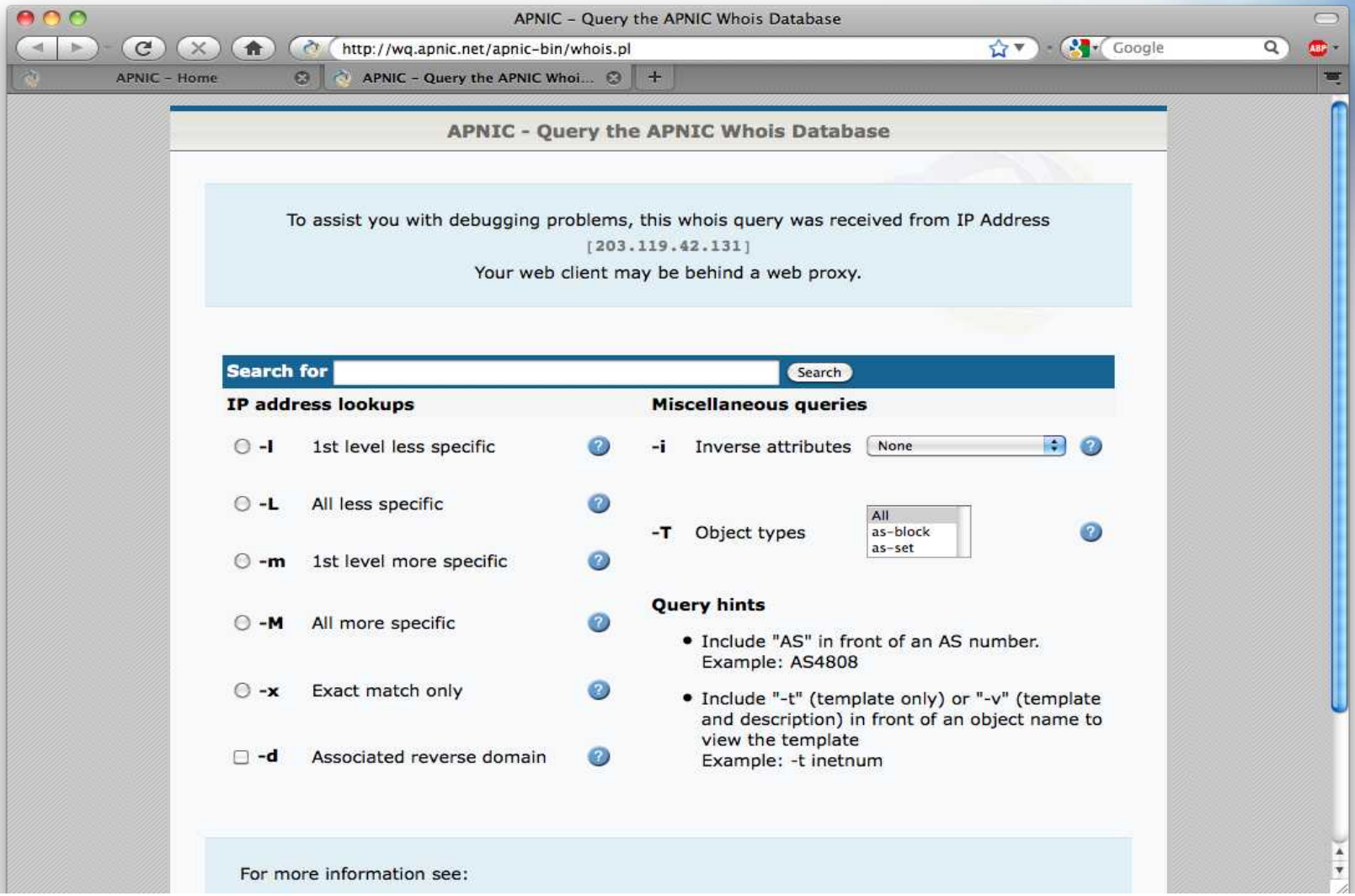
```
% whois zulrich@example.com
% whois zu3-ap
% whois "zane ulrich"

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
```

# APNIC Whois Web Query



# APNIC Whois web query



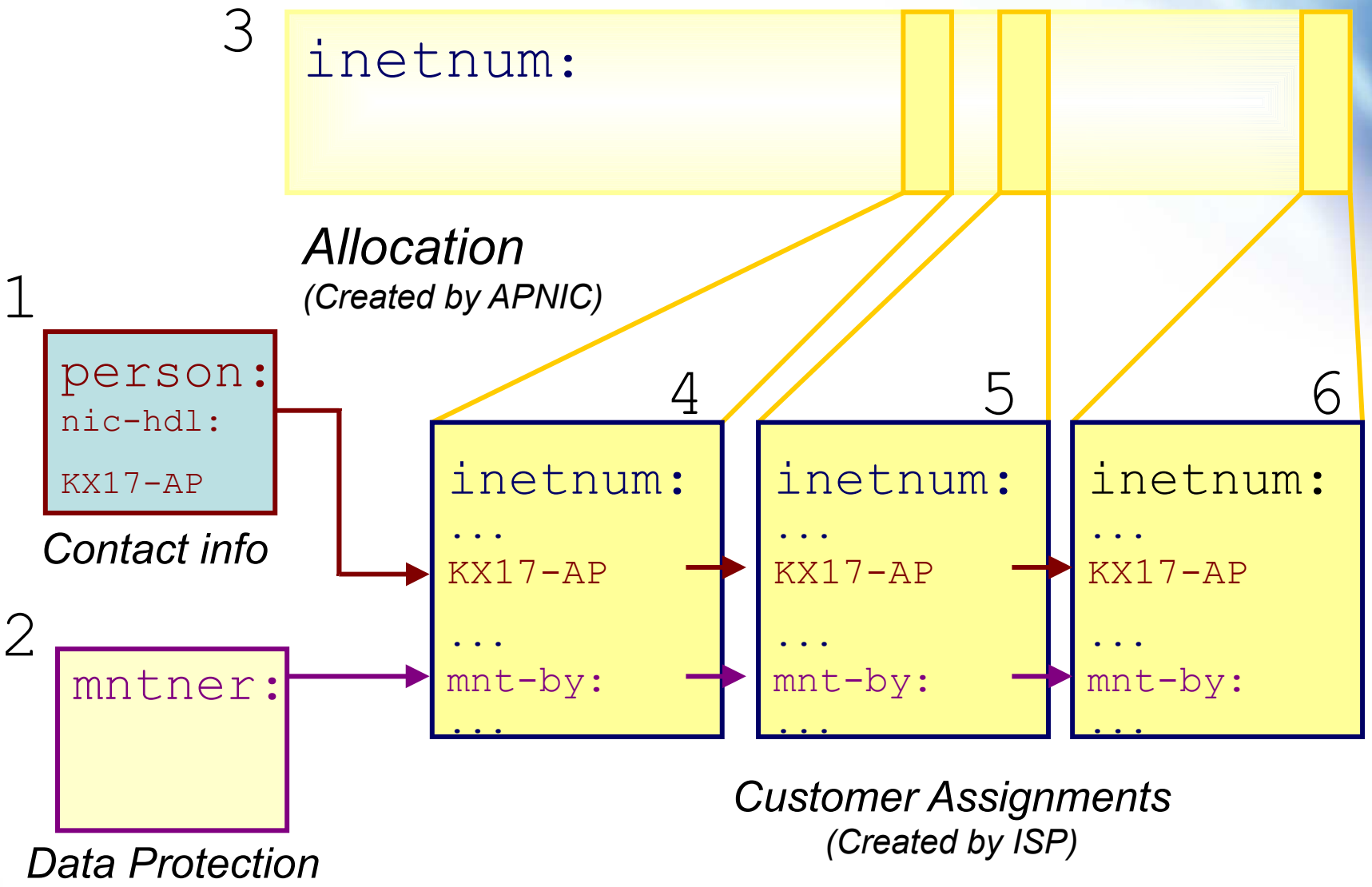
# ISP Registration Responsibilities

1. Create person objects for contacts
   - To provide contact info in other objects
1. Create mntner object
   - To provide protection of objects

   (To be discussed later)

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

# Using the db – Step by Step



# Role Object - Example

- Contains contact info for several contacts

| Attributes | Values |
|---|---|
| role: | Xnet IP ADMINISTRATORS |
| address: | 2000 Miller Road North Sydney |
| country: | AU |
| phone: | +61-2-93420000 |
| phone: | +61-2-93420000 |
| fax-no: | +61-2-9342-0900 |
| fax-no: | +61-2-9342-6100 |
| e-mail: | noc@xnet.net.au |
| admin-c: | XNC2-AP |
| tech-c: | XNC2-AP |
| tech-c: | XNB120-AP |
| nic-hdl: | XND1-AP |
| mnt-by: | MAINT-XNET-AP |
| source: | APNIC |

# 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

# Replacing Contacts in the db
## *- using person objects*

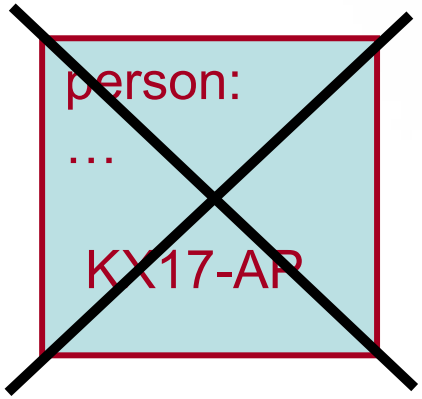
*K. Xander is leaving my organisation. Z. Ulrich is replacing him.*

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.




person:
…
ZU3-AP

inetnum:
202.0.10.0
…
ZU3-AP

inetnum:
202.0.12.127
…
ZU3-AP

inetnum:
202.0.15.192
…
ZU3-AP

# Replacing Contacts in the db – *using a role object*

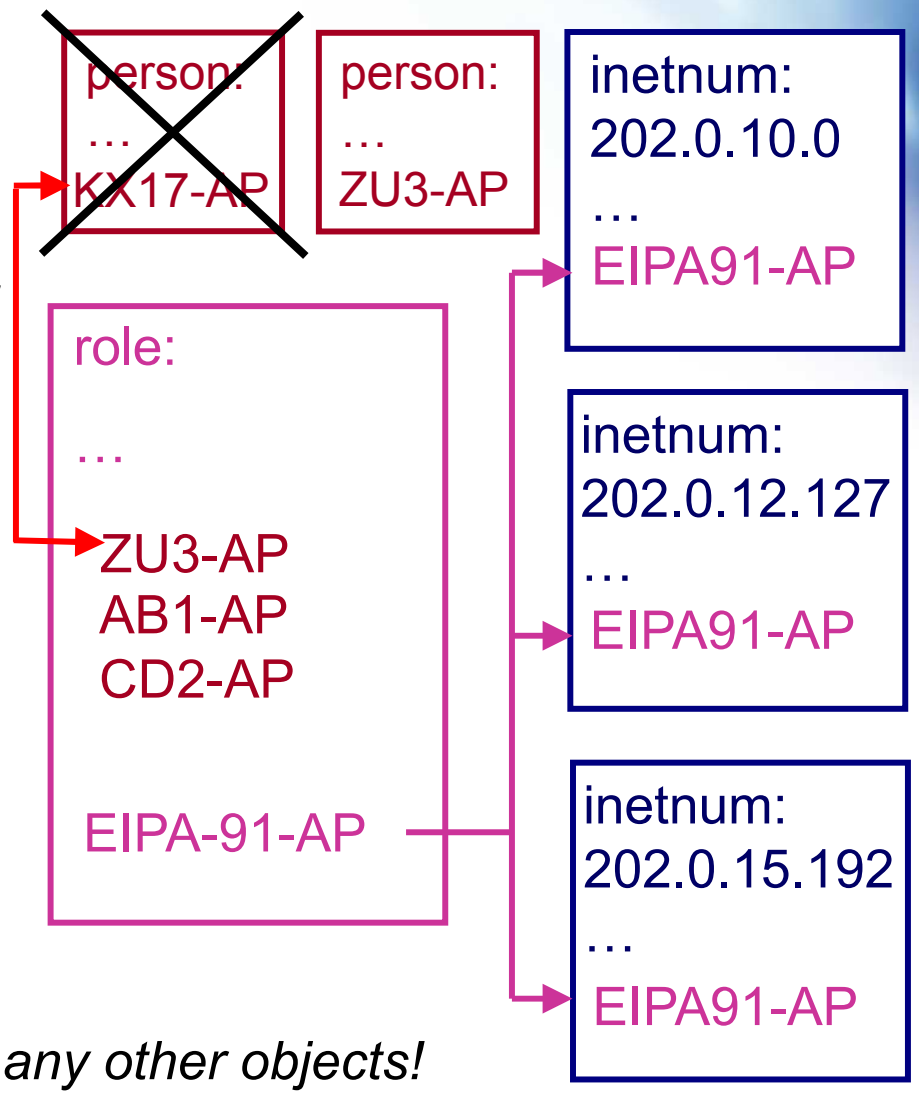
*K. Xander is leaving my organisation. Z. Ulrich is replacing him.*

*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!*

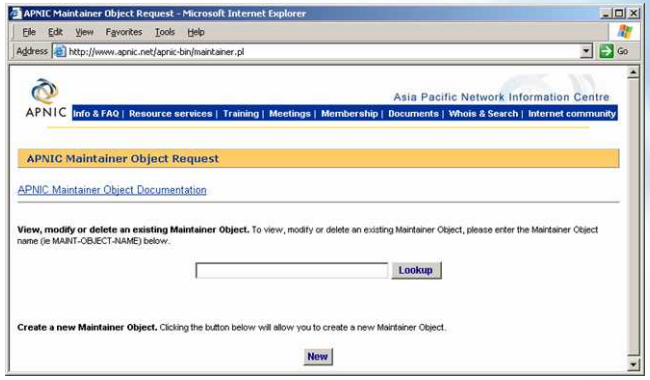
# Database Protection - Maintainer Object

```
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
```

- protects other objects in the APNIC database

# Creating a Maintainer Object

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




1. Completed form will be sent to you
2. Forward request to maint-request@apnic.net
3. Maintainer will be created *manually*
   - Manual verification by APNIC Hostmasters
1. 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 the authentication rule specified by its maintainer object

# Authorisation Mechanism

```
inetnum:        202.137.181.0 – 202.137.185.255
netname:        EXAMPLENET-WF
descr:          ExampleNet Service Provider
…….
mnt-by:         MAINT-WF-EX
```

```
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
changed:        kxander@example.com 20020731
source:         APNIC
```

# Authentication Methods

- ‘auth’ attribute
  - Crypt-PW
    - Crypt (Unix) password encryption
    - Use web page to create your maintainer
  - PGP – GNUPG
    - Strong authentication
    - Requires PGP keys
  - MD5
    - Available

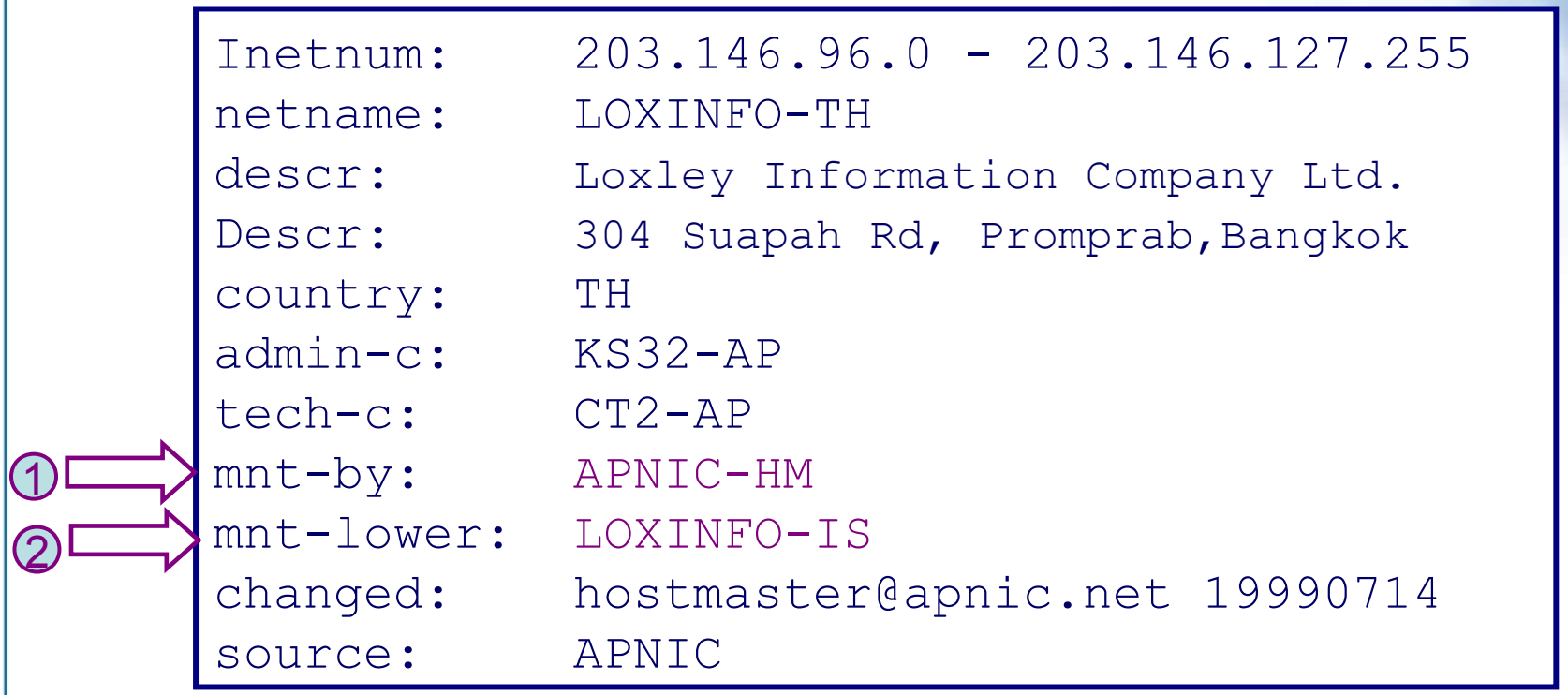
# Mnt-by & Mnt-lower

- ‘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




1. Only APNIC can change this object
2. Only LOXINFO-TH can create assignments within this allocation

# Authentication / Authorisation

- Member assignment to customer
  - Created and maintained by APNIC member

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

source:      APNIC
```

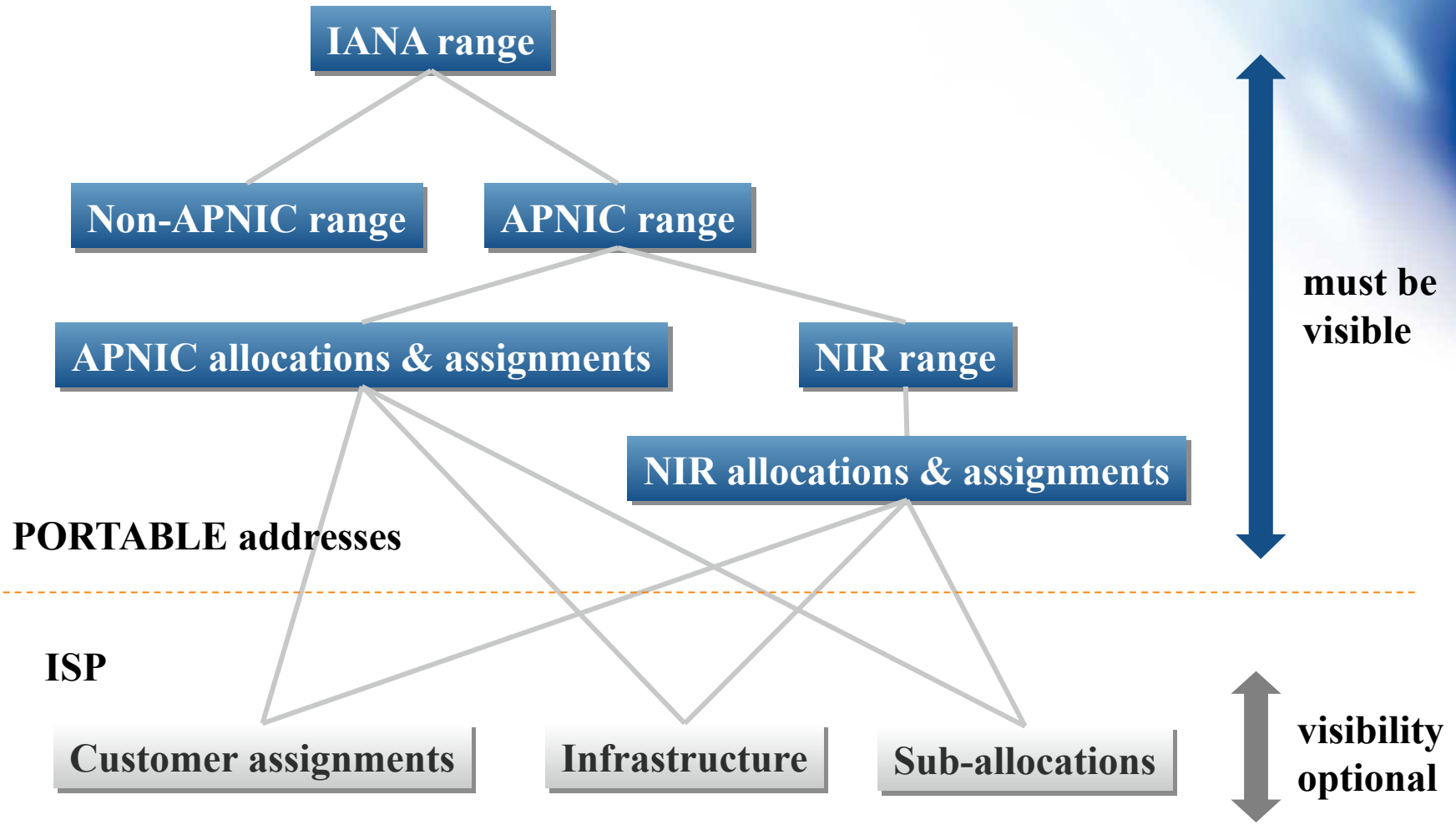
Only LOXINFO-IS can change this object

# Privacy of Customer Assignments

# Customer Privacy

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

# What Needs to be Visible?



# Questions?

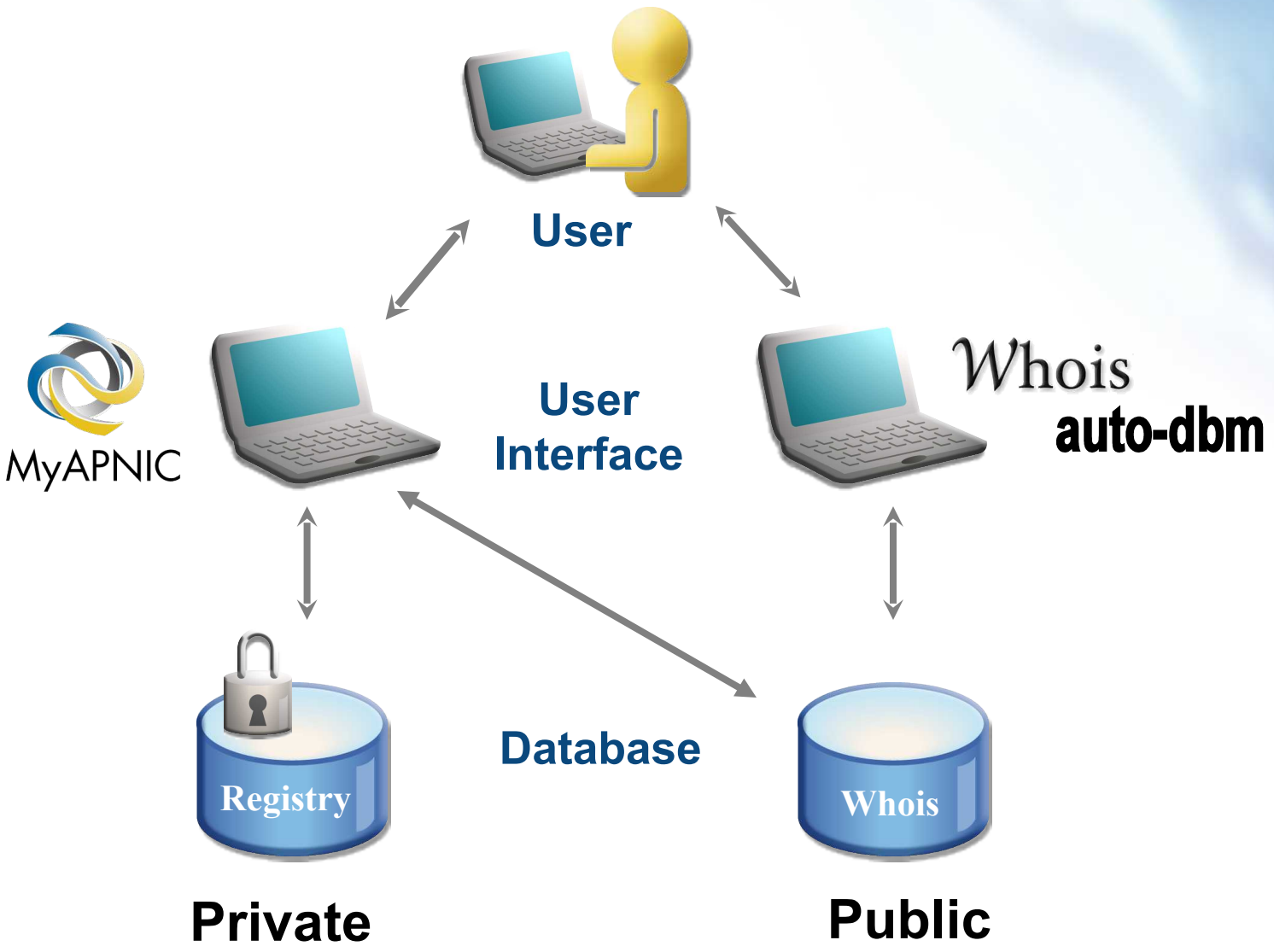
# Overview

- IRMe
  - Introduction to APNIC
  - APNIC policy development process
  - Internet registry policies
  - IP address request (Demo)
  - Second opinion request
  - IPv6 Overview
  - APNIC whois database
  - **MyAPNIC (Demo)**
  - Autonomous System Numbers
  - Reverse DNS
  - APNIC Helpdesk

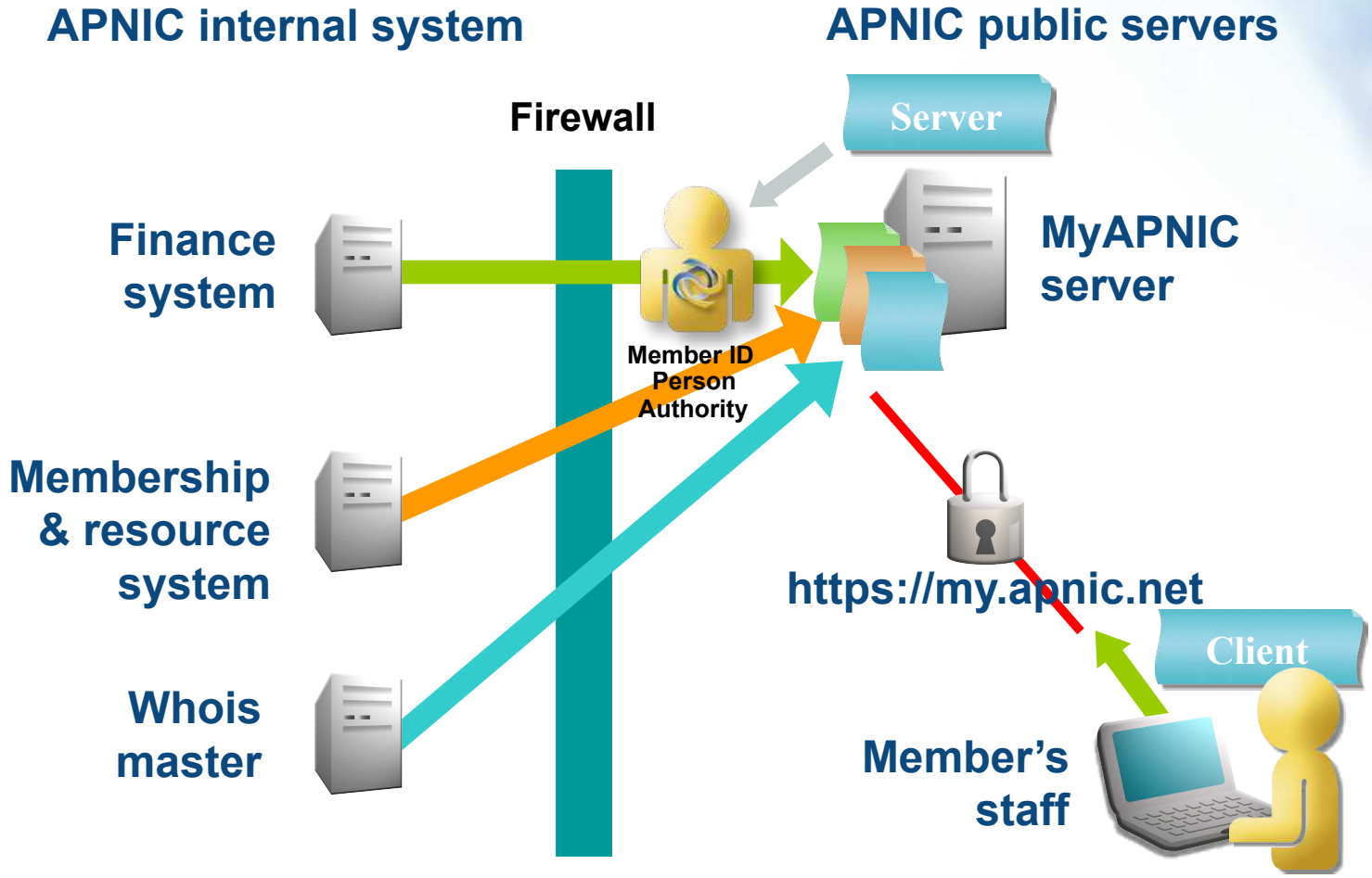
# MyAPNIC


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

# Database Tools



# How it Works




# The new MyAPNIC

- Updated look and feel
- Streamlined navigation
- Log in with username and password
- Improved user management
- Resource Certificates
- Low-bandwidth format making it easier to access from anywhere

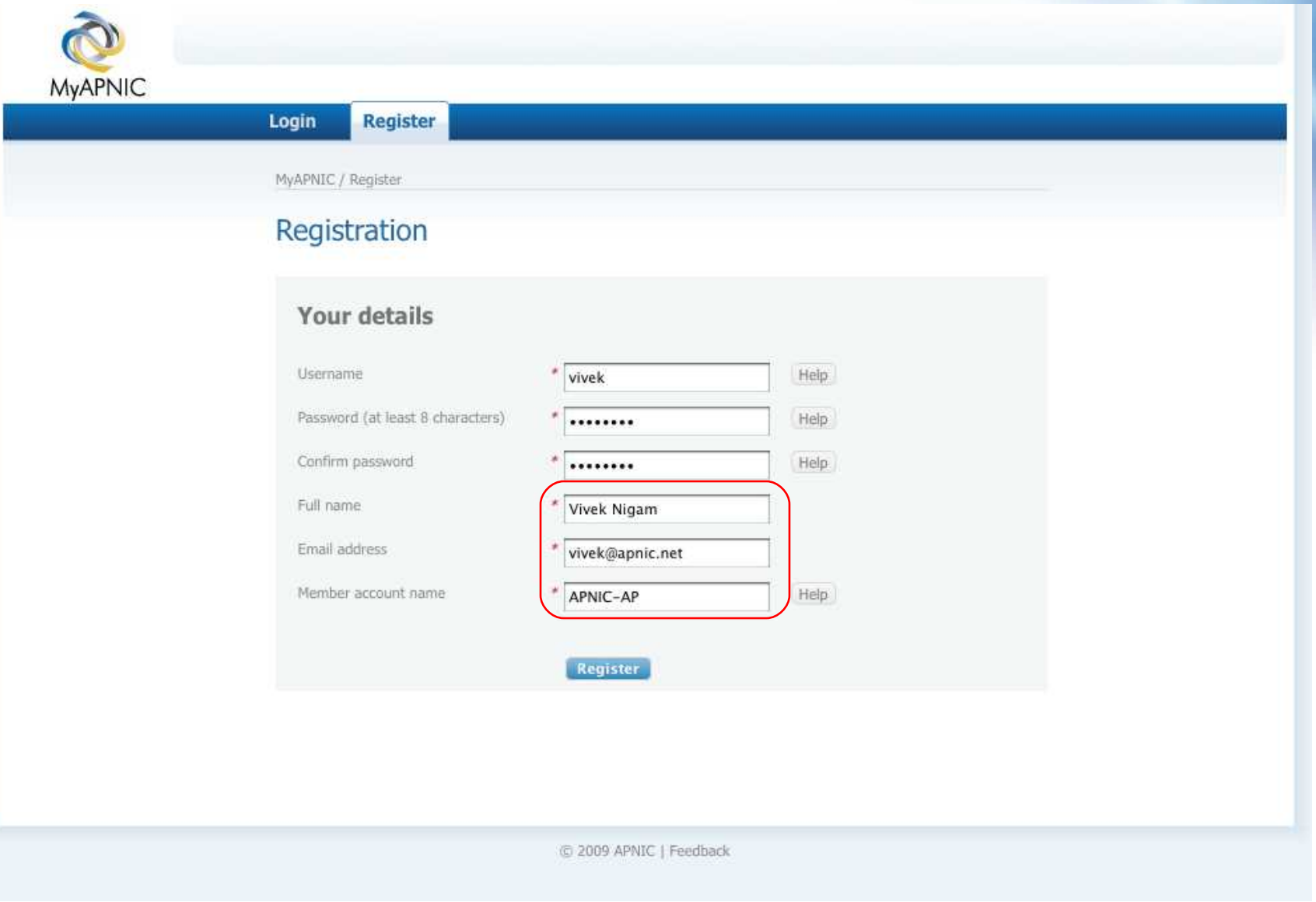
# MyAPNIC Functions

- Resource information
  - IPv4, IPv6, ASN
- Administration
  - Membership detail
  - Contact persons
  - Billing history
- Training
  - Training history
  - Training registration
- Tools
  - Looking glass

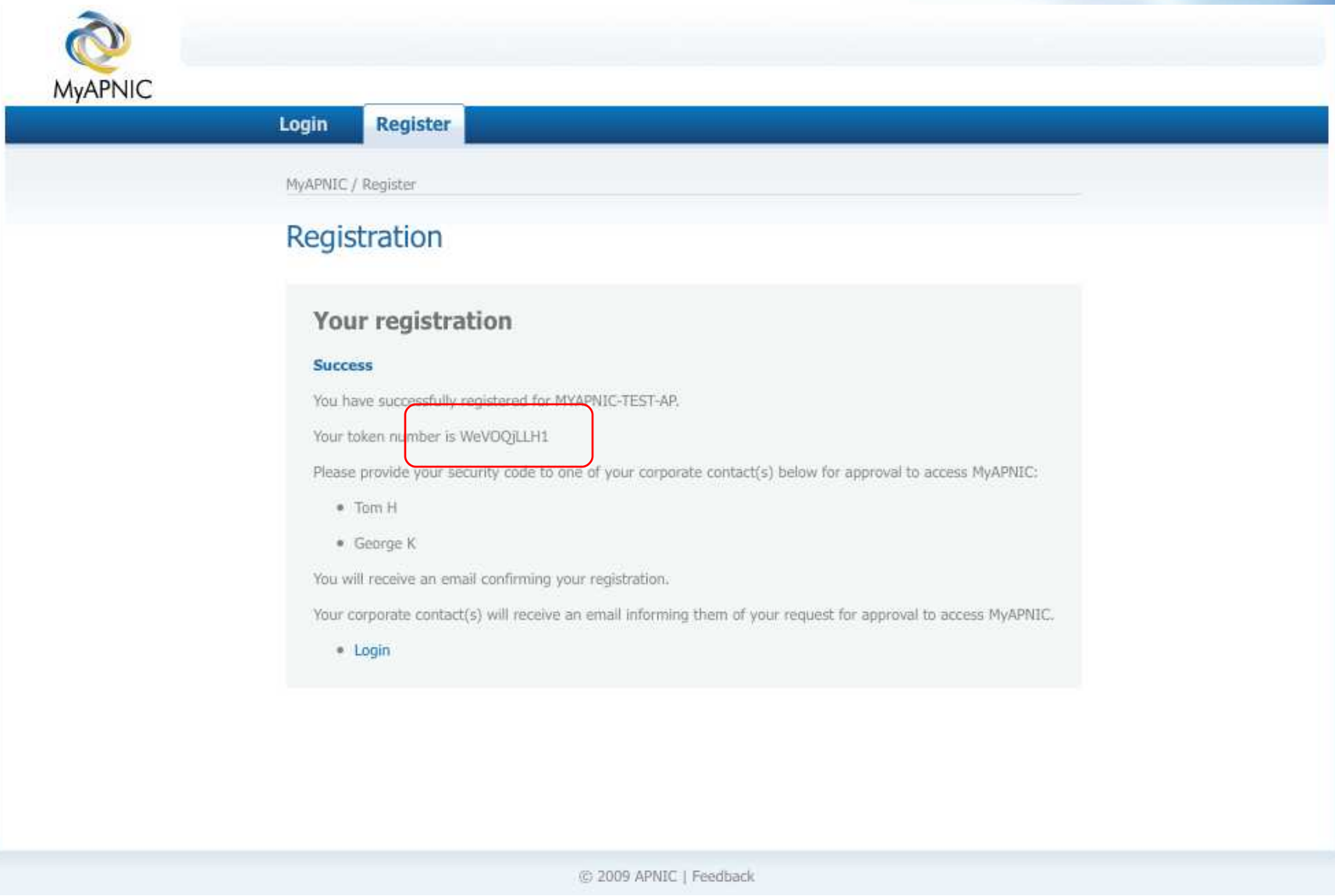

# Accessing MyAPNIC

- Username and password required for authentication
- Corporate contact requires digital certificate
- Corporate contact can approve new users
- New users do not require digital certificate

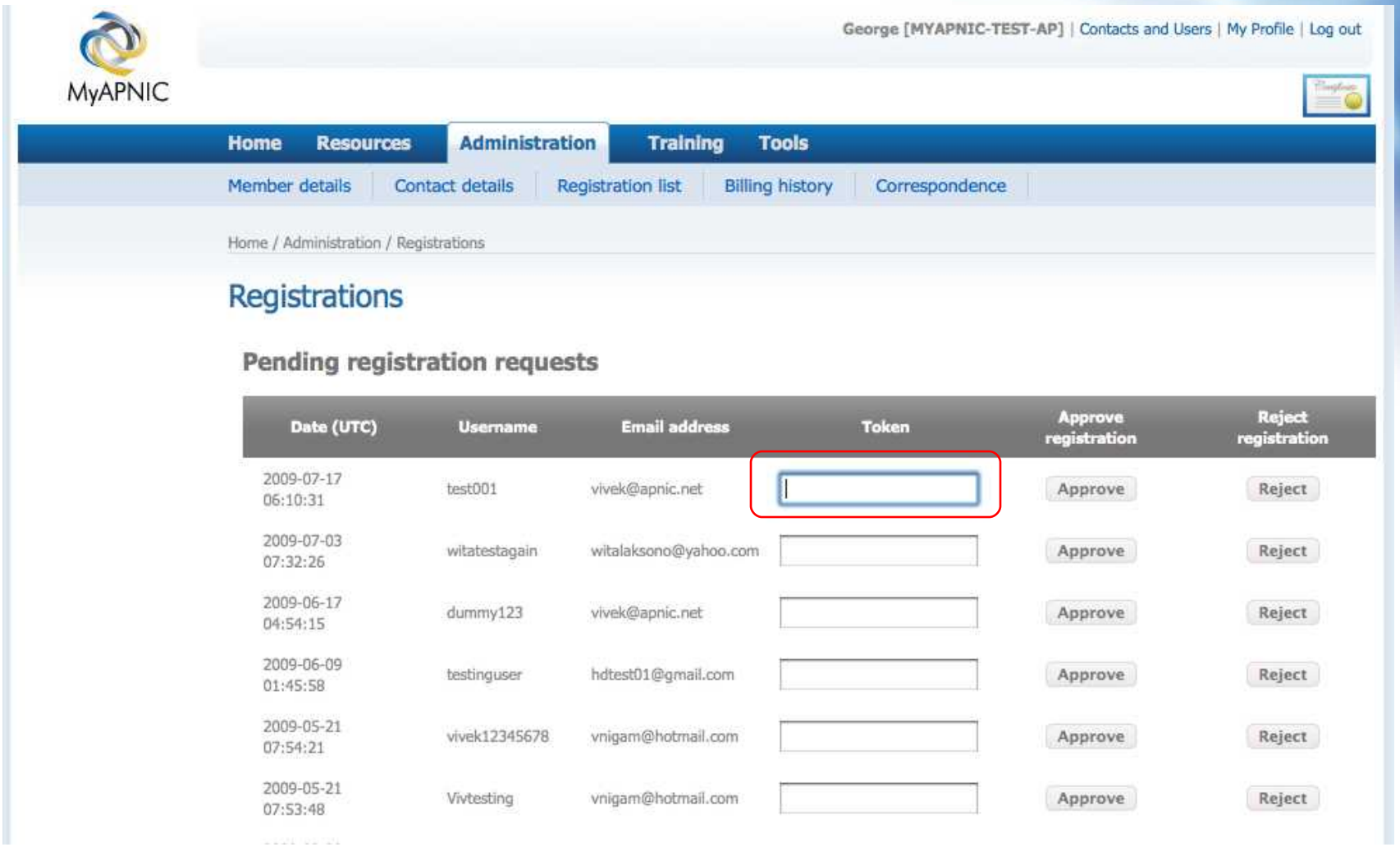
# MyAPNIC registration



# MyAPNIC Registration



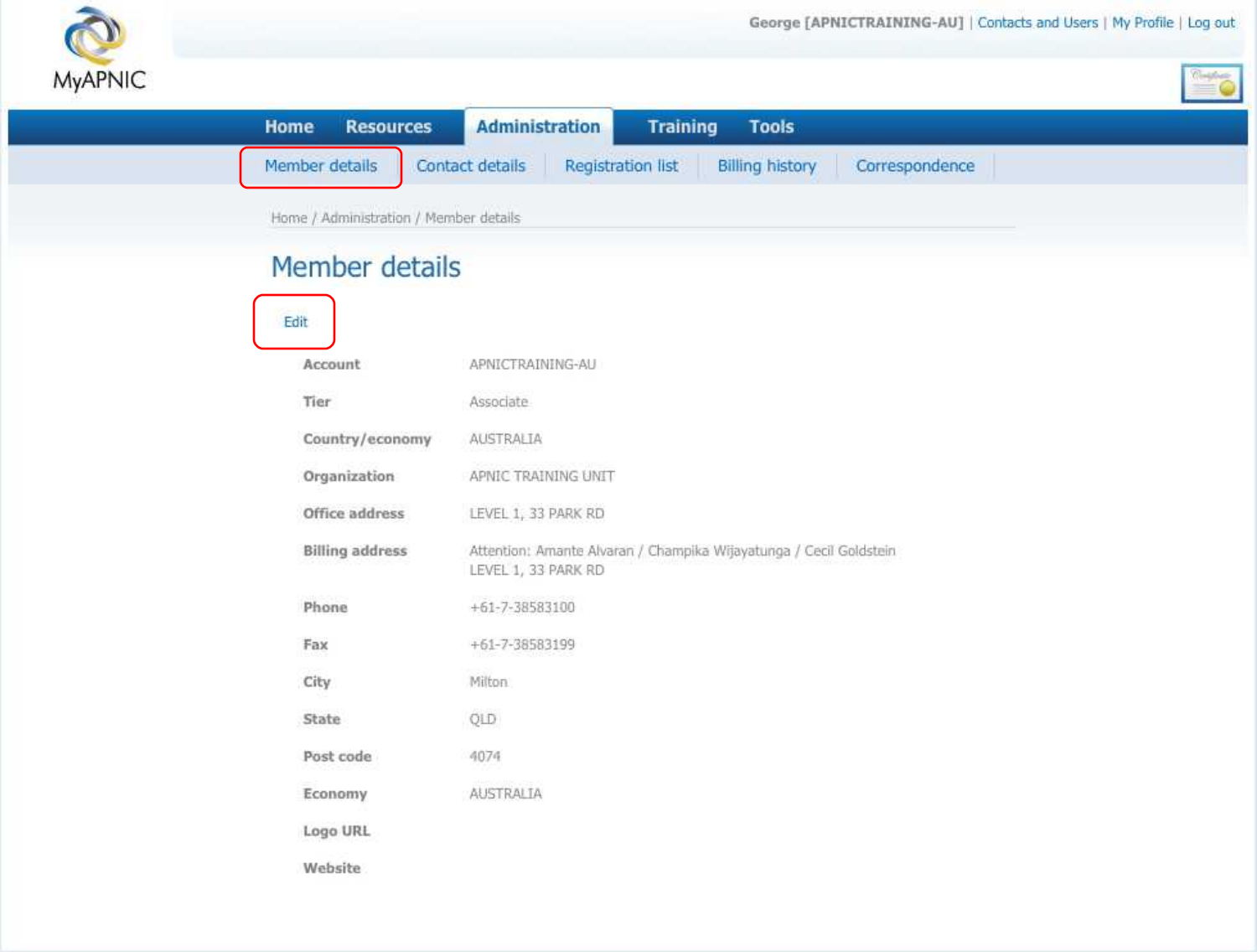
# MyAPNIC Registration



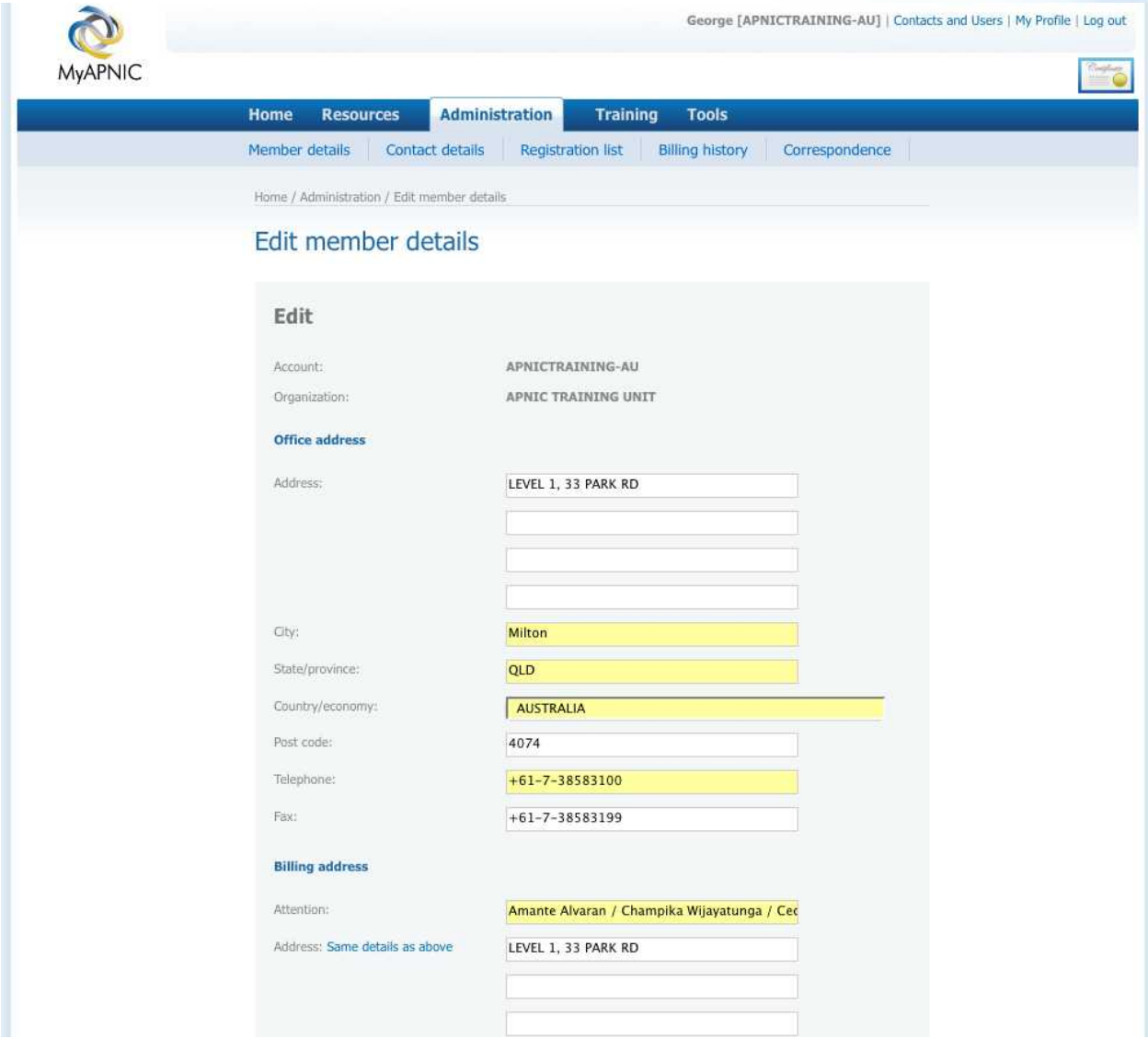

# Digital certificates

- Privileges of Digital Certificate
- Approve new users
- Add or remove contacts
- Update organization details
- Online voting

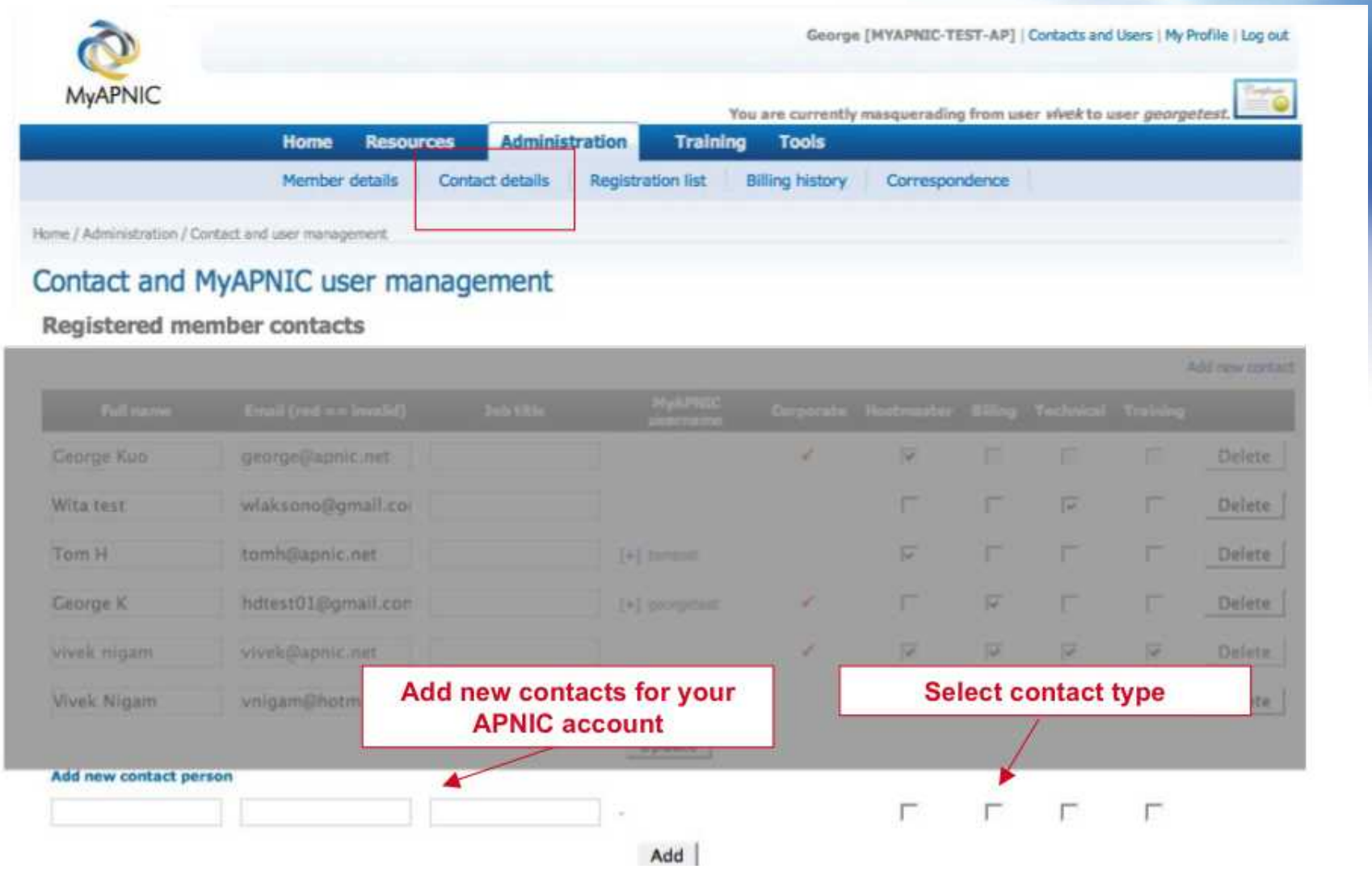
# Manage your membership



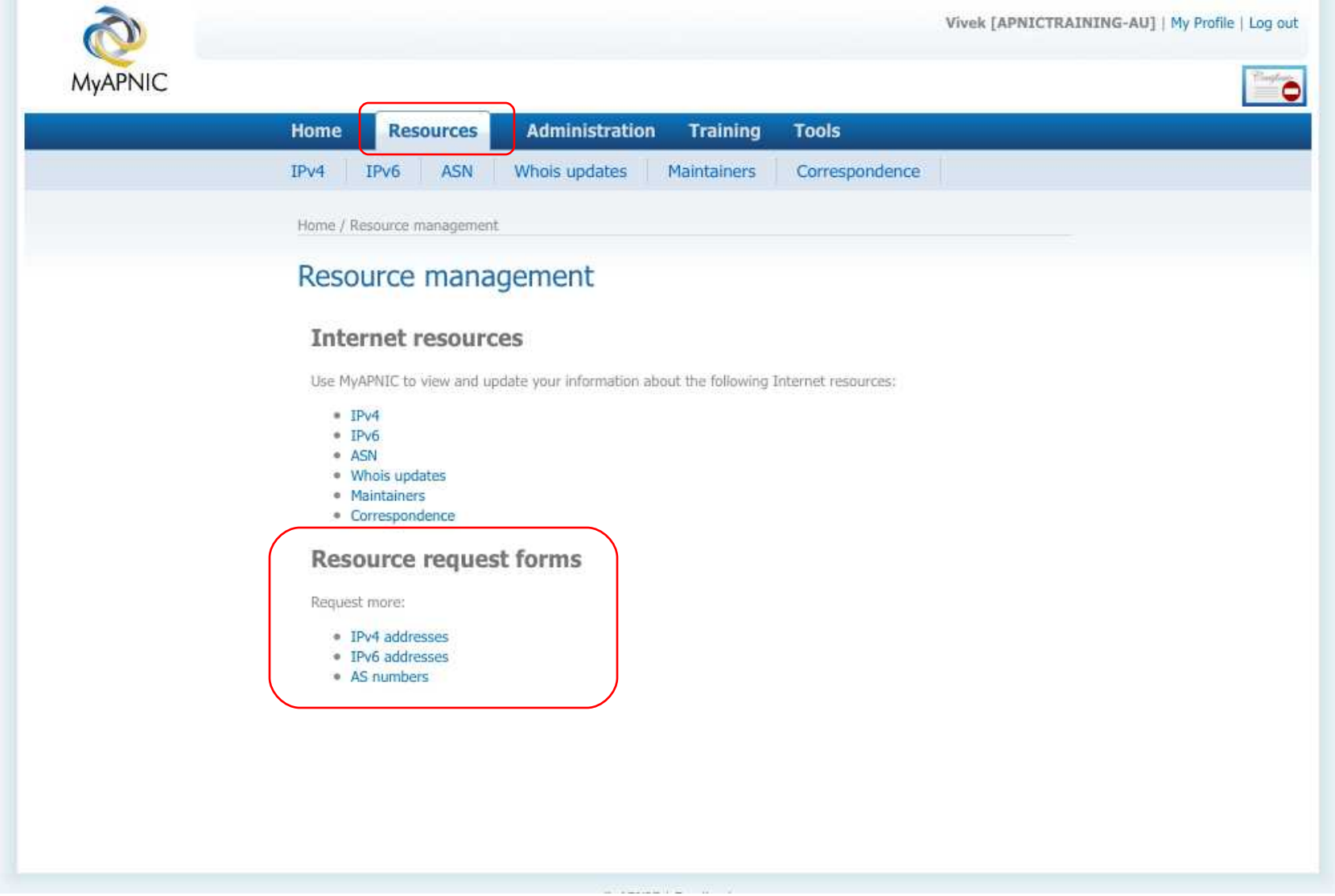
# Manage your membership



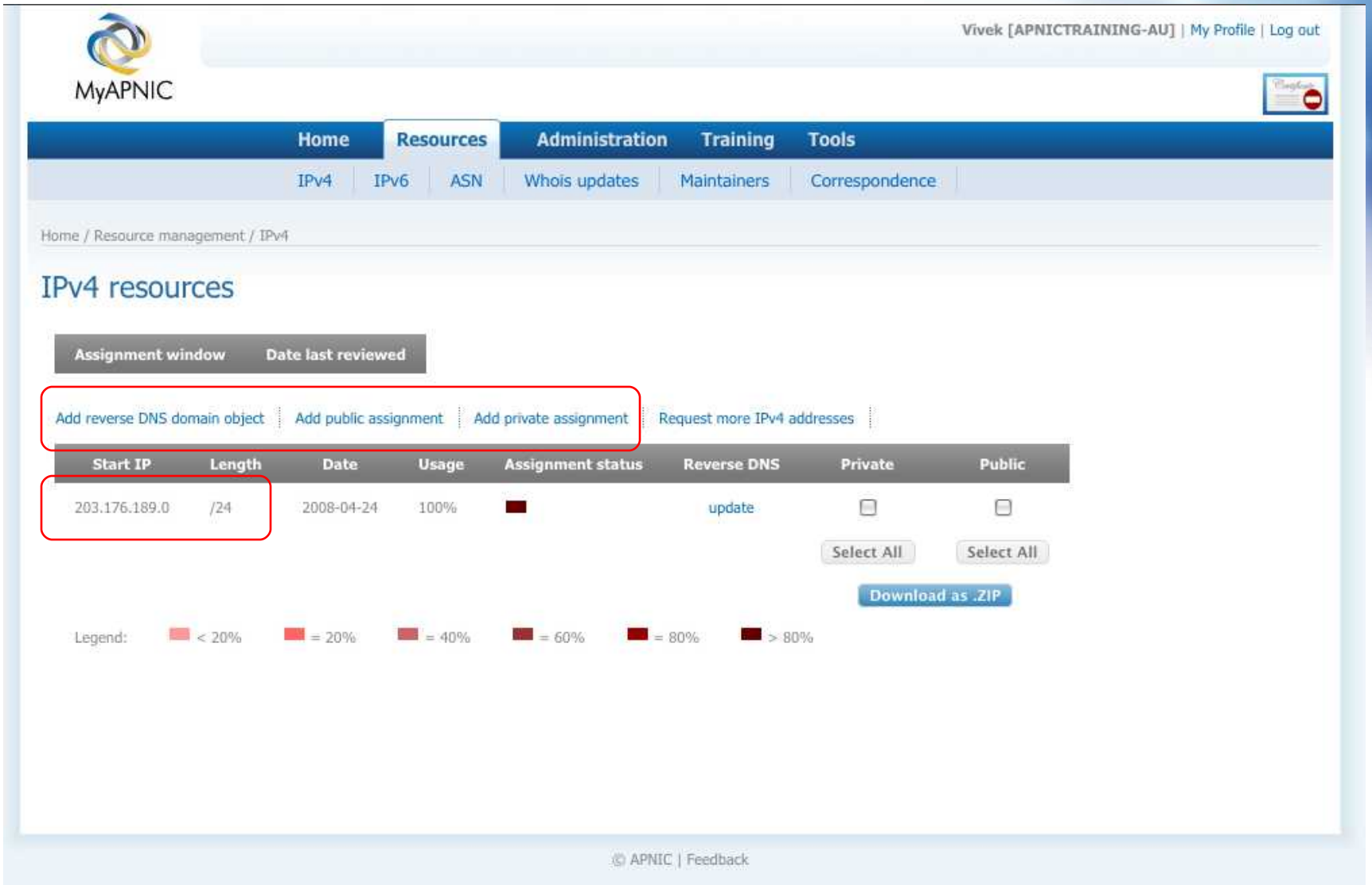
# Update contact details



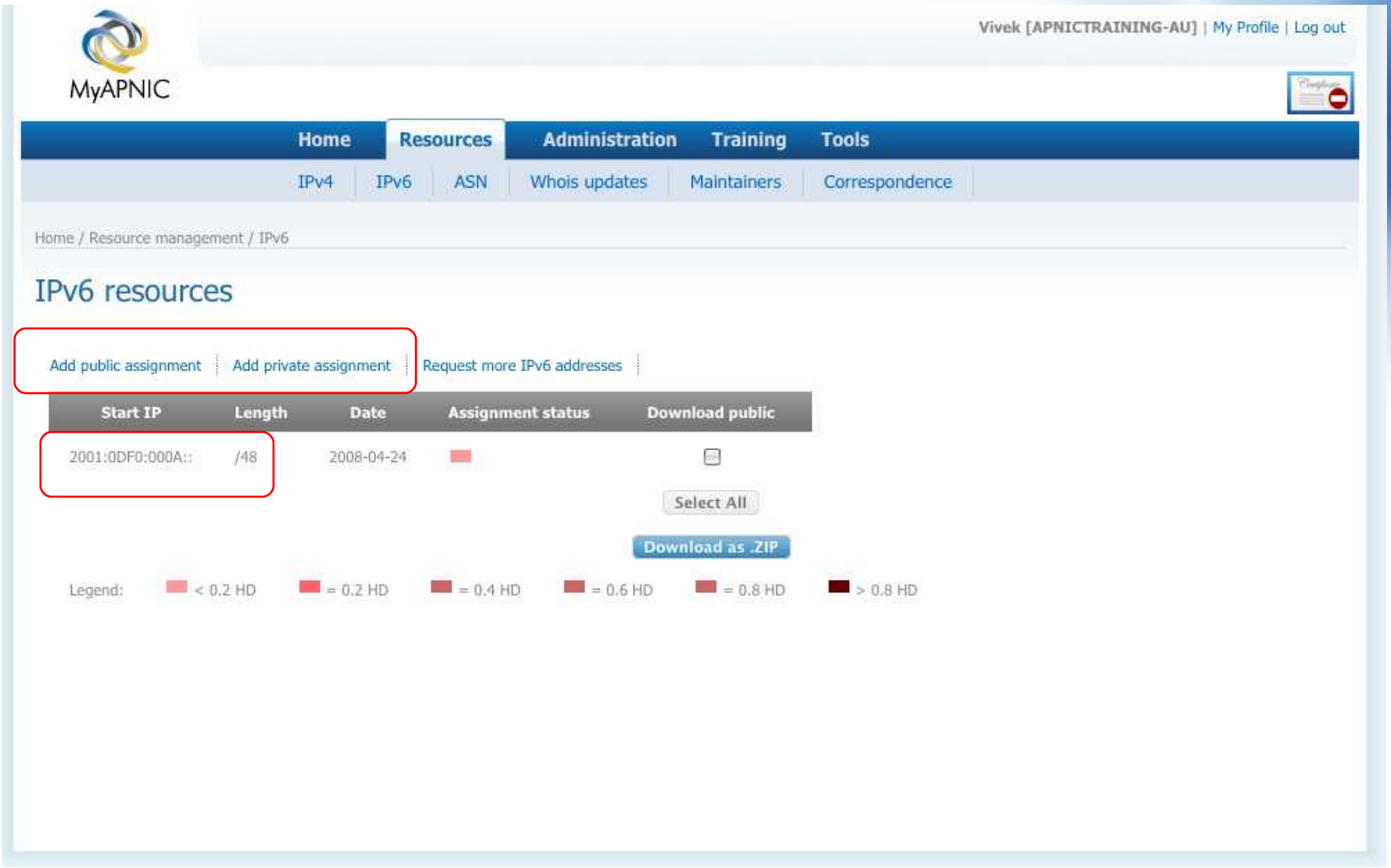
# Manage Internet Resources



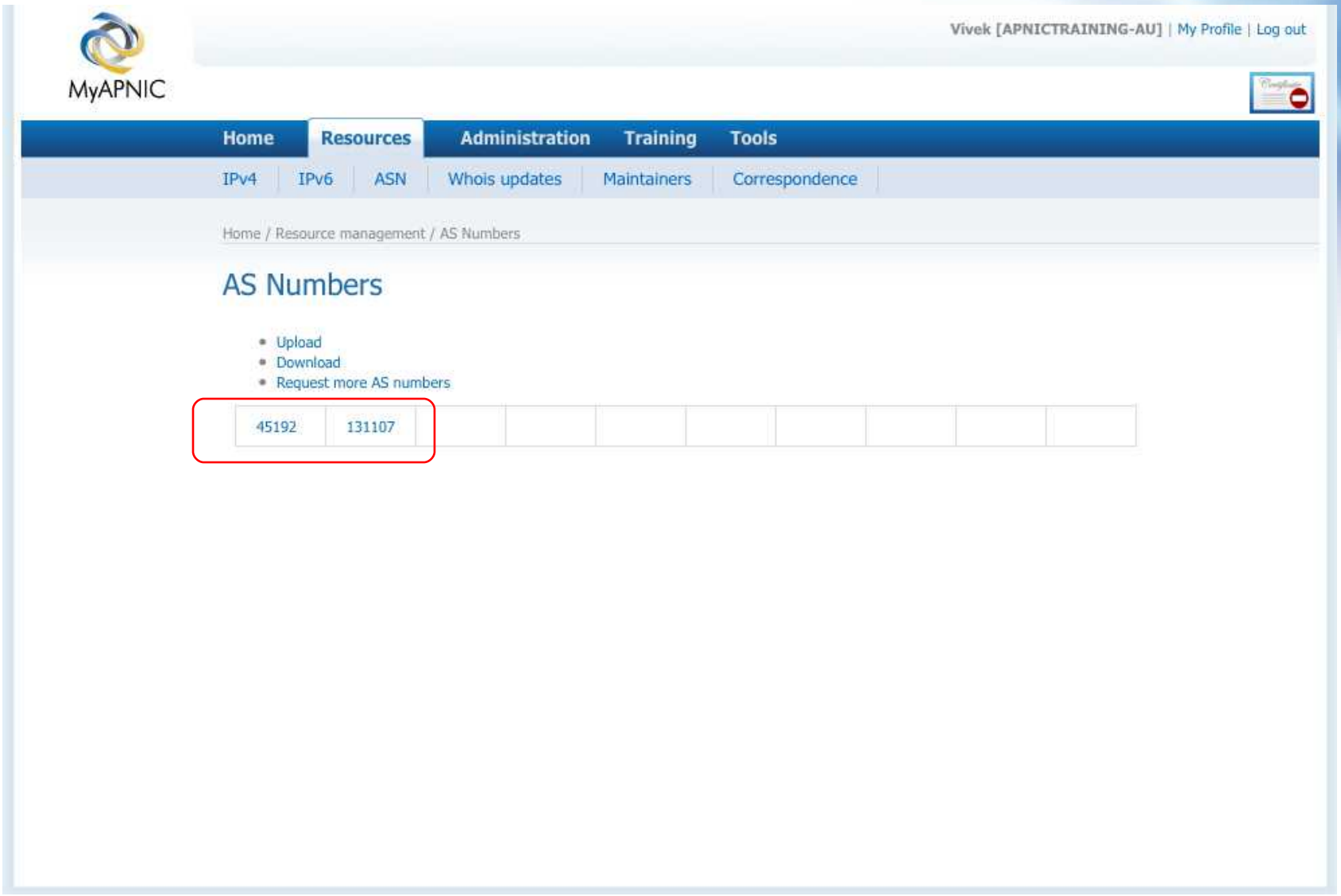
# IPv4 Resources



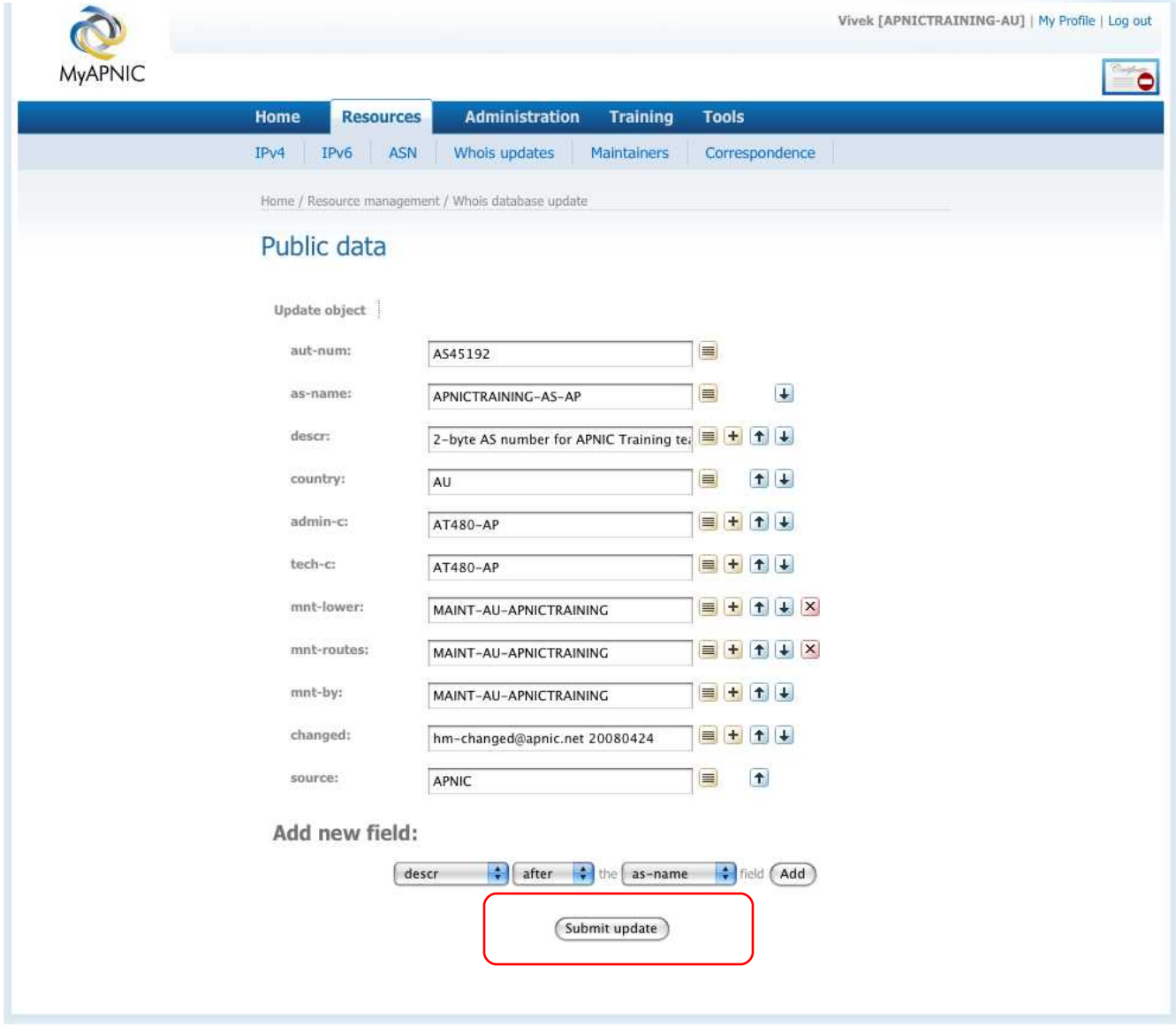
# IPv6 Resources



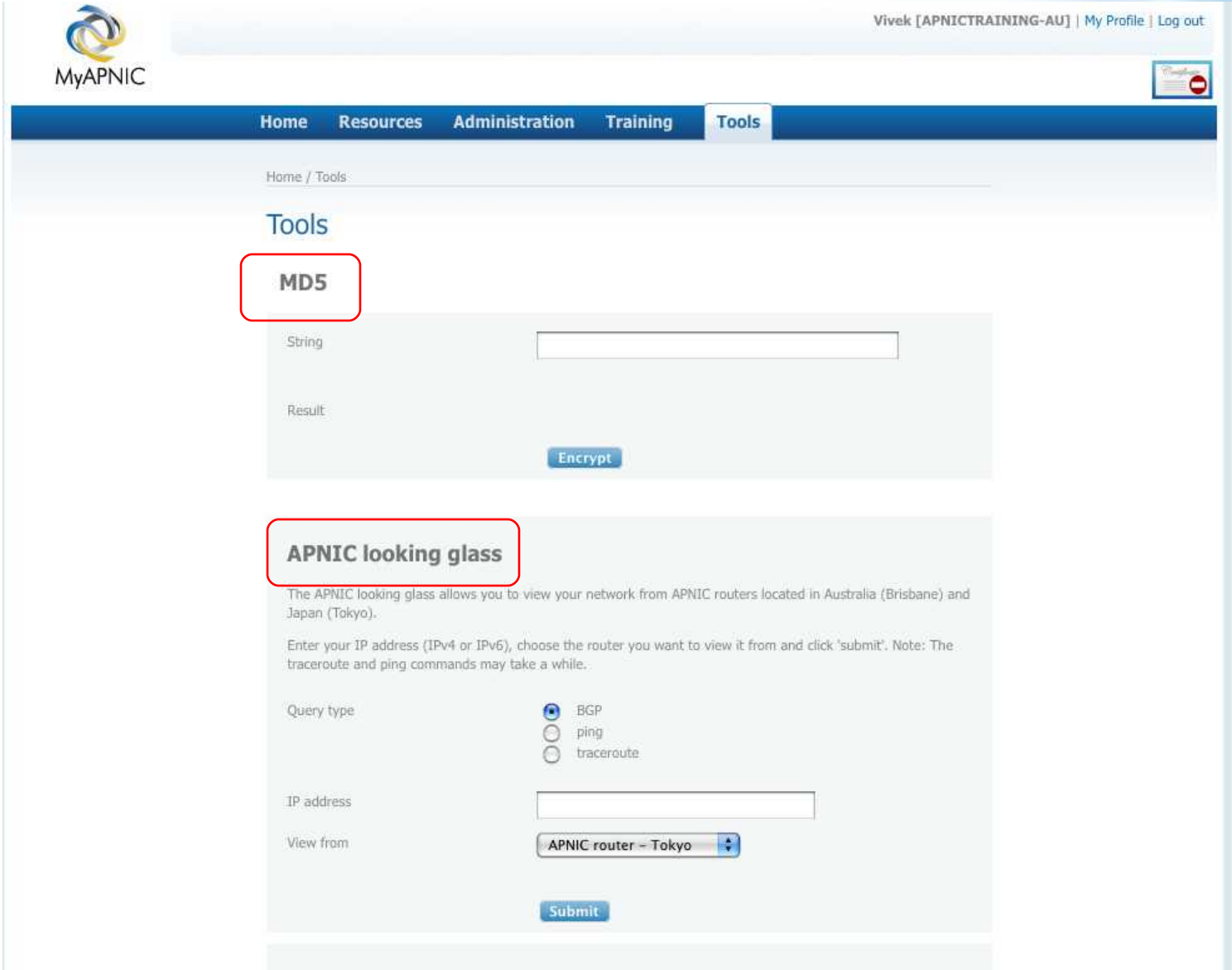
# AS number Resources



# AS number Resources



# Useful tools



# 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)

# Questions?

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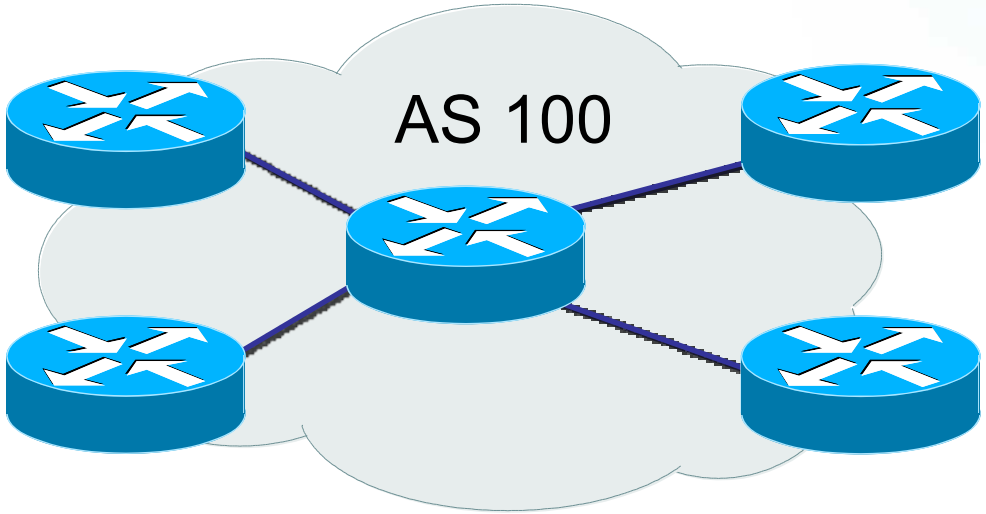
  - Second opinion request
  - APNIC whois database
  - MyAPNIC (Demo)
  - **Autonomous System Number (ASN)**
  - Reverse DNS
  - APNIC Helpdesk

# What is an Autonomous System?

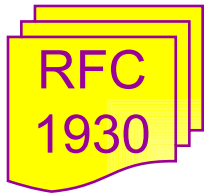



- Collection of networks with same routing policy
- Usually under single ownership, trust or administrative control

# 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

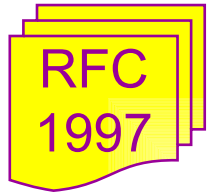
RFC1930: Guidelines for creation, selection and registration of an Autonomous System



# 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”
1. 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

# 4 byte AS Numbers

# Background

- Previously 2 byte ASN (16 bits)
  - Possibly run into exhaustion by 2010
  - 4 byte ASN was developed by IETF
- Currently 4 byte ASN distribution policy (32 bits)

- Timeline
  - July 1 2009: Default 4 byte ASN, 2 byte ASN on request with documented justification
  - Jan 2010: 4 byte ASN only

# 4 Byte AS number

- 2-byte only AS number range 0 – 65535
  (decimal range 0- 65,535)

- 4-byte only AS number range 1.0 - 65535.65535
  (decimal range 65,536 - 4,294,967,295)

- AS number representation
  - AS DOT
  - AS PLAIN

# 4 Byte AS number

- AS number representation
  - **AS DOT**
  - Based upon 2-Byte AS representation
  - <Higher2bytes in decimal> . <Lower2bytes in decimal>
  - For example: AS 65546 is represented as 1.10
  - Easy to read, however hard for regular expressions
  - There is a meta character “.” in regular expression
  - i.e For example, a.c matches "*abc*", etc., but [a.c] matches only "*a*", "*.*", or "*c*".

# 4 Byte AS number

- AS number representation
  - **AS PLAIN**
  - ASPLAIN IETF preferred notation
  - 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 (0 – 65535 - 65,536 - 4,294,967,295)

# 4 Byte AS number

APNIC resource range:

- In AS DOT: 2.0 ~ 2.1023
- In AS PLAIN: 131072 ~ 132095

AS number converter

**http://submit.apnic.net/cgi-bin/convert-asn.pl**

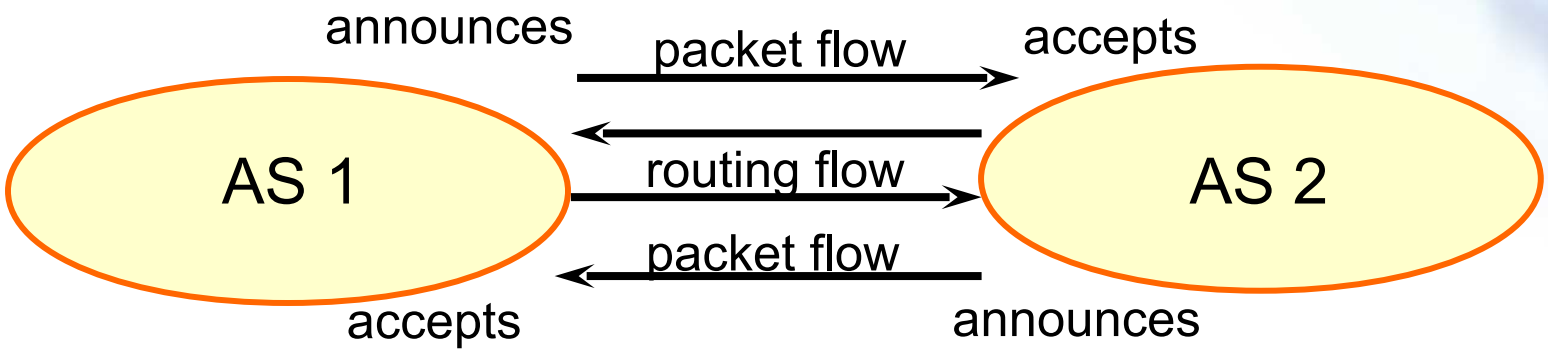
# Aut-num object example

| | |
|---|---|
| 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 |

POLICY RPSL

# Representation of routing policy

- Routing and packet flows

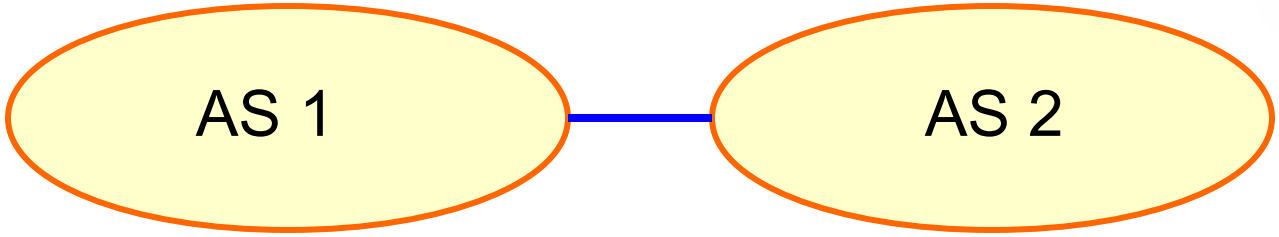



For AS1 and AS2 networks to communicate

- 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

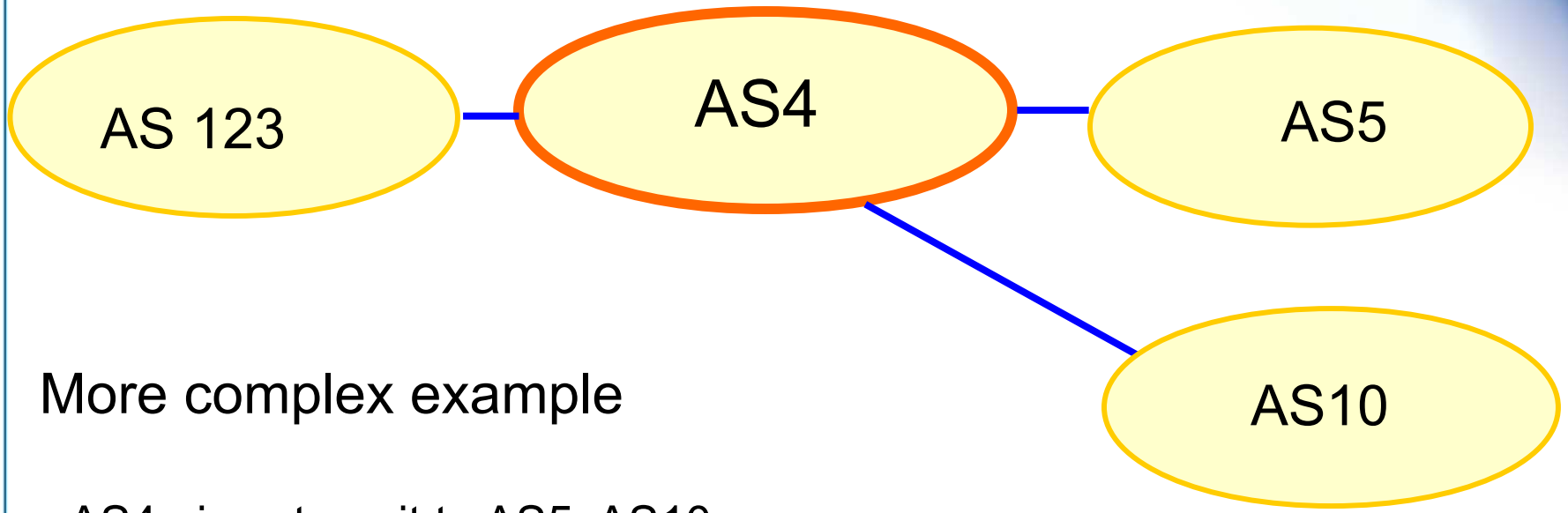



*"action pref" - the lower the value, the preferred the route*

```
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
```

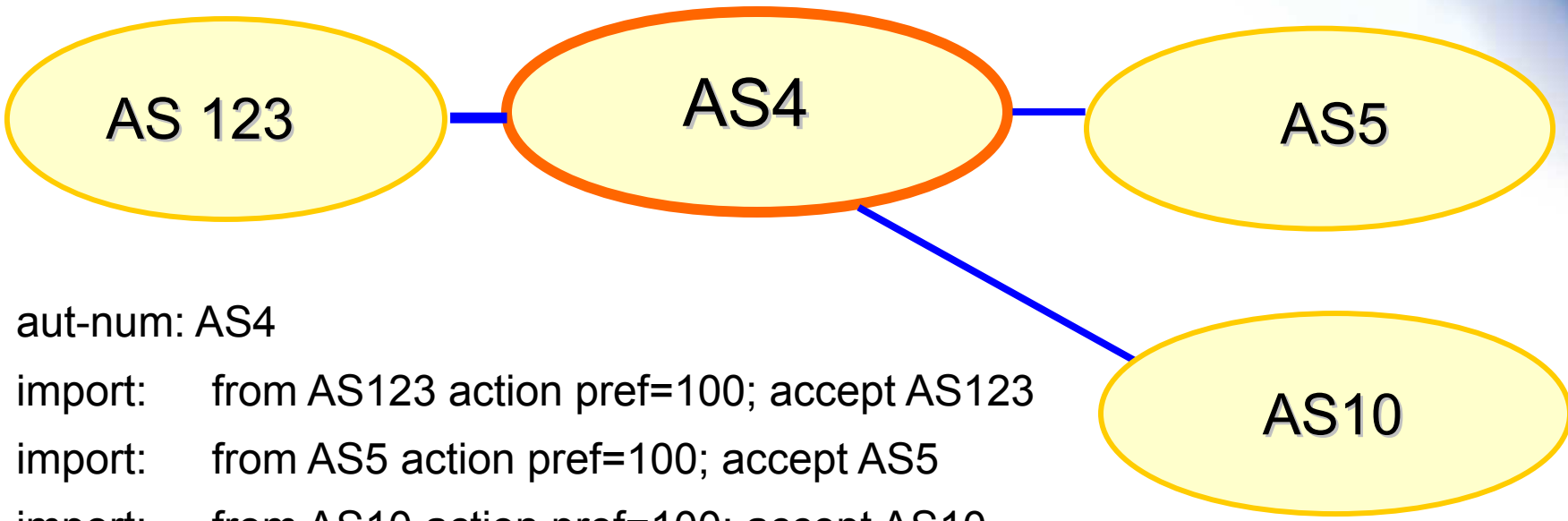
# Representation of routing policy




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

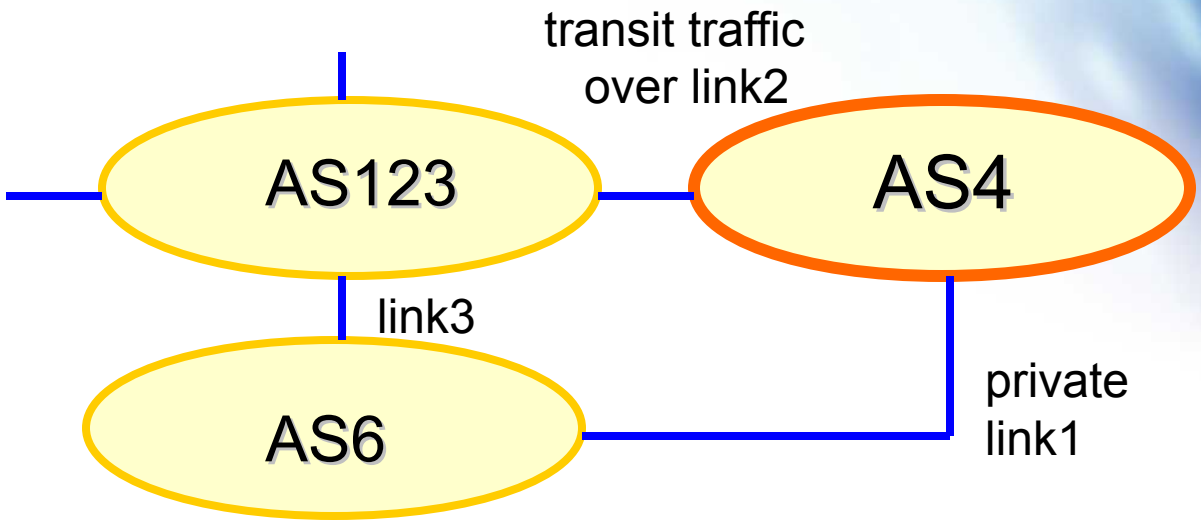
import: from AS10 action pref=100; accept AS10

export: to AS123 announce AS4

export: to AS5 announce AS4 AS10

export: to AS10 announce AS4 AS5 ← *Not a path*

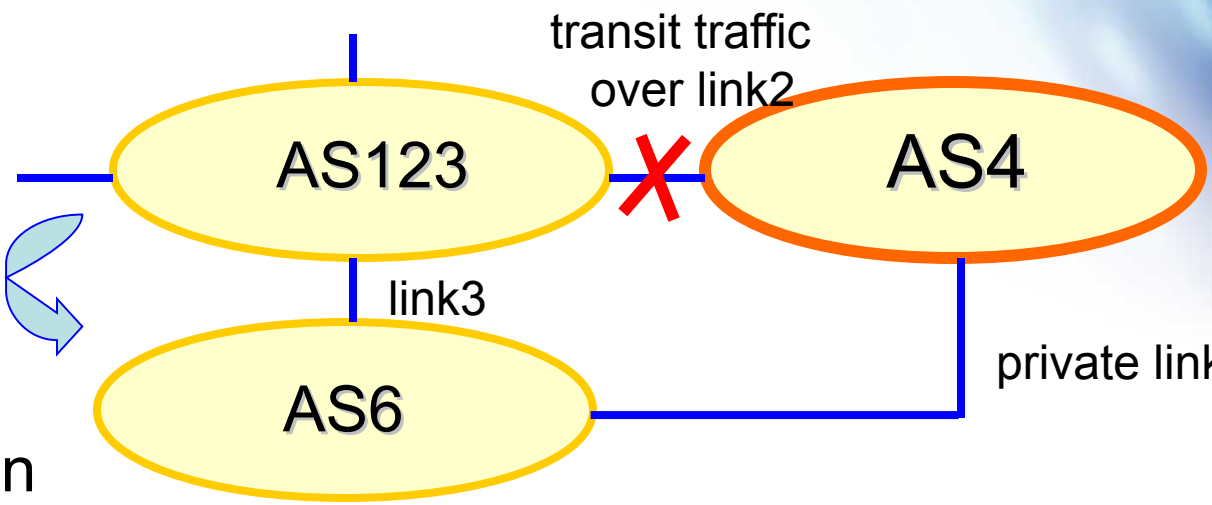
# Representation of routing policy




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




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*

# Questions?

# Overview

- IRMe
  - Introduction to APNIC
  - APNIC policy development process
  - Internet registry policies
  - IP address request (Demo)
  - Second opinion request
  - IPv6 Overview
  - APNIC whois database
  - MyAPNIC (Demo)
  - Autonomous System Number (ASN)
  - **Reverse DNS**
  - APNIC helpdesk

# Reverse DNS - why bother?

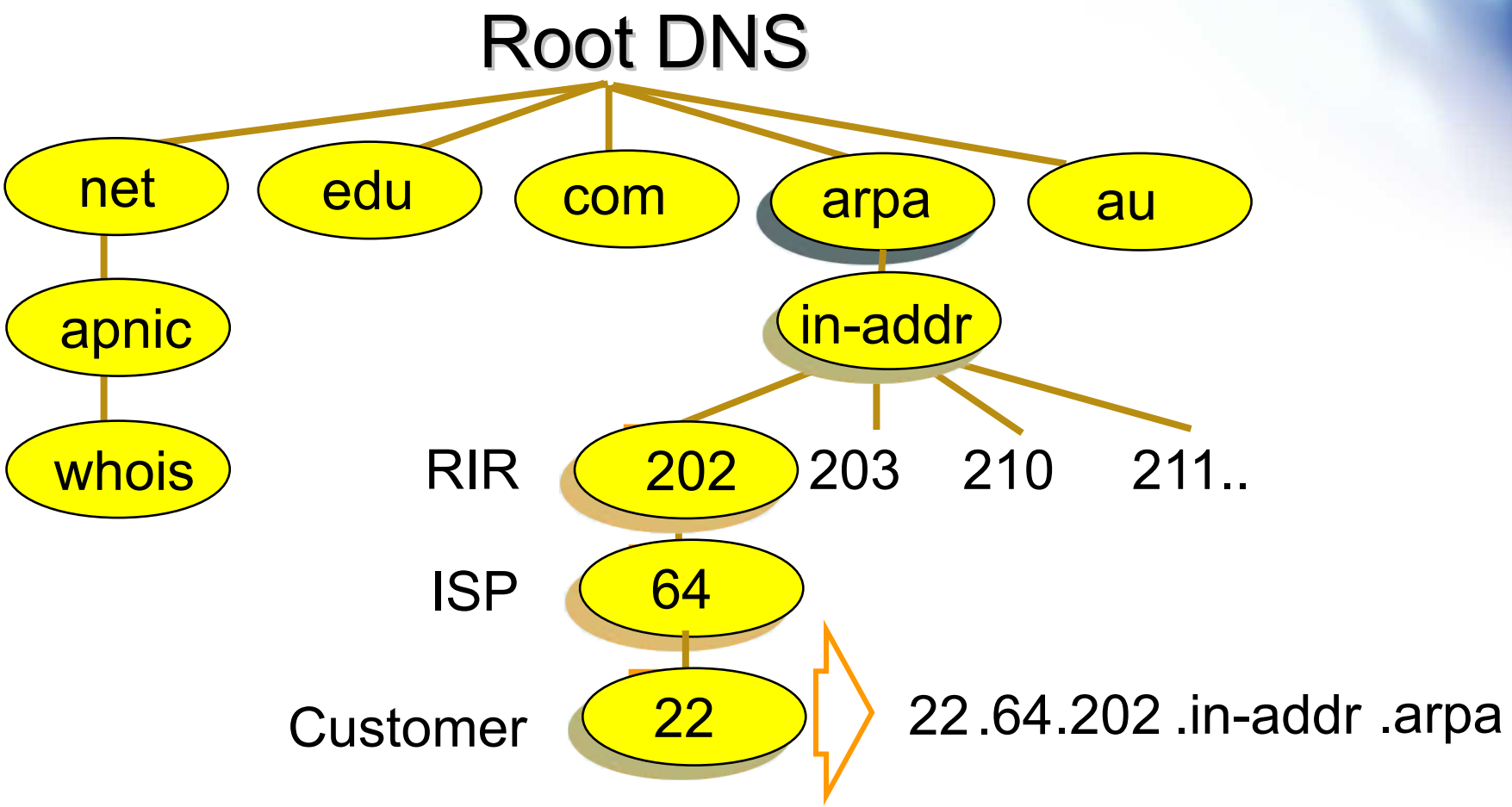
- Service denial
  - That only allow access when fully reverse delegated eg. anonymous ftp
- Diagnostics
  - Assisting in trace routes etc
- Spam identification
- Registration
  - Responsibility as a member and Local IR

# 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

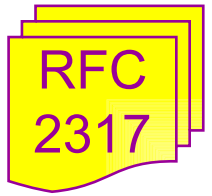
# Principles – DNS tree

*- Mapping numbers to names - 'reverse 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”



# 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.
```

# 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

- IRMe
  - Introduction to APNIC
  - APNIC policy development process
  - Internet registry policies
  - IP address request (Demo)
  - Second opinion request
  - IPv6 Overview
  - APNIC whois database
  - MyAPNIC (Demo)
  - Autonomous System Number (ASN)
  - Reverse DNS
  - **APNIC helpdesk**

# Member Services Helpdesk


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

## Helpdesk hours

9:00 am - 7:00 pm (AU EST, UTC + 10 hrs)

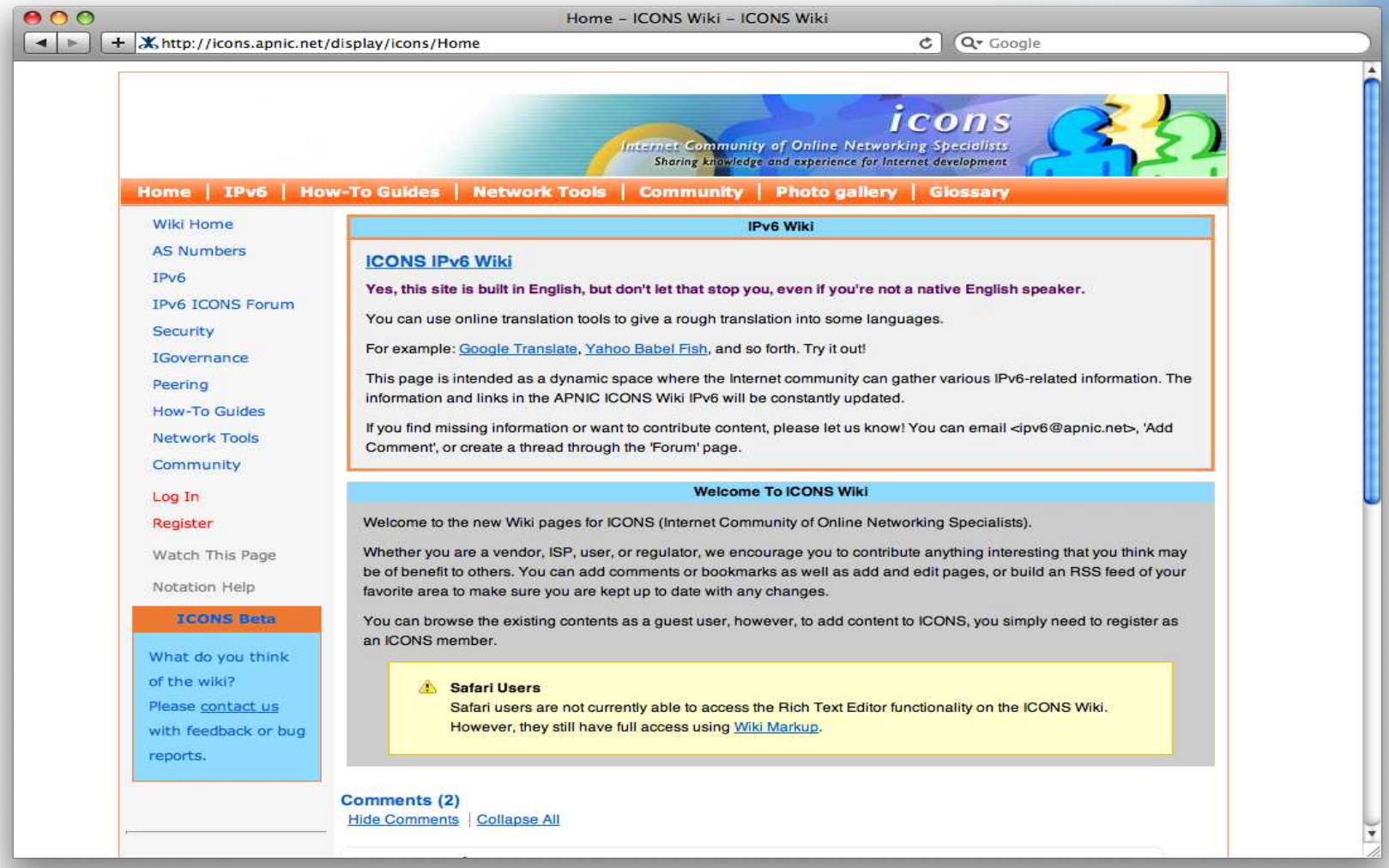
**ph: +61 7 3858 3188** **fax: 61 7 3858 3199**

- ***More personalised service***
  - Range of languages:
    Cantonese, Filipino, Mandarin, Thai, Vietnamese etc.

- ***Faster response and resolution of queries***
  - IP resource applications, status of requests, obtaining help in completing application forms, membership enquiries, billing issues & database enquiries

# APNIC Helpdesk Chat

# ICONS



# Questions?

# Training Survey

- http://www.tiny.cc/apnictrainingsurvey

# Thank you!