Asia Pacific Network Information Centre

APNIC

APRICOT 2003 Taipei

# Welcome!
# APNIC Members Training Course

*Effective IP Address Management*
*Asia Pacific Policies and Procedures*

24 February 2003, Taipei, Taiwan
APNIC 15 Open Policy Meeting

# Introduction

- Presenters
  - Miwa Fuji
    - Training Officer
  - Narumon Sribudsayadee
    - Internet Resource Analyst
  - Nurani Nimpuno
    - Training Development Officer
  - Sunny Chendi
    - Internet Resource Analyst

<training@apnic.net>

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Assumptions & Objectives

## Assumptions

- Are current or prospective APNIC member
- Have not submitted many requests
- Are not familiar / up-to-date with policies
- Are not familiar with procedures

## Objectives

- Teach members how to request resources from APNIC
- Keep membership up-to-date with latest policies
- Liaise with members
  - ☺ Faces behind the e-mails

# Schedule

- Introduction (5)
- Policies (15)
- Whois Db Intro (38)

TEA BREAK
(10:30 – 11:00)

- Addressing Plan (65)
- ISP Request form (81)
- ISP Request evaluation (110)

LUNCH (12:30 – 13:30)

- IP Management (123)
- 2nd Opinion Request (137)
- DB protection & updates (158)
- Reverse DNS (177)

TEA BREAK
(15:30 – 16:00)

- DB admin & adv queries (201)
- ASN (218)
- IPv6 (238)
- Summary (263)

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# Introduction to APNIC

Asia Pacific Network Information Centre

# What is APNIC?

- RIR for the Asia Pacific
  - Regional Internet Registry
  - Regional authority for Internet Resource distribution
  - IPv4 & IPv6 addresses, ASNs, reverse dns delegation
- Industry self-regulatory body
  - Non-profit, neutral and independent
- Open membership-based structure

# APNIC Services & Activities

## Resources Services

- IPv4, IPv6, ASN, reverse DNS
- Policy development
  - Approved and implemented by membership
- APNIC whois db
  - whois.apnic.net
  - Registration of resources

## Information dissemination

- APNIC meetings
- Web and ftp site
- Mailing lists
  - Open for anyone!
- Training Courses
  - Subsidised for members
- Co-ordination & liaison
  - With membership, other RIRs & other Internet Orgs.

# Questions ?

- Want to learn more about APNIC and the APNIC meetings?
  - *Come to the newcomers' orientation this evening at 18.00!*

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# Internet Registry Allocation and Assignment

Policies

# Overview of APNIC policies

- Definitions
- Background
- Objectives
- Environment
- Allocation & Assignment Policies
- Summary

Asia Pacific Network Information Centre
APNIC

# Allocation and Assignment

## Allocation

*"A block of address space held by an IR (or downstream ISP) for subsequent allocation or assignment"*

- Not yet used to address any networks

## Assignment

*"A block of address space used to address an operational network"*

- May be provided to LIR customers, or used for an LIR's infrastructure ('self-assignment')

Asia Pacific Network Information Centre
APNIC

# Allocation and Assignment

APNIC
*Allocates*
to APNIC Member

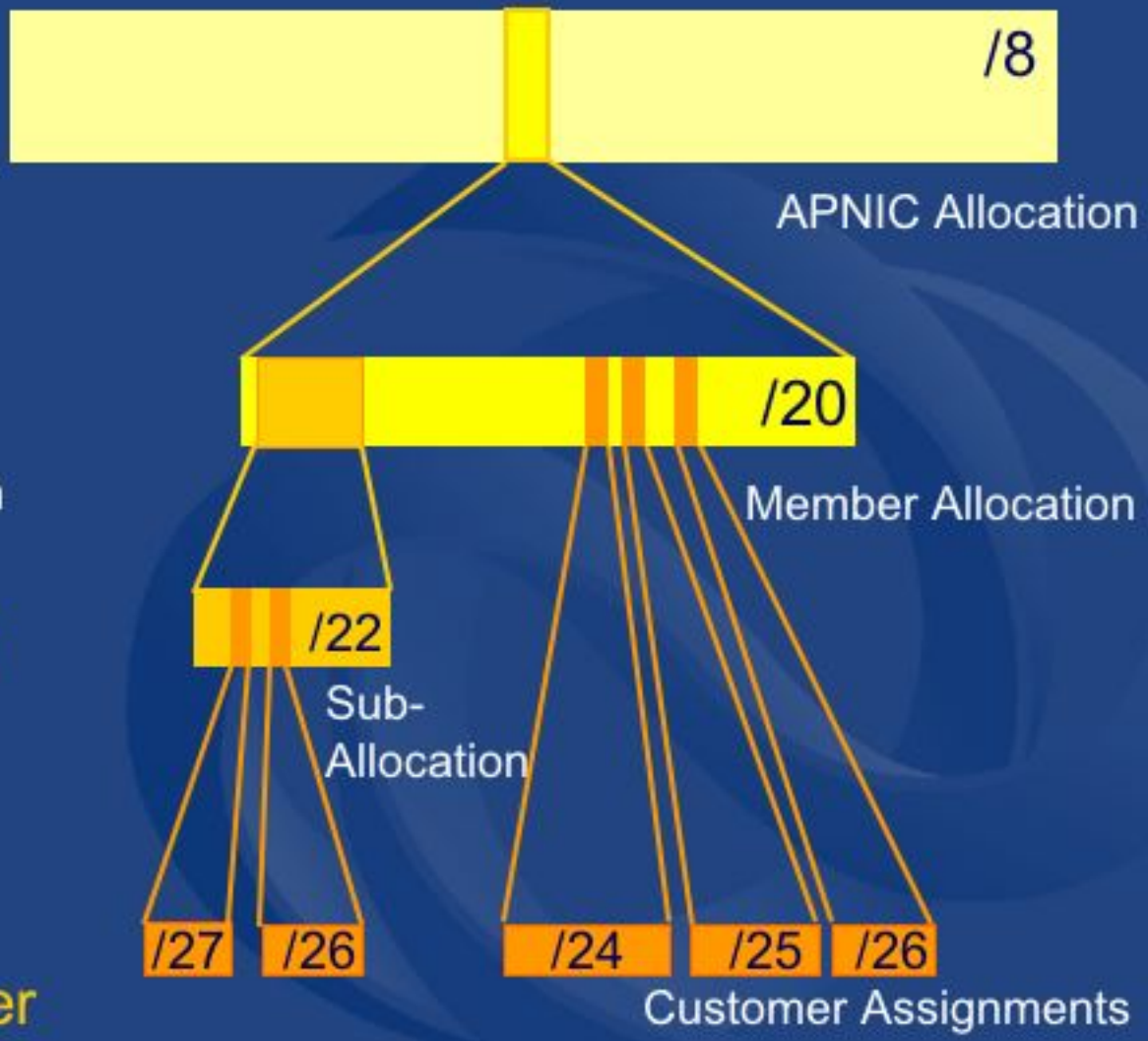
APNIC Member

*Assigns*
to end-user

*Allocates*
to downstream

Downstream
*Assigns*
to end-user

Customer / End User



# Portable & non-portable

## Portable Assignments

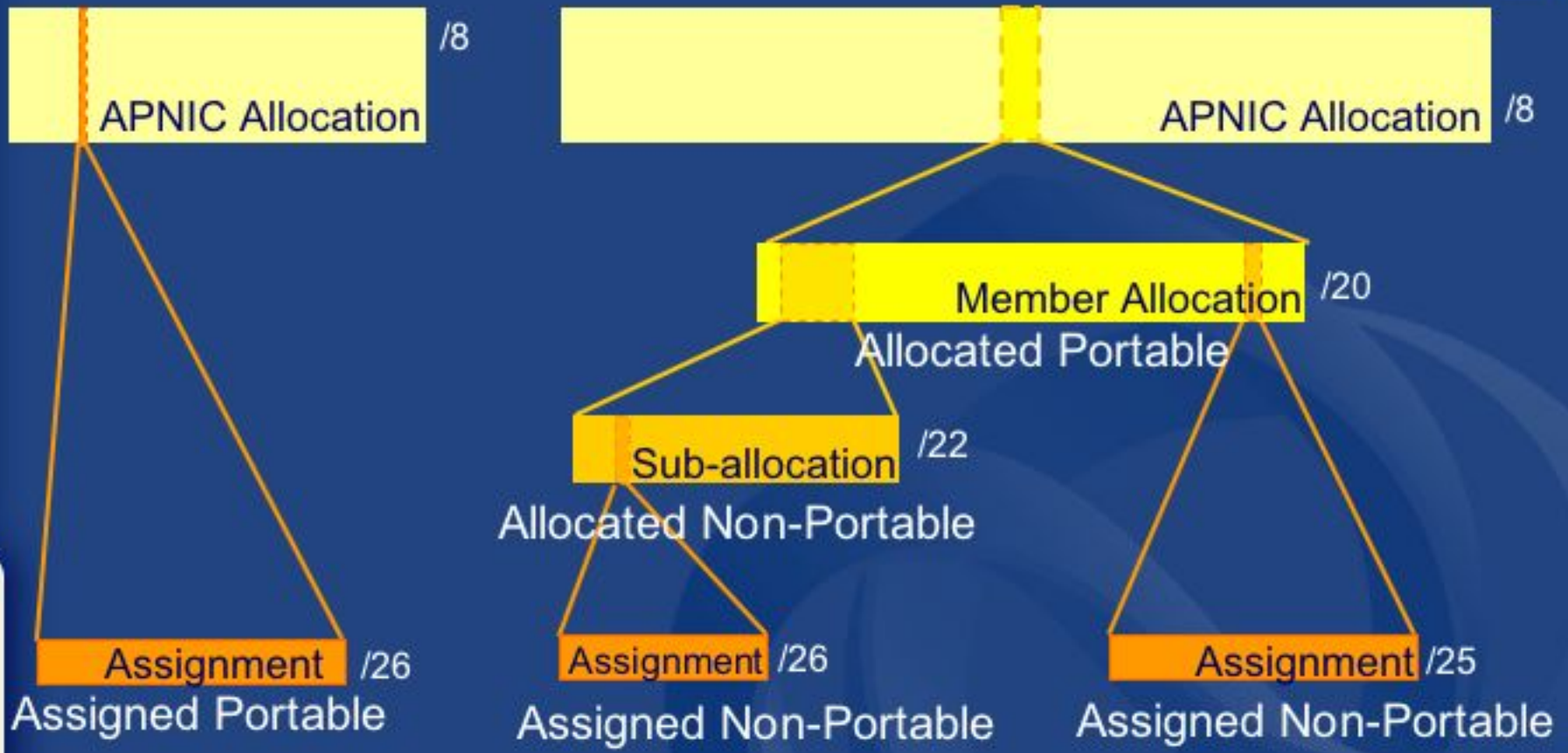
- Customer addresses independent from ISP
  - Keeps addresses when changing ISP
- Bad for size of routing tables ☹
- Bad for QOS: routes may be filtered, flap-dampened

## Non-portable Assignments

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

Asia Pacific Network Information Centre
APNIC

# Allocation & assignment terms




- Terms used in 'status' field in the APNIC database
- Describes "portability" of the address space

Asia Pacific Network Information Centre
APNIC

# Classful and Classless

- Classful *(Obsolete)*
  - Wasteful address architecture
    - network boundaries are fixed at 8, 16 or 24 bits (class A, B, and C)
- **Classless**
  - Efficient architecture
    - network boundaries may occur at any bit (e.g. /12, /16, /19, /24 etc)
- CIDR
    - Classless Inter Domain Routing architecture
  - Allows *aggregation* of routes within ISPs infrastructure

Best Current Practice

Asia Pacific Network Information Centre
APNIC

# Aggregation and "portability"

Asia Pacific Network Information Centre
APNIC

## Aggregation

BGP Announcement (1)

(Non-portable Assignments)

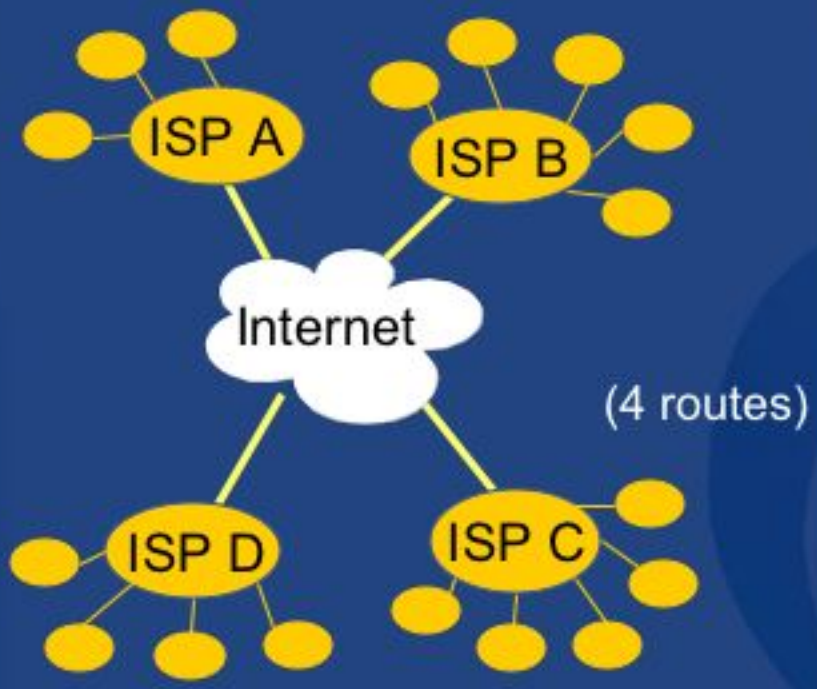
## No Aggregation

BGP Announcements (4)

(Portable Assignments)

# Aggregation and "portability"

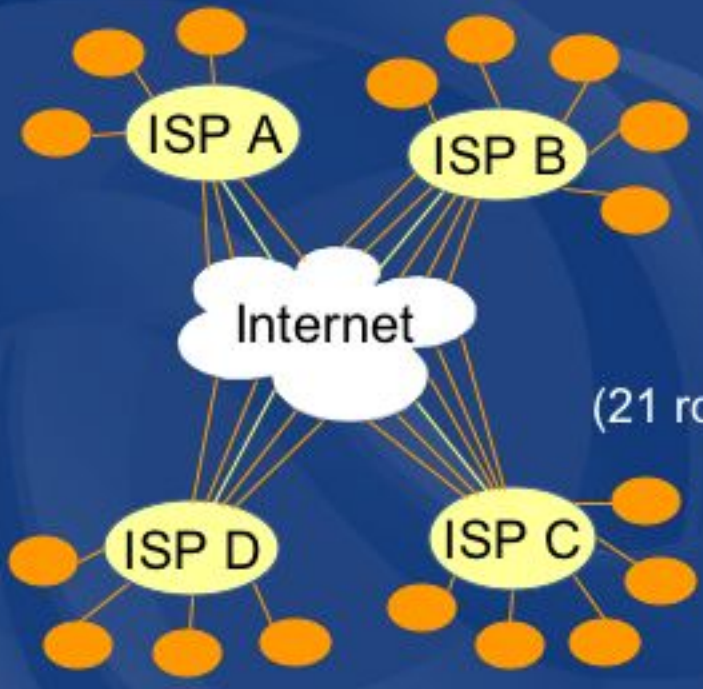
## Aggregation




(4 routes)

(Non-portable Assignments)

## No Aggregation




(21 routes)

(Portable Assignments)

# APNIC policies - objectives

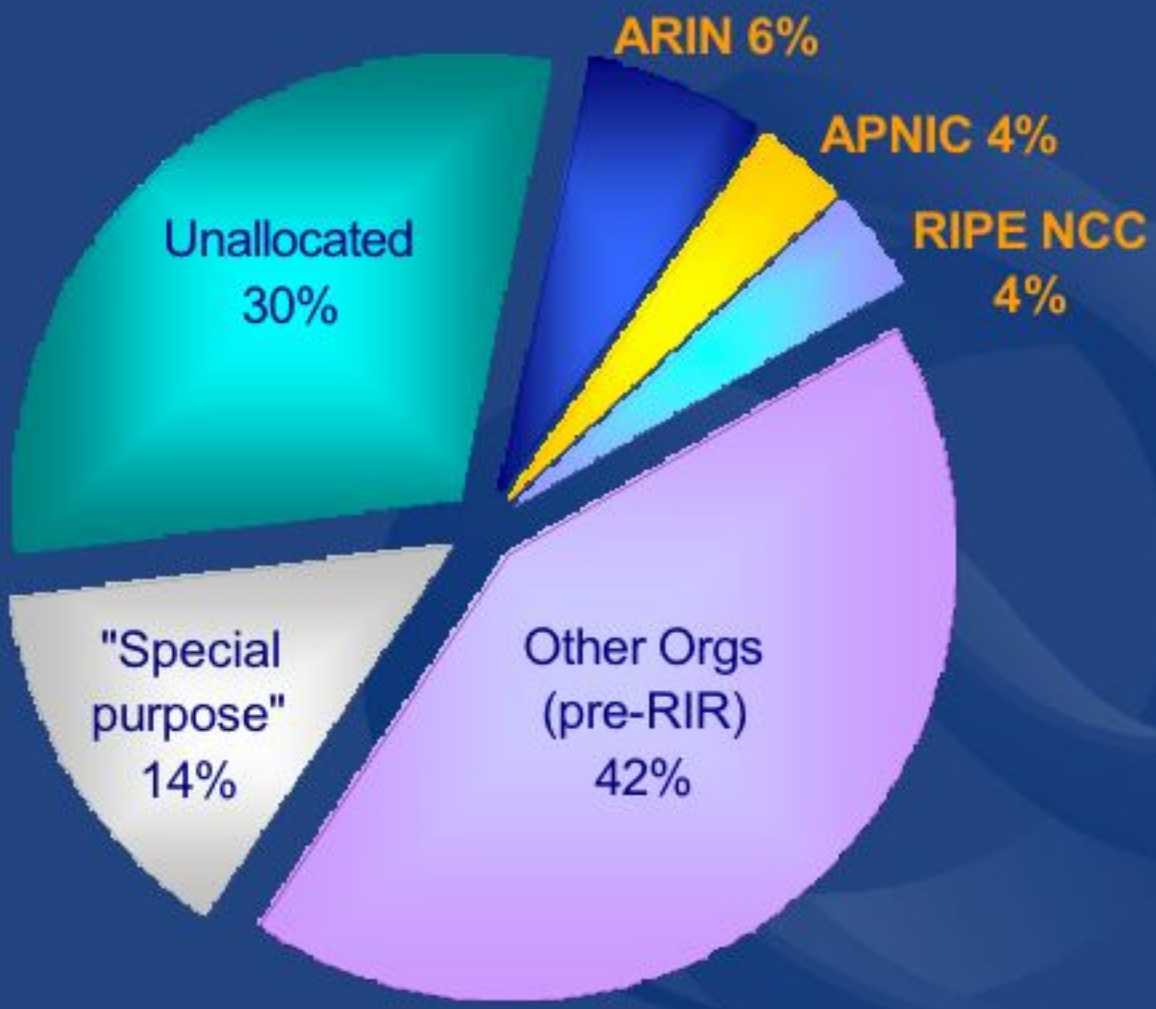
- Conservation
  - *Ensuring efficient use and conservation of resources*
- Aggregation
  - *Limiting growth of routable prefixes*
- Registration
  - *Registering the Internet resources in a public db*
- Uniqueness
  - *Global visibility*
- Fairness and consistency
  - *Equal consideration irrespective of external factors*

Asia Pacific Network Information Centre
APNIC

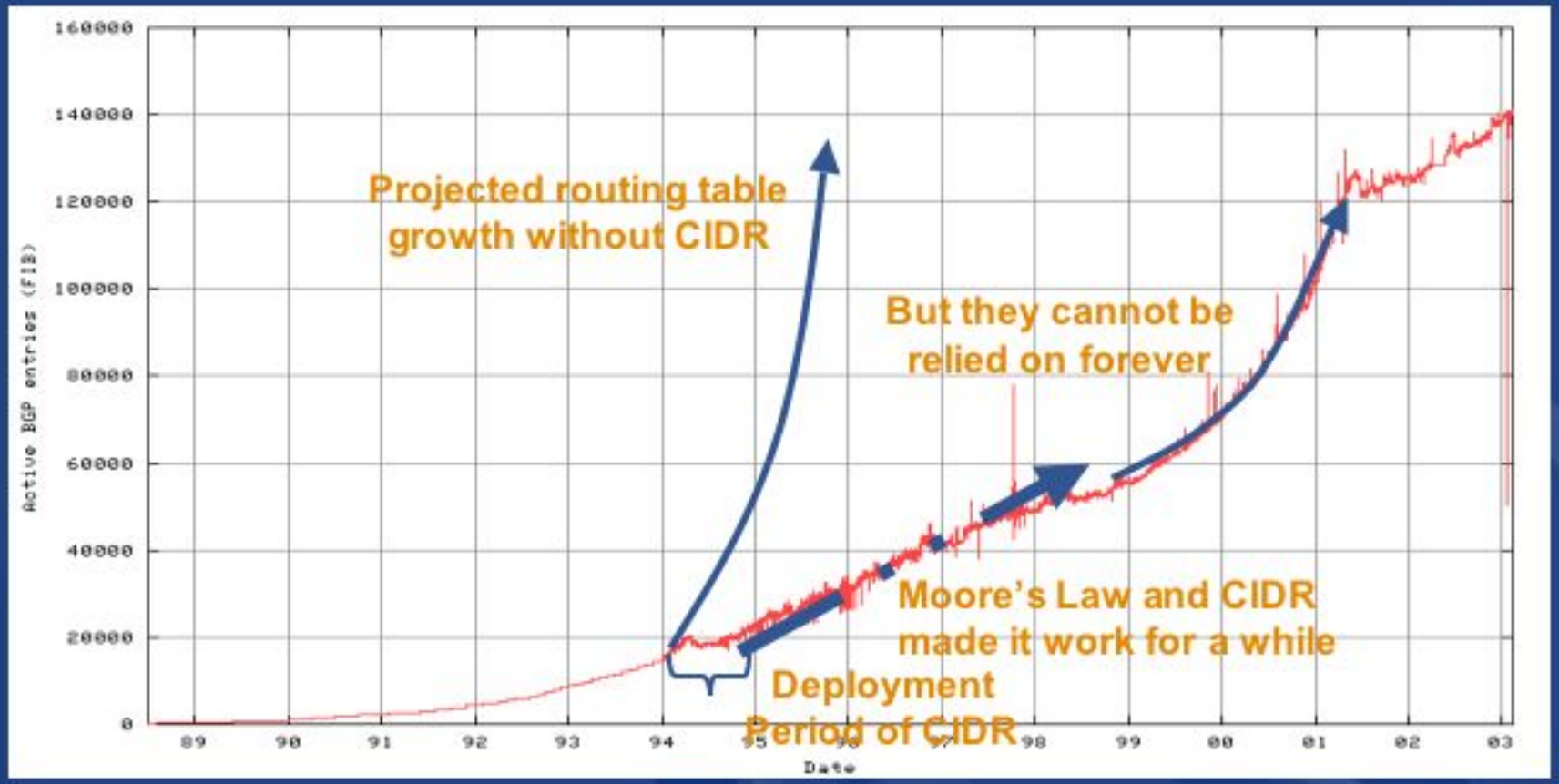
# Why do we need policies ?
## - Global IPv4 Delegations



Asia Pacific Network Information Centre
APNIC



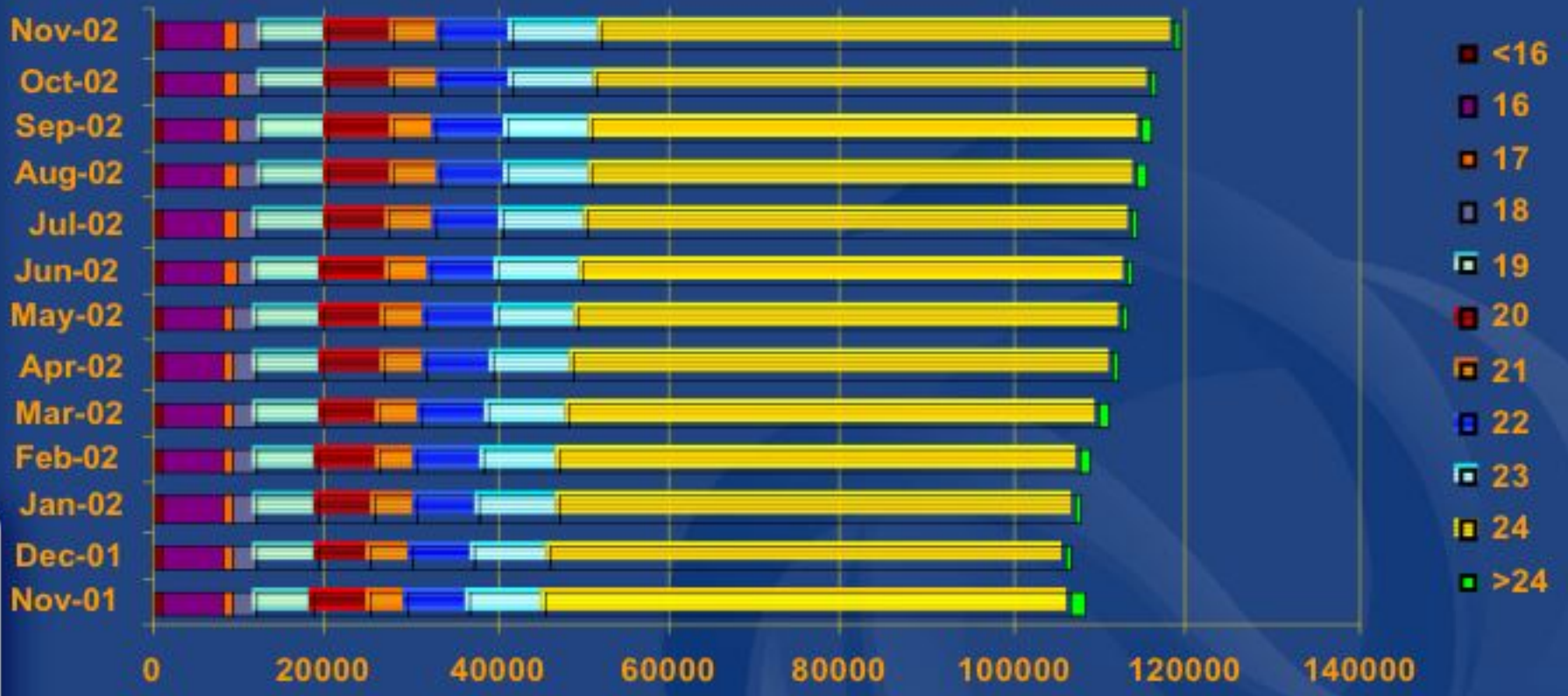
# Growth of global routing table




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

last updated 12 Feb 2003

# Routing table prefix distribution




Last updated 29 Nov 2002

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# 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

Asia Pacific Network Information Centre
APNIC

# 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

Asia Pacific Network Information Centre
APNIC

# Initial IPv4 allocation criteria

1a. Have used a /22 from upstream provider
- Demonstrated efficient previous address usage

OR

1b. Show immediate need for /22
- Can include customer projections & infrastructure equipment

2. Detailed plan for use of /21 within a year

3. Renumber to new space within 1 year
- Meet all policy requirements
  - Applicants may be required to show purchase receipts

Asia Pacific Network Information Centre
APNIC

# 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

Asia Pacific Network Information Centre
APNIC

# 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

Asia Pacific Network Information Centre
APNIC

# Small multihoming assignment policy

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
- Meet all policy requirements or have the assignment revoked

# IPv4 policy for IXPs

*IXPs can apply for an assignment of /24 for Transit LAN*

## Criteria

- 3 or more peers
- Demonstrate "open peering policy"
- Not announce assignment to global routing table

  - APNIC has a reserved block of space from which to make IXP assignments

Asia Pacific Network Information Centre
APNIC

# Portable assignments for critical infrastructure

- What is Critical Internet Infrastructure?
  - Domain registry infrastructure
    - Root DNS operators,
    - Generic Top Level Domain (gTLD) operators
    - Country Code Top Level Domain (ccTLD) operators
  - Address Registry Infrastructure
    - RIRs & NIRs
    - IANA
- Why a specific policy ?
    - Protect stability of core Internet function
- Assignment sizes:
  - IPv4: /24
  - IPv6: /32

New Policy
1 Dec 2002

Asia Pacific Network Information Centre
APNIC

# Questions ?

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# The APNIC Database

## Introduction and Usage

# Overview

- What is the APNIC database?
- Why use it?
- Database query
- Database updating process

Asia Pacific Network Information Centre
APNIC

# What is the APNIC database?

- Public network management database
  - Operated by IRs
- Tracks network resources
  - IP addresses, ASNs, Reverse Domains, Routing policies
- Records administrative information
  - Contact information (persons/roles)
  - Authorisation

Asia Pacific Network Information Centre
APNIC

# 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/

Asia Pacific Network Information Centre
APNIC

# 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:  [optional]   [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

Asia Pacific Network Information Centre
APNIC

# 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 |

Asia Pacific Network Information Centre
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
```

Asia Pacific Network Information Centre
APNIC

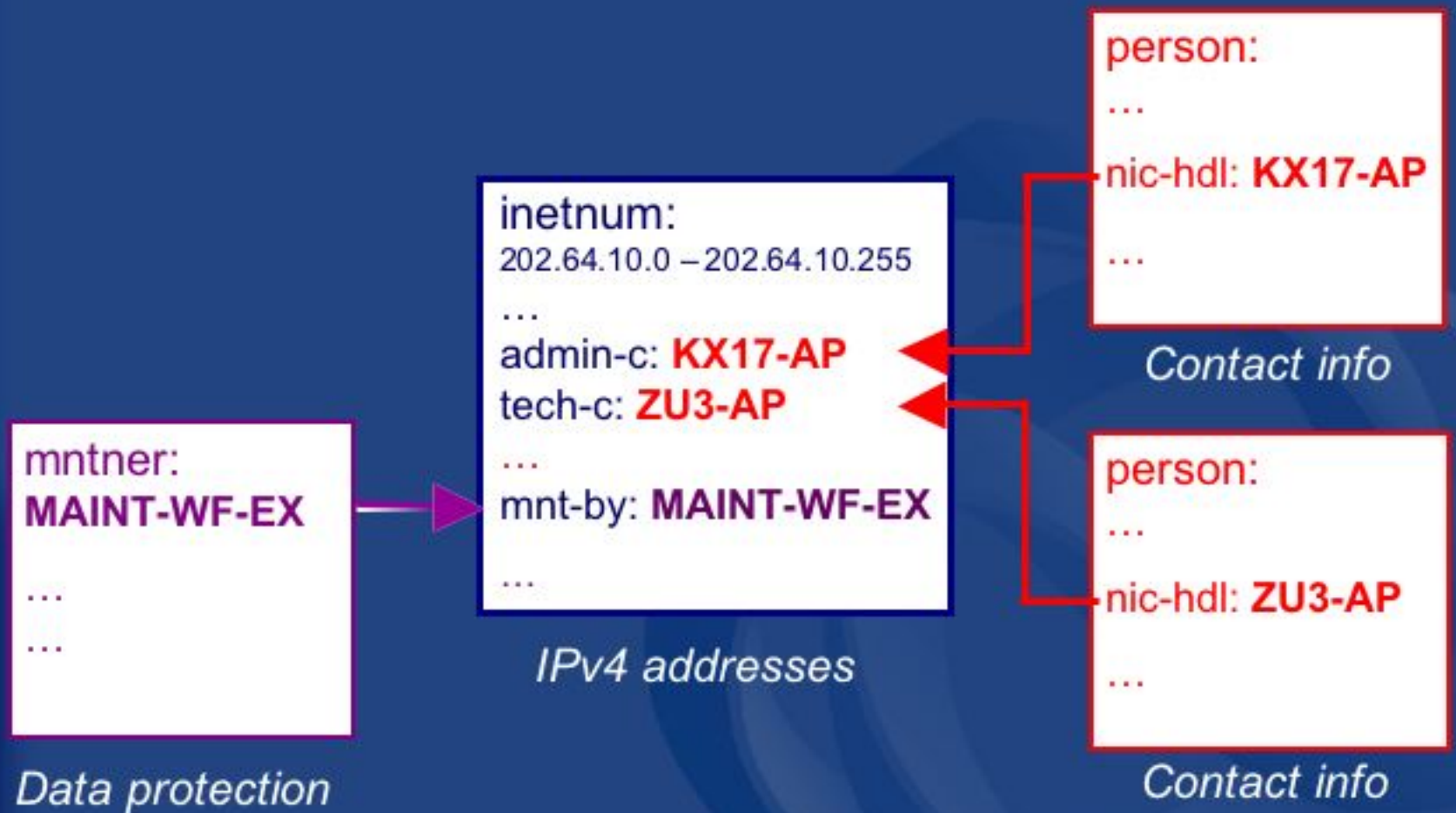
# Inetnum object example

– 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 |
| source: | APNIC |

Asia Pacific Network Information Centre
APNIC

# Inter-related objects



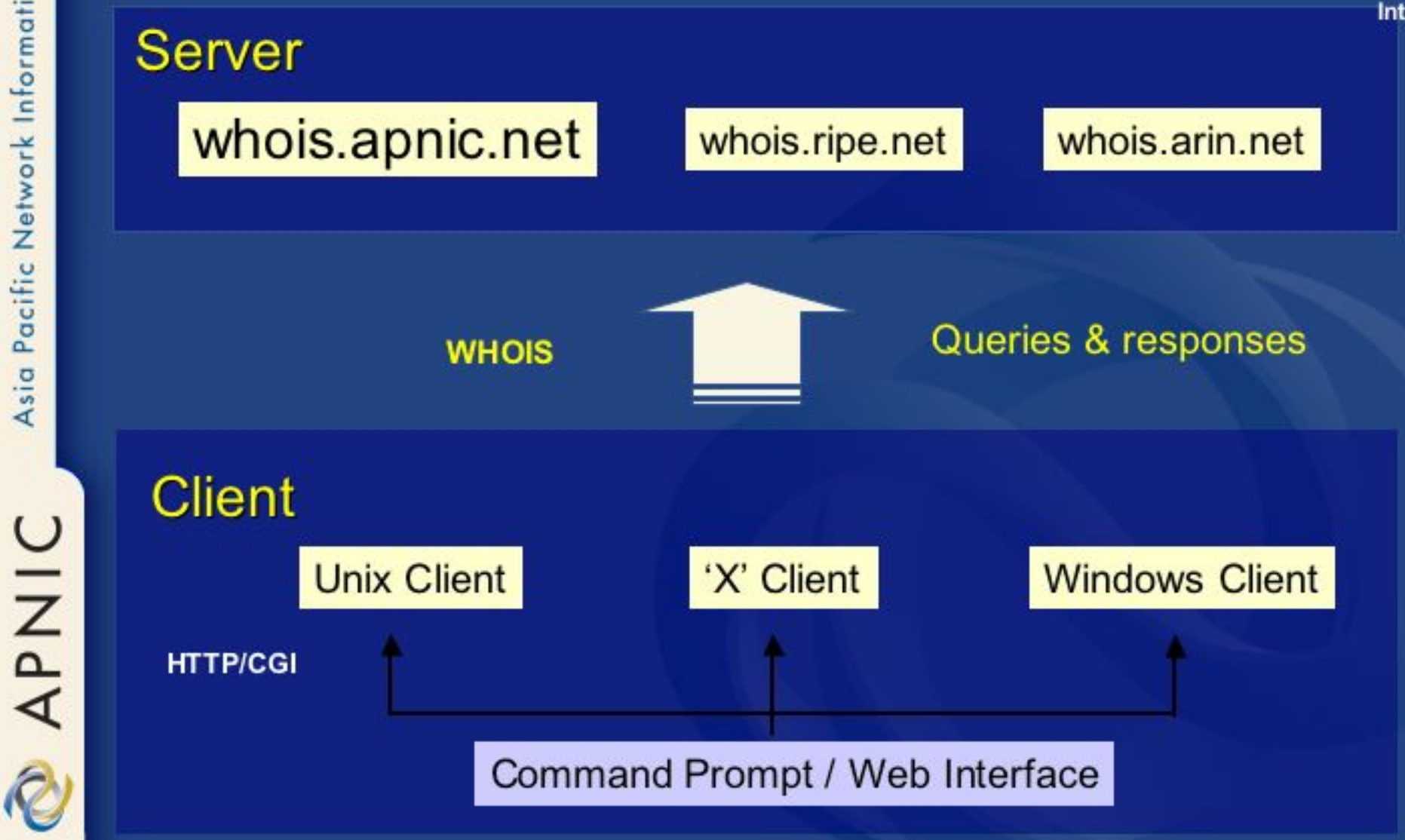

Asia Pacific Network Information Centre
APNIC

# Admin-c and tech-c

- Responsibility – 'admin' contacts
  - Legal authority
  - Technical management
  - Network planning, backbone design
  - Deployment, capacity, and upgrade planning
- Expertise - 'tech' contacts
  - Routing, aggregation, BGP, etc
  - Addressing, subnetting, CIDR, etc

Asia Pacific Network Information Centre
APNIC

# Database query - architecture




Asia Pacific Network Information Centre
APNIC

# 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

Asia Pacific Network Information Centre
APNIC

# Why use the database?

- Register use of Internet Resources
  - IP assignments, reverse DNS, etc
  - Ascertain custodianship of a resource
  - Fulfill responsibilities as resource holder
- Obtain details of technical contacts for a network
  - Investigate security incidents
  - Track source of network abuse or “spam” email

Asia Pacific Network Information Centre
APNIC

# Basic database queries

- Unix
  - whois –h whois.apnic.net <lookup key>
- Web interface
  - http://www.apnic.net/apnic-bin/whois2.pl
- Look-up keys
  - usually the object name
  - Check template for look-up keys

Asia Pacific Network Information Centre
APNIC

# Database query – look-up keys



Asia Pacific Network Information Centre
APNIC

| 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

# Database query - UNIX

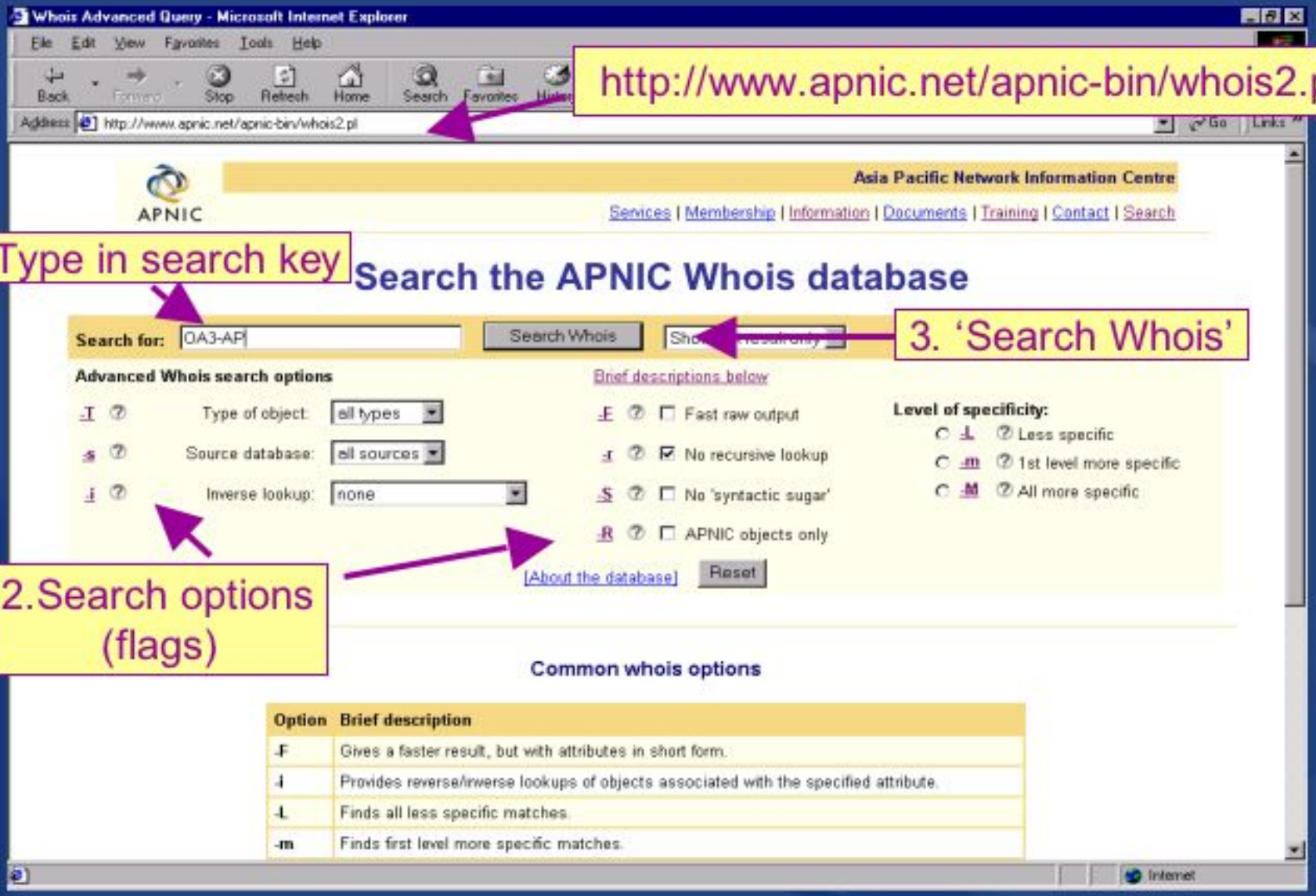


```
% whois zulrich@example.com
% whois zu3-ap
% whois "zane ulrich"
```

```
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
```

Asia Pacific Network Information Centre
APNIC

# Database query - web




Asia Pacific Network Information Centre
APNIC

# Database query - inetnum

```
% whois 203.127.128.0 - 203.127.159.255
% whois 203.127.128.0/19
% whois SINGNET-SG
```

```
inetnum:    203.127.128.0 - 203.127.159.255
netname:    SINGNET-SG
descr:      Singapore Telecommunications Ltd
descr:      31, Exeter Road, #02-00, Podium Block
descr:      Comcentre, 0923
country:    SG
admin-c:    CWL3-AP
tech-c:     CWL3-AP
mnt-by:     APNIC-HM
changed:    hostmaster@apnic.net 19990803
source:     APNIC
```

Notes

- Incomplete addresses padded with ".0"
- Address without prefix interpreted as "/32"

Asia Pacific Network Information Centre
APNIC

# Creating a person object

Whois Database Guide:

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

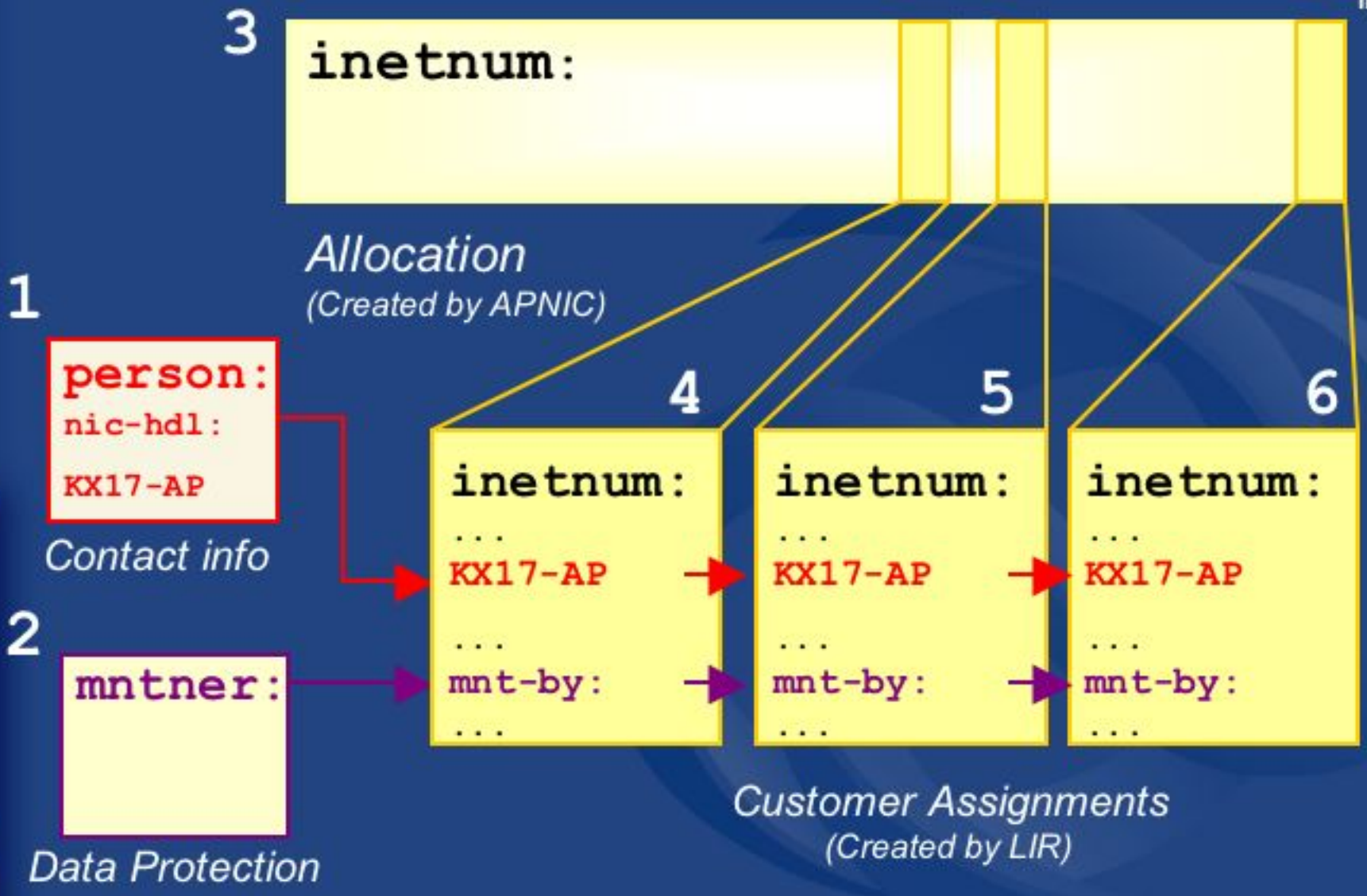
1. Fill out person object form on web
   - Name, e-mail, phone, address etc
   - Tick 'MNT-NEW' for temporary protection
2. Completed template is sent to you
3. Forward template to <auto-dbm@apnic.net>
4. Person object created and nic-hdl is generated

# LIR registration – reminder!

1. Create person objects for contacts
   - To provide contact info in other objects
2. Create mntner object
   - To provide protection of objects
     - (To be discussed later)
3. *Create inetnum objects for all customer address assignments and sub-allocations*
   - (Allocation object created by APNIC)

Asia Pacific Network Information Centre
APNIC

# Using the db – step by step



# Database auto-responses

- Successful update
  - Objects accepted
- Warnings
  - Objects accepted but ambiguous
  - Objects corrected and accepted
- Errors
  - Objects NOT accepted

*Don't understand the error message?*

– Contact the APNIC helpdesk!
  - Include the error message

Asia Pacific Network Information Centre
APNIC

# Database mailboxes

- Automatic request processing

<auto-dbm@apnic.net>

  - Automatic "robot" for all db updates
  - Email template for create/update/delete

- Database service support

<helpdesk@apnic.net>

  - E-mails answered by APNIC staff
  - 1 day response time

# Summary

- Use the APNIC whois database
  - To register information
  - To search information
- Create a person object
- Register all your assignments!
  - Fulfill your responsibility as a resource holder

<auto-dbm@apnic.net>

*- for all updates!*

Asia Pacific Network Information Centre
APNIC

# Questions ?

- Want to learn more about advanced queries?
  - *Come to the IRR tutorial tomorrow!*

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# Internet Registry Procedures

## Addressing Plan

# Addressing plan

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

Asia Pacific Network Information Centre
APNIC

# Some icons

Router
(layer 3, IP datagram forwarding)

Network Access Server
(layer 3, IP datagram forwarding )

Ethernet switch
(layer 2, packet forwarding)

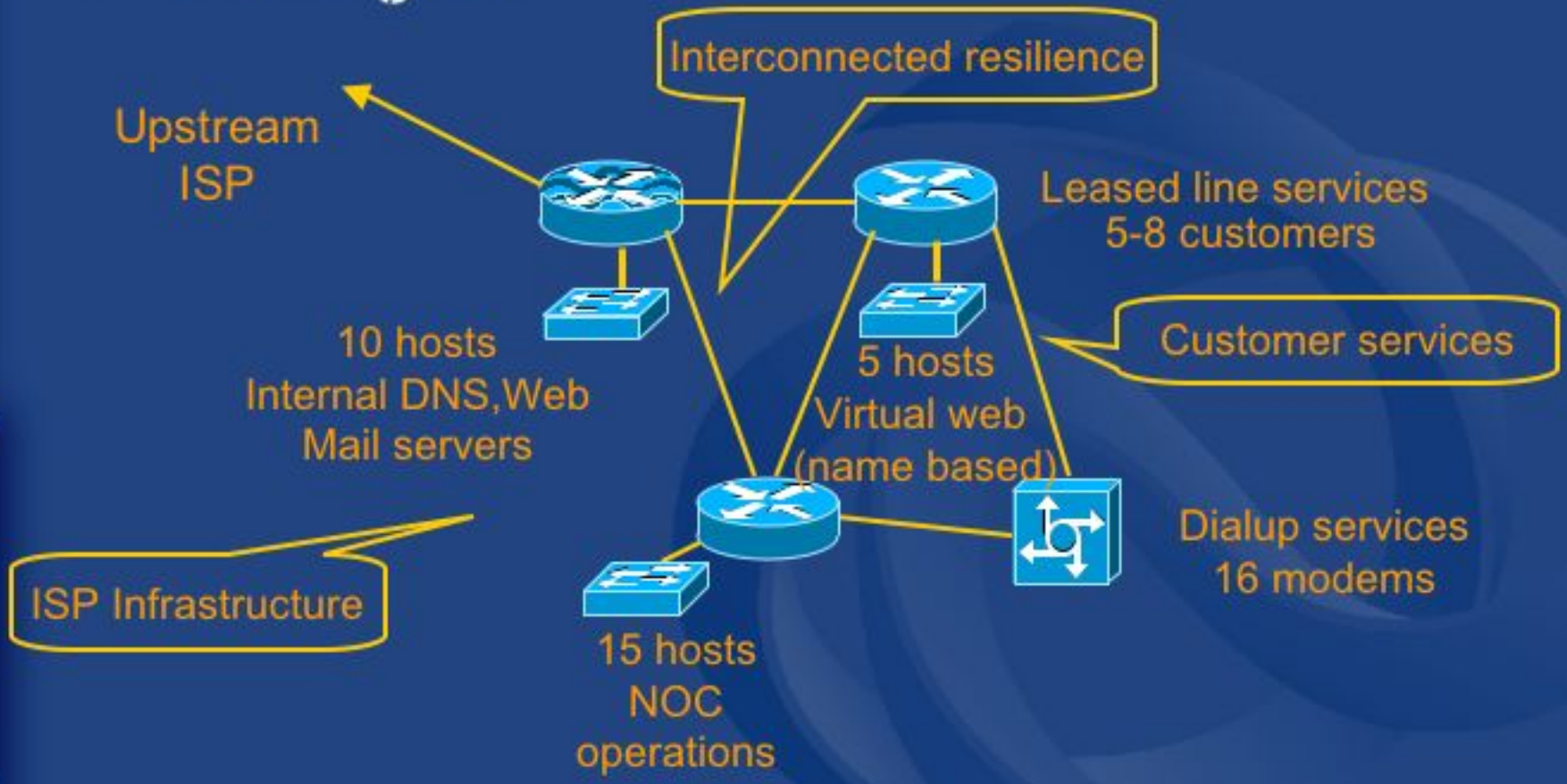
# Addressing plan

- 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

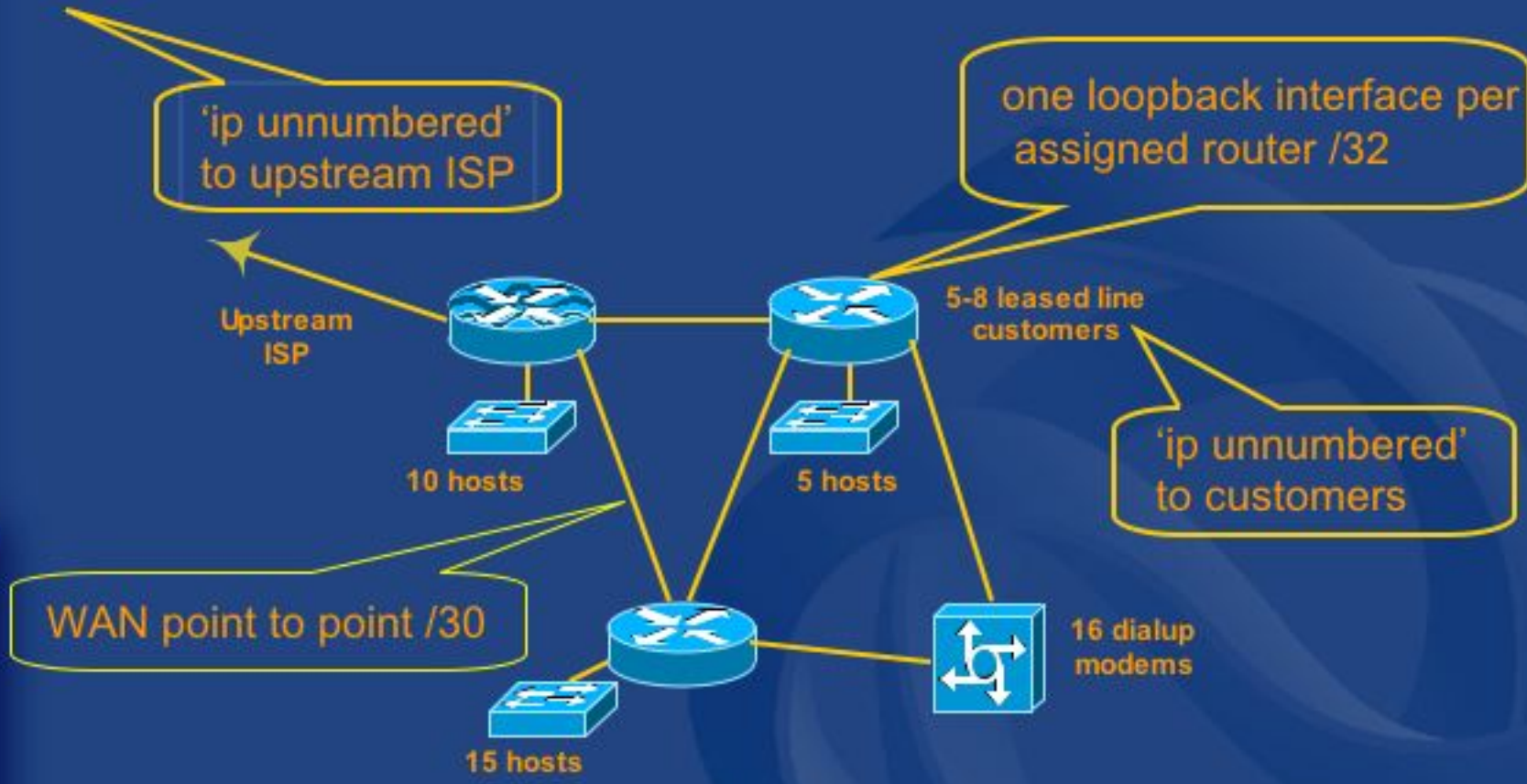
Asia Pacific Network Information Centre
APNIC

# Network plan

- Starting off



# Network plan



# Addressing plan

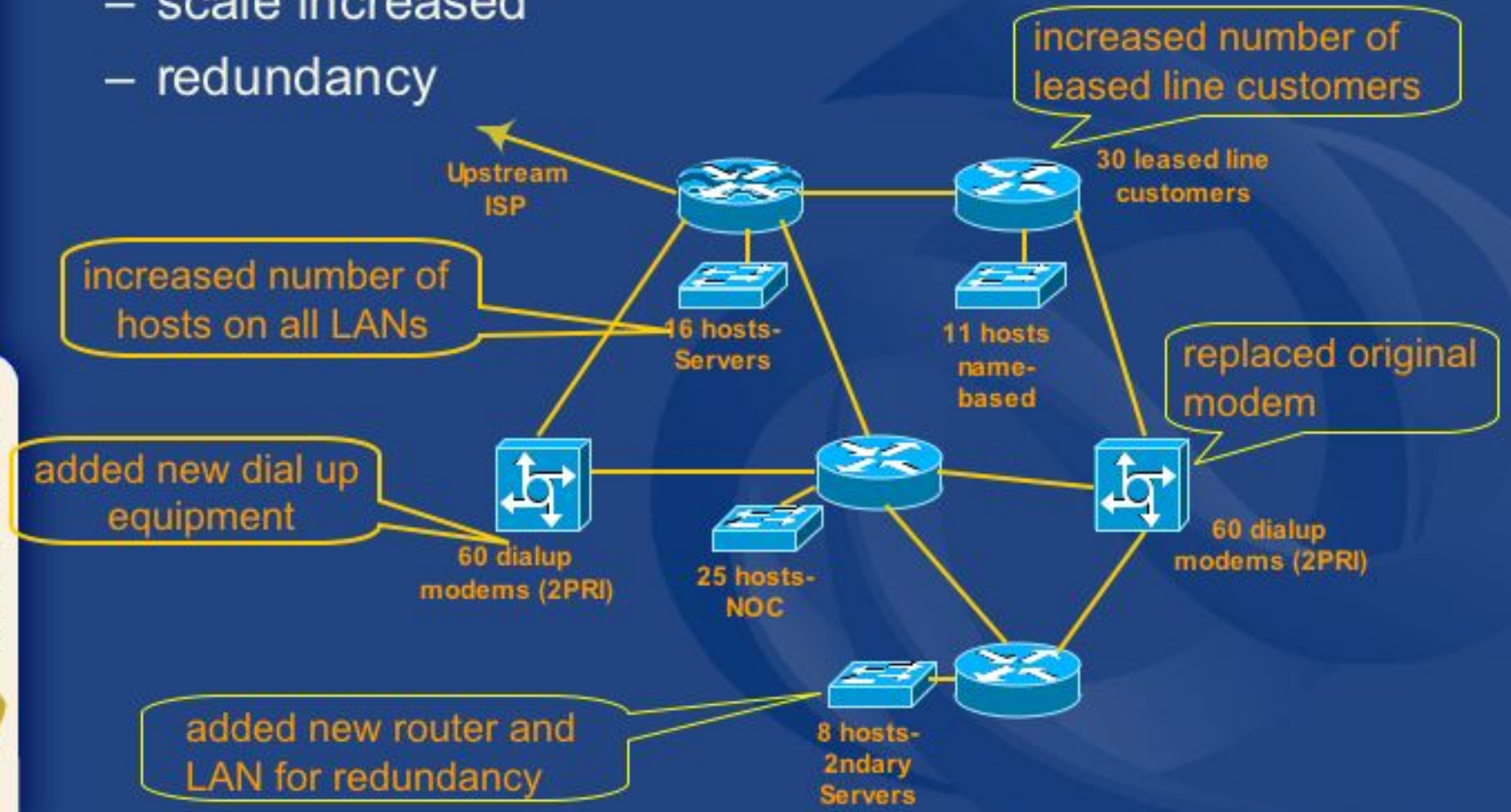
- Initial addressing plan

  - 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: | **2** | router WAN ports (x 5 lines) |

# Network plan – 6 months

- 6 months later
  - scale increased
  - redundancy




Asia Pacific Network Information Centre
APNIC

# Addressing Plan – 6 months

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

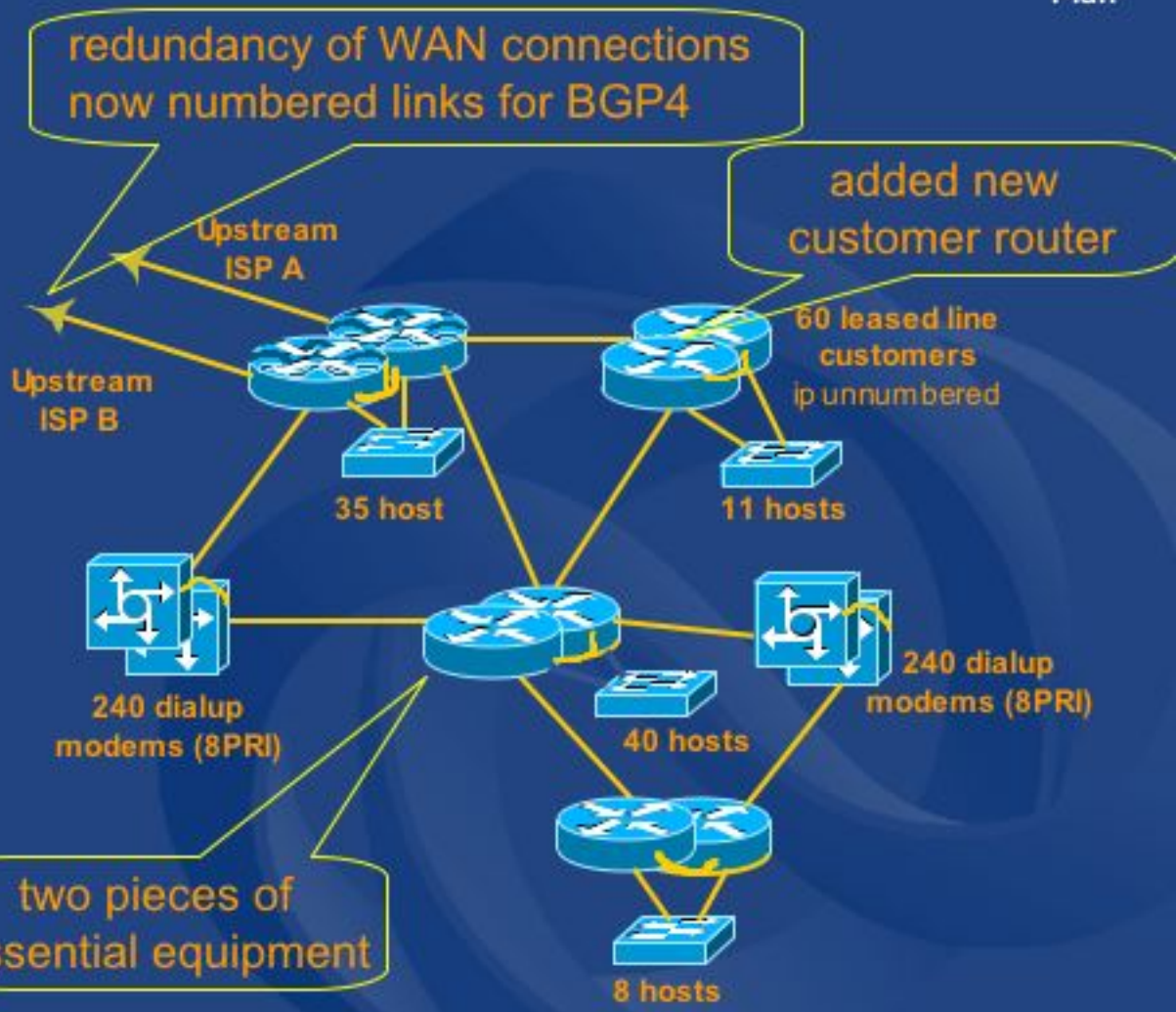
Changed description

| | | | |
|---|---|---|---|
| network-plan: | 16/ | **60** | **2 PRI dialup modems, vendor 'y'** |
| network-plan: | 5/ | **11** | LAN -web hosting (Name-based hosting) |
| network-plan: | 128/ | **512** | 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: | 2/ | **2** | 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

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




Asia Pacific Network Information Centre
APNIC

# Addressing Plan – 12 months

- 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: | 128/512/ | **1020** | 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: | 2/2/ | **2** | 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** | 128/512/**1020** | 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: | **8** | 0/8/**8** | LAN-secondary servers |
| network-plan: | **4** | 2/2/**2** | 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 | 128/512/1020 | 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** | 16 | 5/11/11 | LAN -web hosting (Name-based hosting) |
| network-plan: | **0.0.6.144** | 16 | 0/8/8 | LAN -secondary servers |
| network-plan: | **0.0.6.160** | 16 | 4/6/12 | loopback router interfaces |
| network-plan: | **0.0.6.176** | 4 | 2/2/2 | router WAN ports (x8) |

  – 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 | 128/512/1020 | 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 | 255.255.255.240 | **YES** | 16 | 5/11/11 | LAN -web hosting (Name-based) |
| network-plan: | 0.0.6.144 | 255.255.255.240 | **YES** | 16 | 0/8/8 | LAN -secondary servers |
| network-plan: | 0.0.6.160 | 255.255.255.240 | **YES** | 16 | 4/6/12 | loopback router interfaces |
| network-plan: | 0.0.6.176 | 255.255.255.252 | **YES** | 4 | 2/2/2 | router WAN ports (x 8 ) |

# 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 | 128/512/1020 | 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 | 255.255.255.240 | YES | 16 | 5/11/11 | LAN -web hosting (Name-based) |
| network-plan: | 0.0.6.144 | 255.255.255.240 | YES | 16 | 0/8/8 | LAN -secondary servers |
| network-plan: | 0.0.6.160 | 255.255.255.240 | YES | 16 | 4/6/12 | loopback router interfaces |
| network-plan: | 0.0.6.176 | 255.255.255.252 | YES | 4 | 2/2/2 | router WAN ports (x 8 lines ) |

– detailed, efficient and accurate

# Questions ?

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# Internet Registry Procedures

## ISP Request

# ISP address request

- Hostmaster Administrivia
  - <hostmaster@apnic.net> mailbox filtered
    - Requires member account name
      - Subject: IP Address Request [CONNECT-AU]

members only

- 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

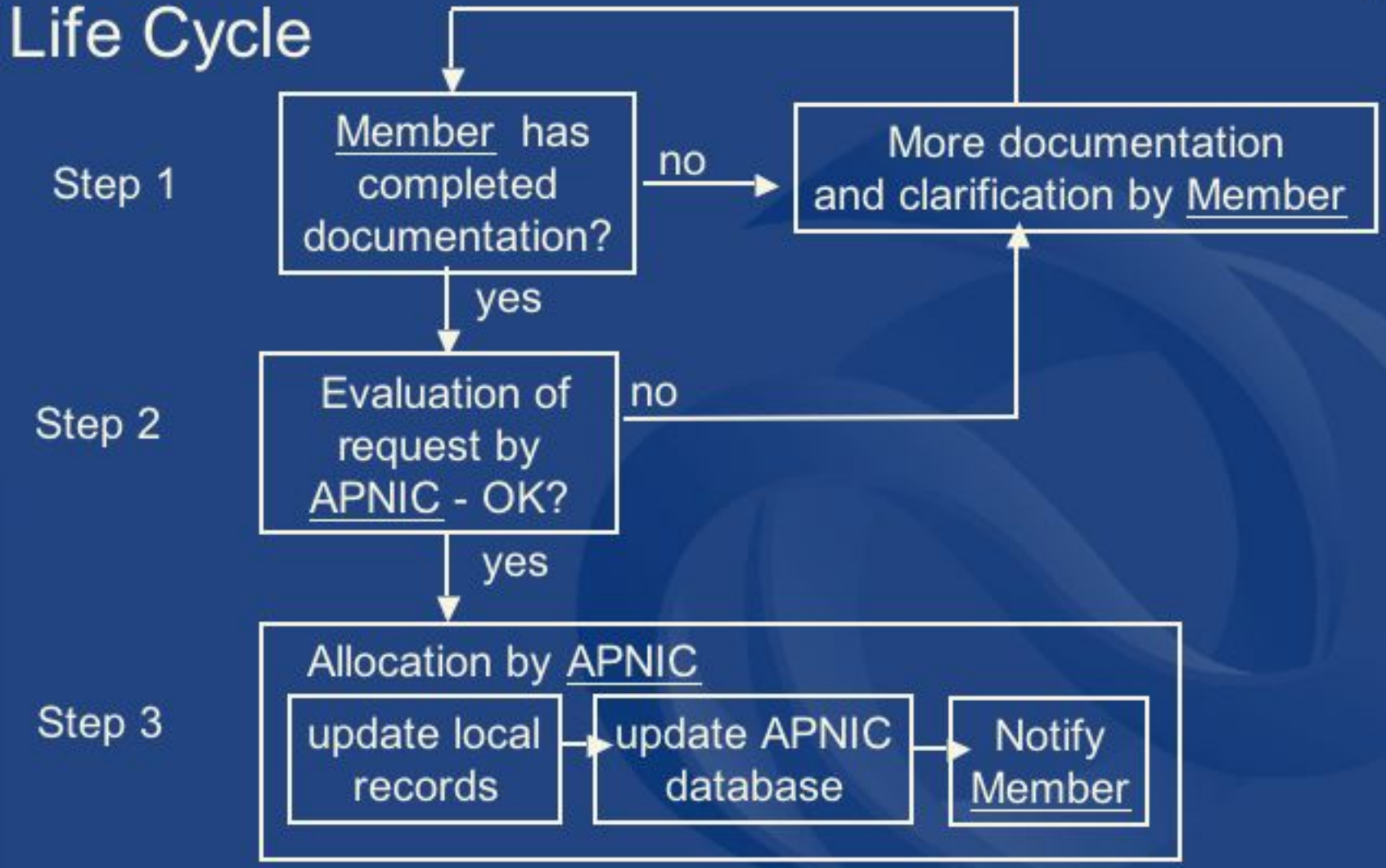
Asia Pacific Network Information Centre
APNIC

# ISP address request





## Life Cycle



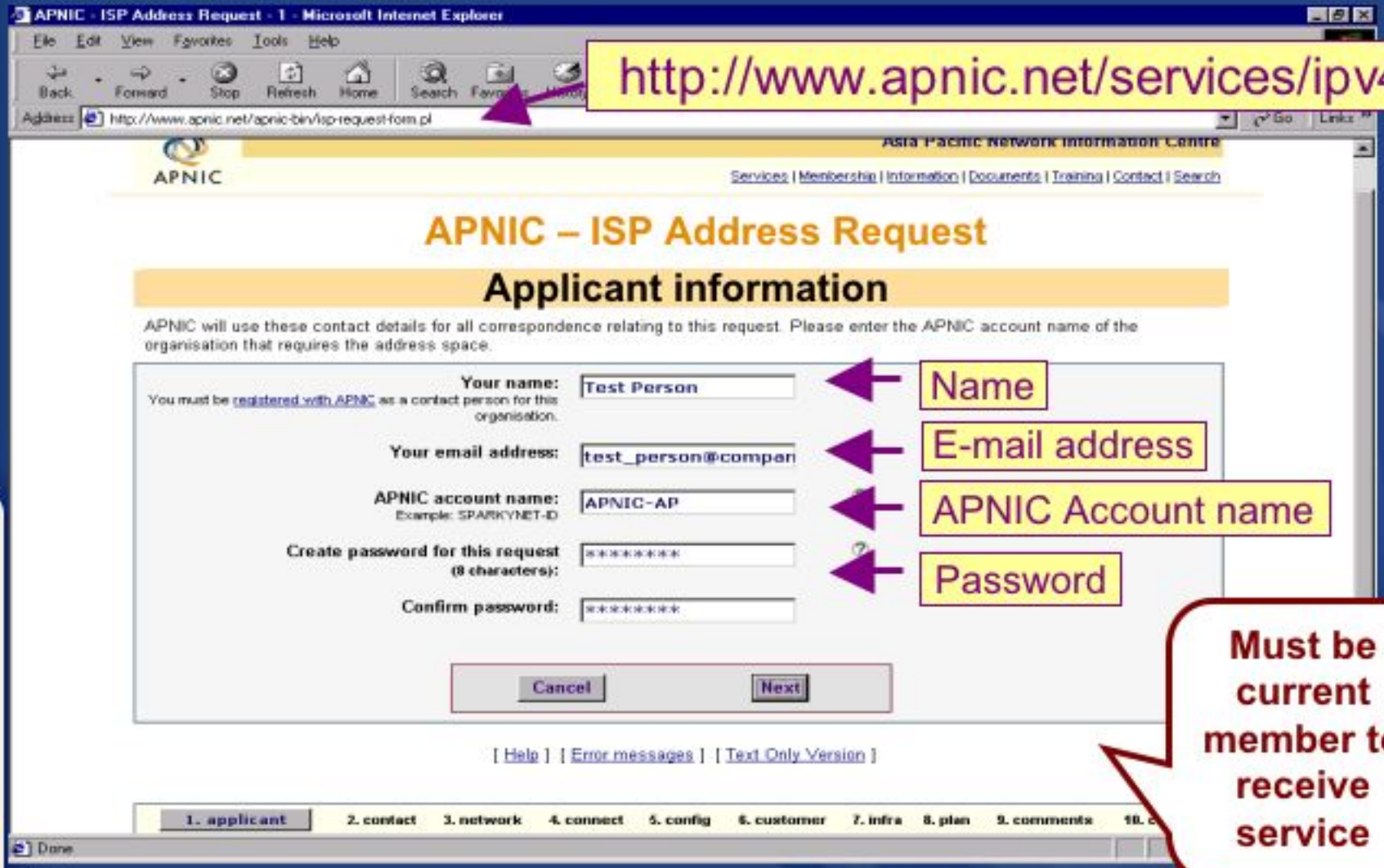
# ISP address request - overview



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

Asia Pacific Network Information Centre
APNIC

# ISP address request



# ISP address request instructions



- Complete the documentation
  - ISP Address Request Form
    - Web Form:
      - http://www.apnic.net/services/ipv4/
    - Plain text
      - http://ftp.apnic.net/apnic/docs/isp-address-request

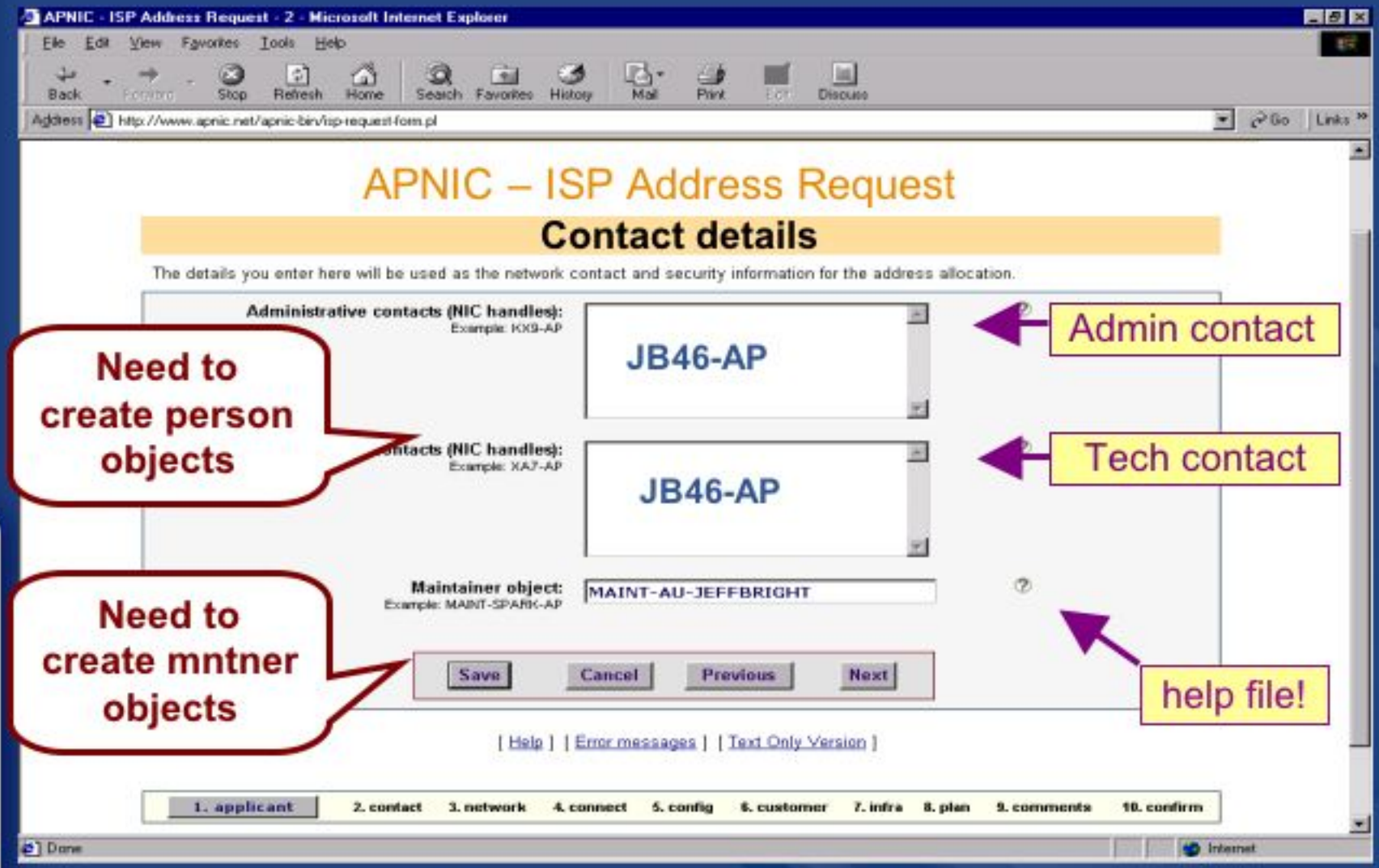
- The more detailed and precise
  - Fewer iterations with APNIC
    - Quicker resolution time

- *Read the quick tips!*
  http://www.apnic.net/faq/isp-request-tips.html

Asia Pacific Network Information Centre
APNIC

# Contact details



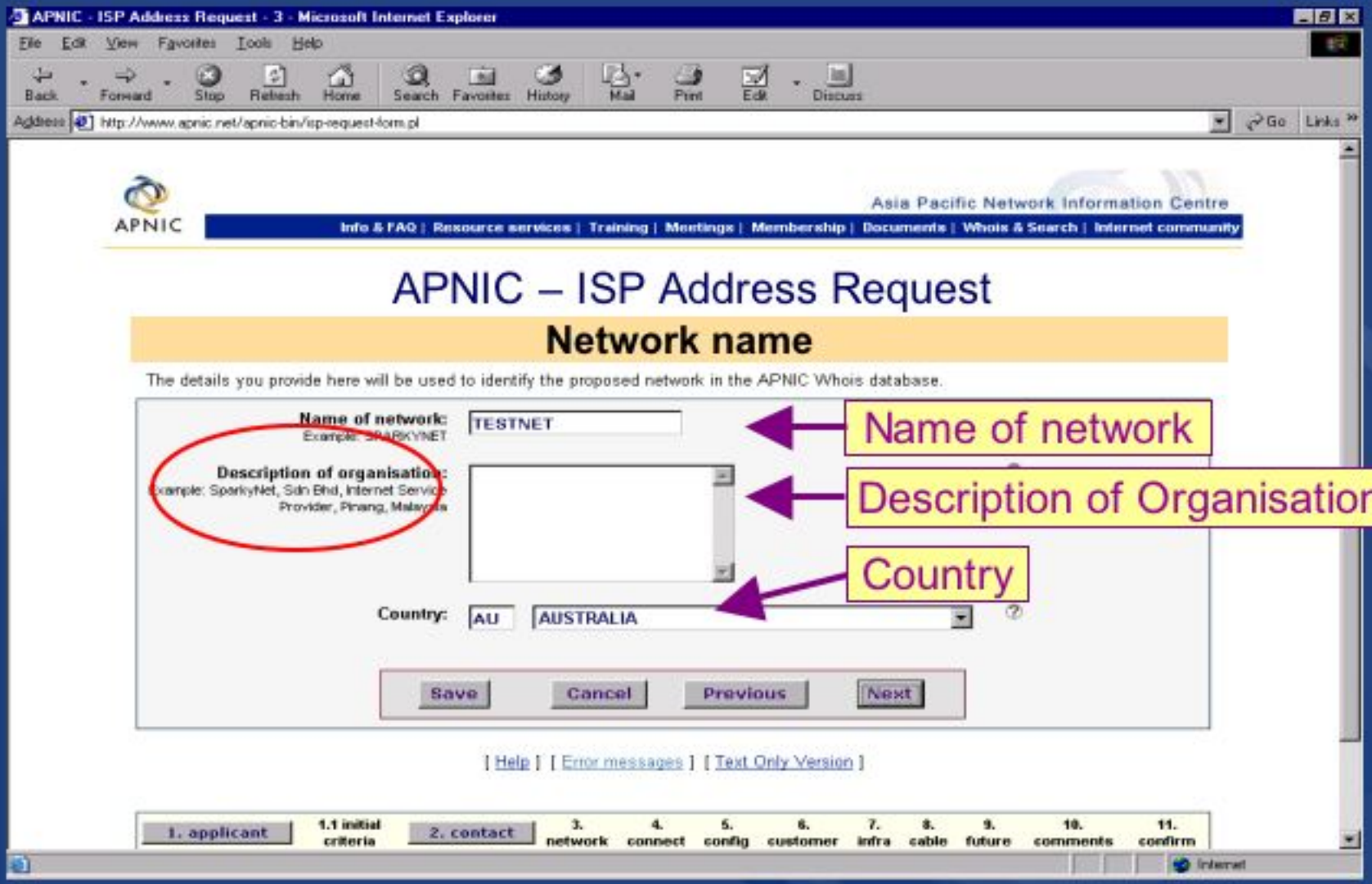



Administrative & Technical contacts, Maintainer

Asia Pacific Network Information Centre
APNIC

# Network name

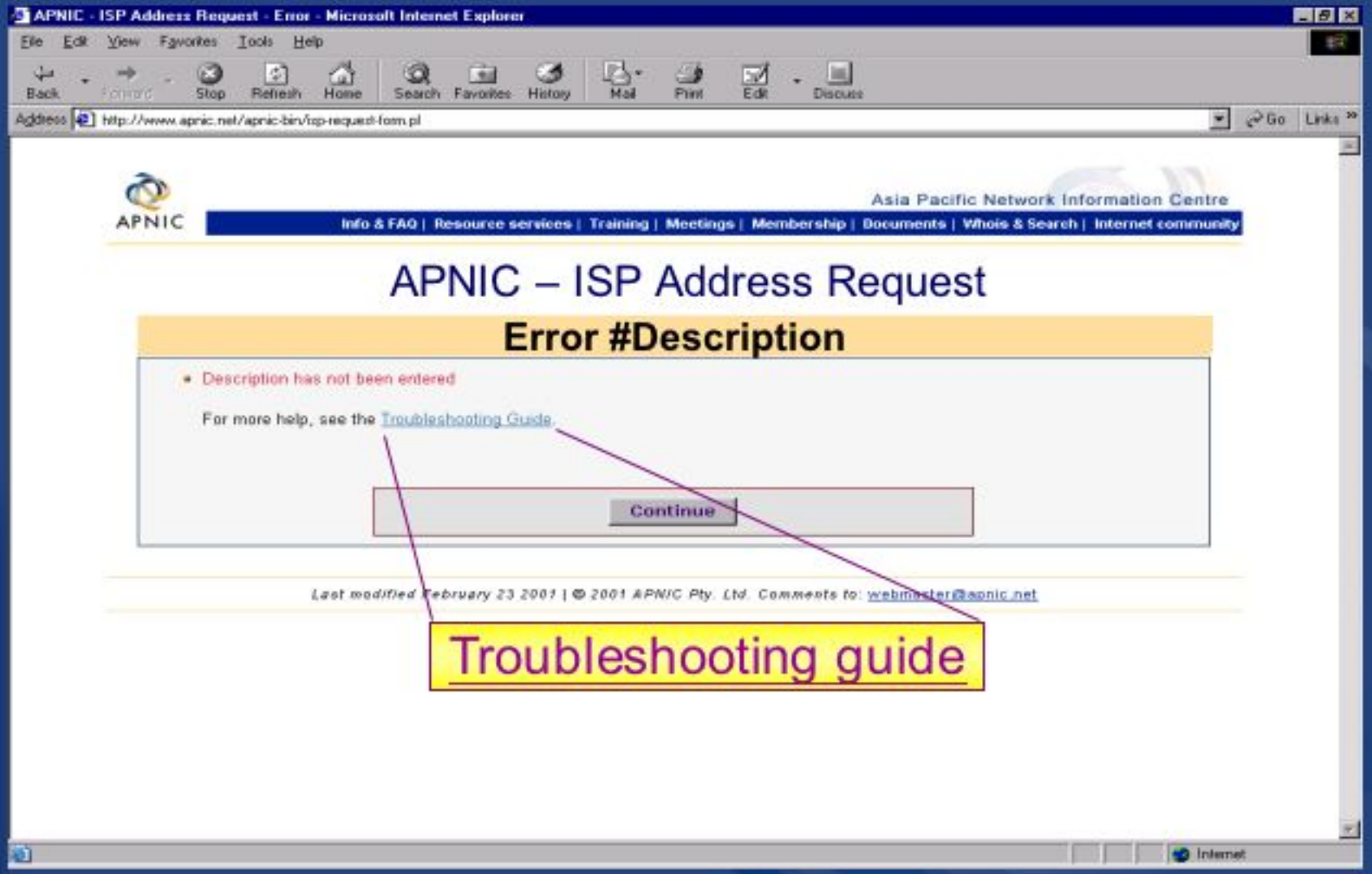





Description of organisation not entered…

# Error description

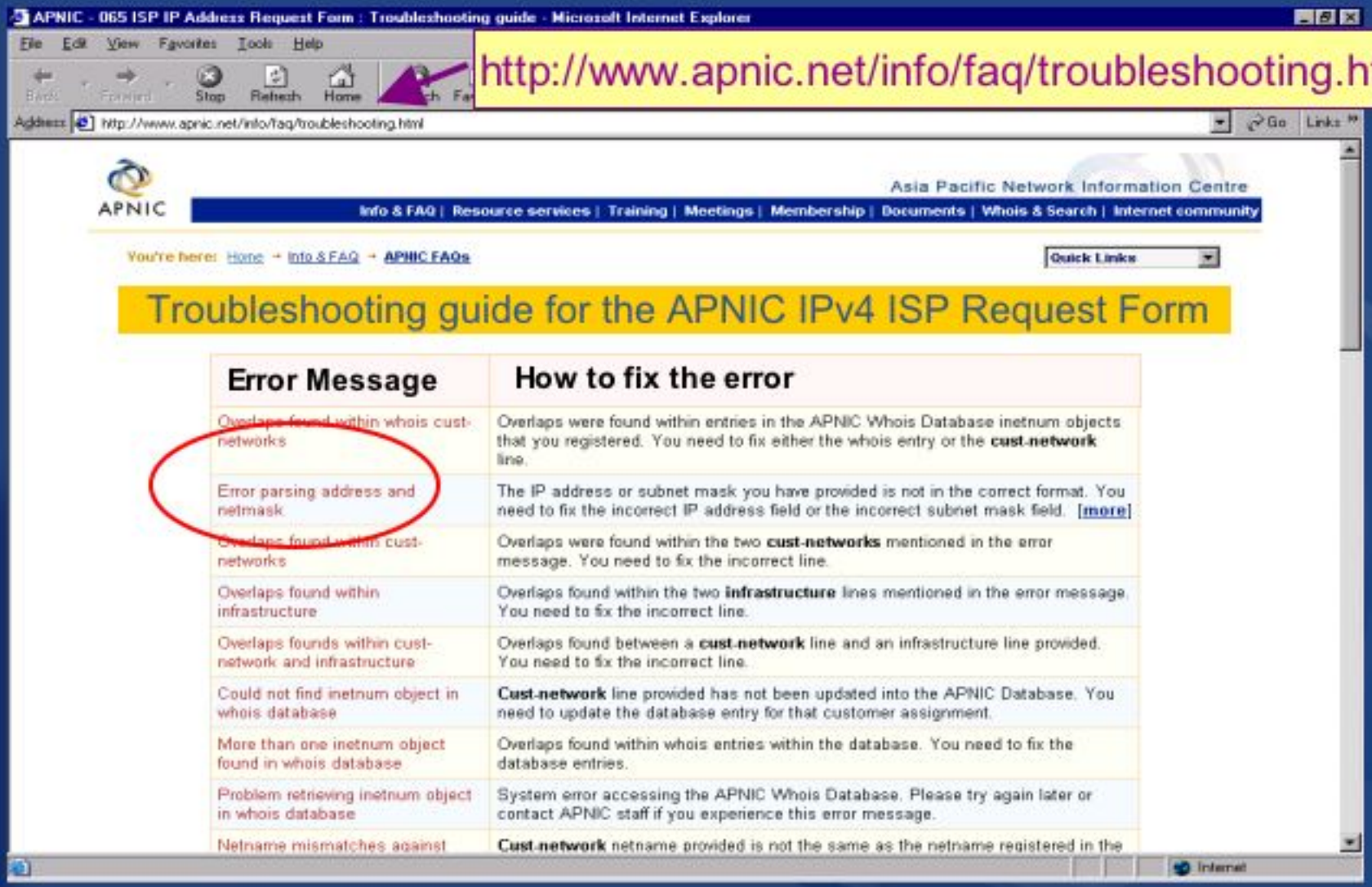





Error: “Description has not been entered”

# Troubleshooting guide

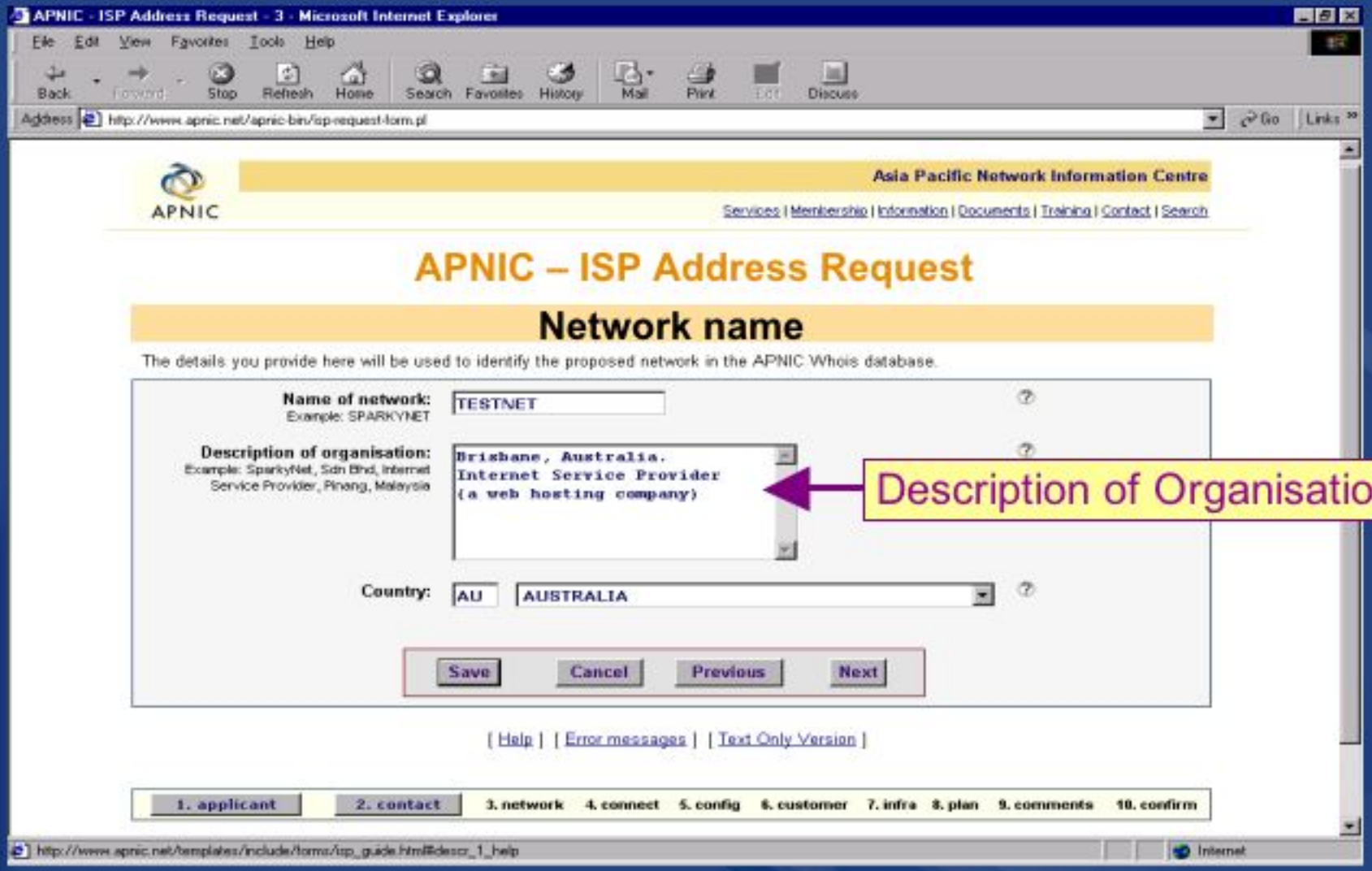





| Error Message | How to fix the error |
|---|---|
| Overlaps found within whois cust-networks | Overlaps were found within entries in the APNIC Whois Database inetnum objects that you registered. You need to fix either the whois entry or the **cust-network** line. |
| Error parsing address and netmask | The IP address or subnet mask you have provided is not in the correct format. You need to fix the incorrect IP address field or the incorrect subnet mask field. [more] |
| Overlaps found within cust-networks | Overlaps were found within the two **cust-networks** mentioned in the error message. You need to fix the incorrect line. |
| Overlaps found within infrastructure | Overlaps found within the two **infrastructure** lines mentioned in the error message. You need to fix the incorrect line. |
| Overlaps founds within cust-network and infrastructure | Overlaps found between a **cust-network** line and an infrastructure line provided. You need to fix the incorrect line. |
| Could not find inetnum object in whois database | **Cust-network** line provided has not been updated into the APNIC Database. You need to update the database entry for that customer assignment. |
| More than one inetnum object found in whois database | Overlaps found within whois entries within the database. You need to fix the database entries. |
| Problem retrieving inetnum object in whois database | System error accessing the APNIC Whois Database. Please try again later or contact APNIC staff if you experience this error message. |
| Netname mismatches against | **Cust-network** netname provided is not the same as the netname registered in the |

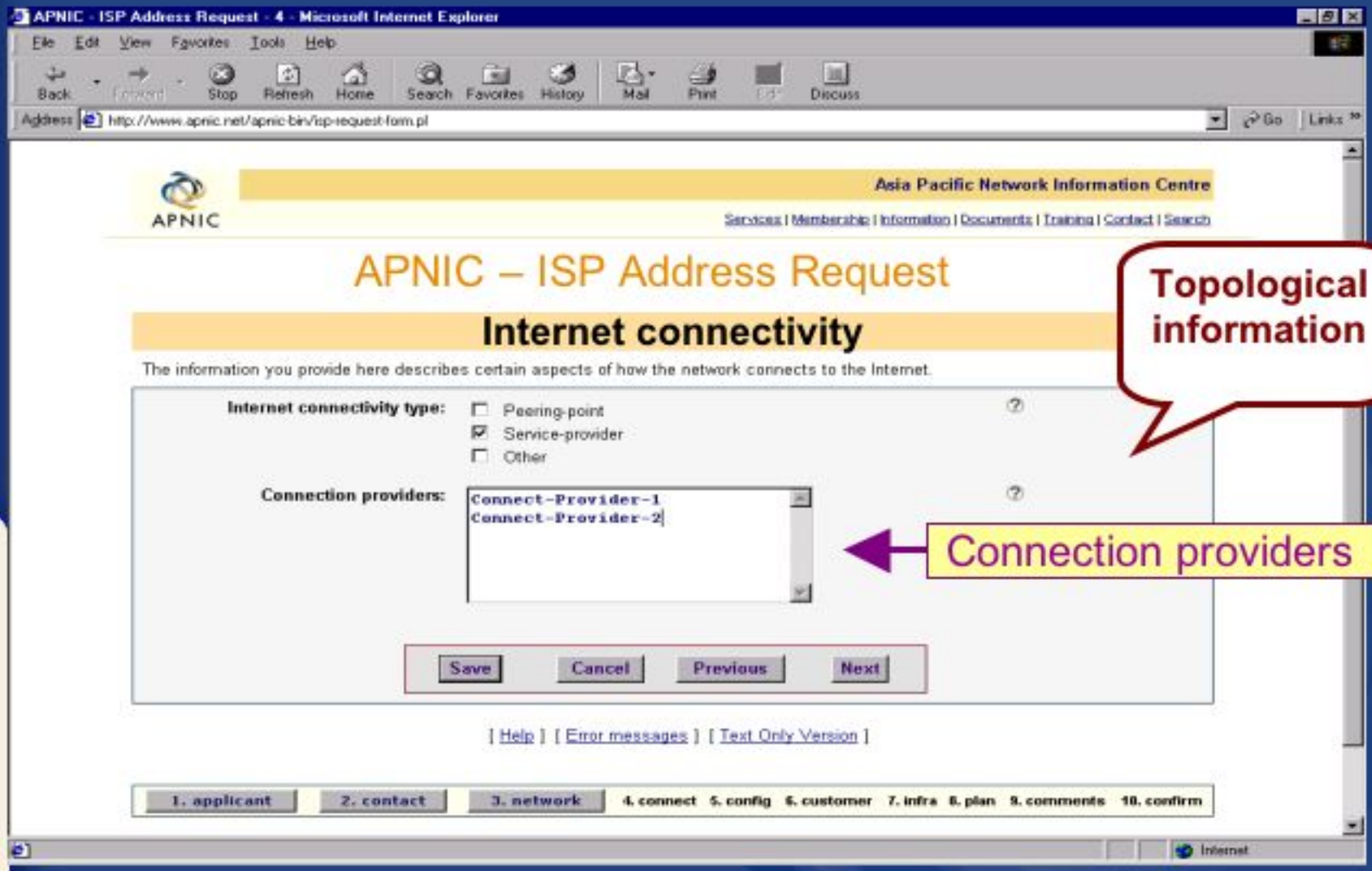
Asia Pacific Network Information Centre
APNIC

# Description of organisation



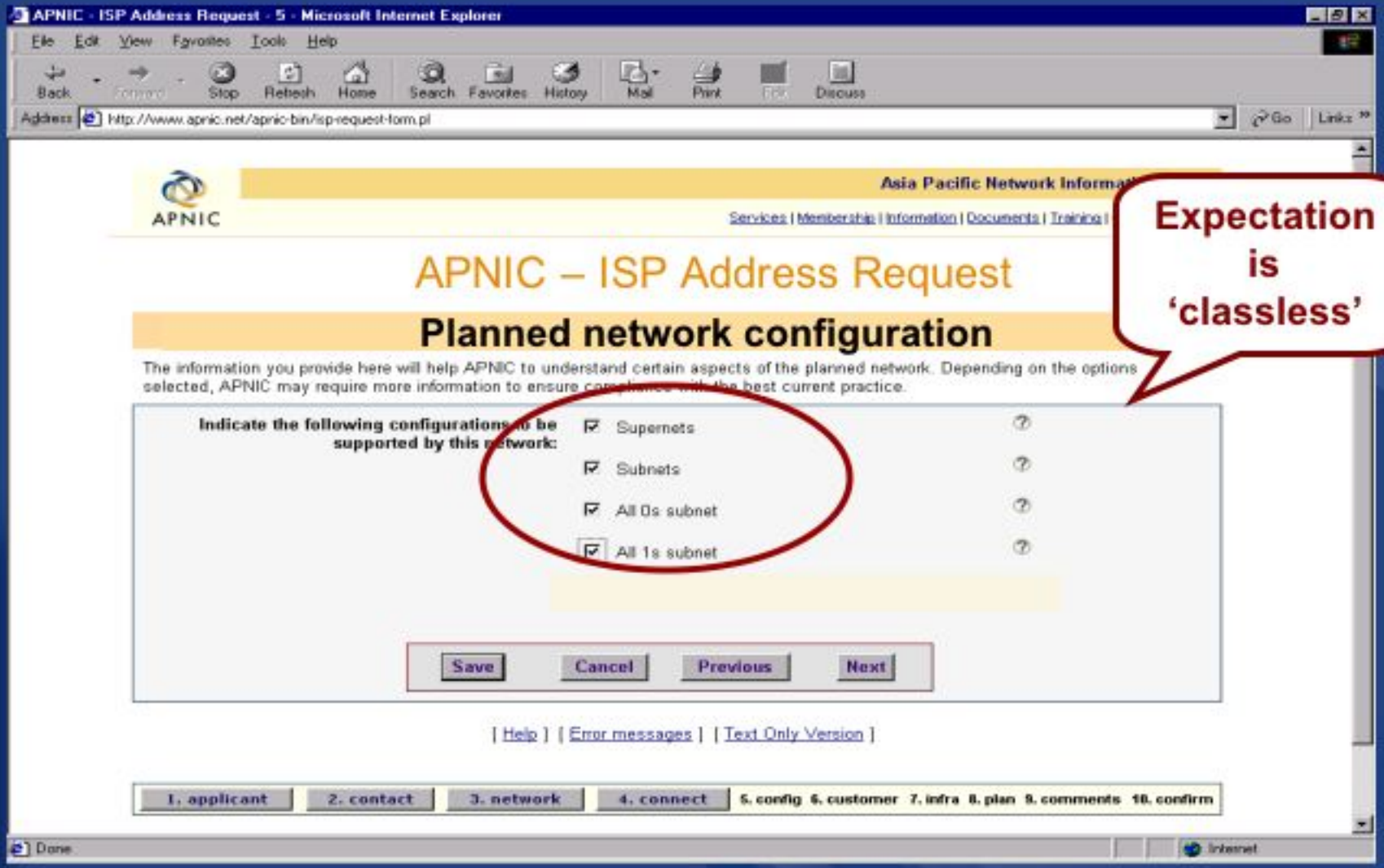

Name of network, Description of Org., Country

# Internet connectivity



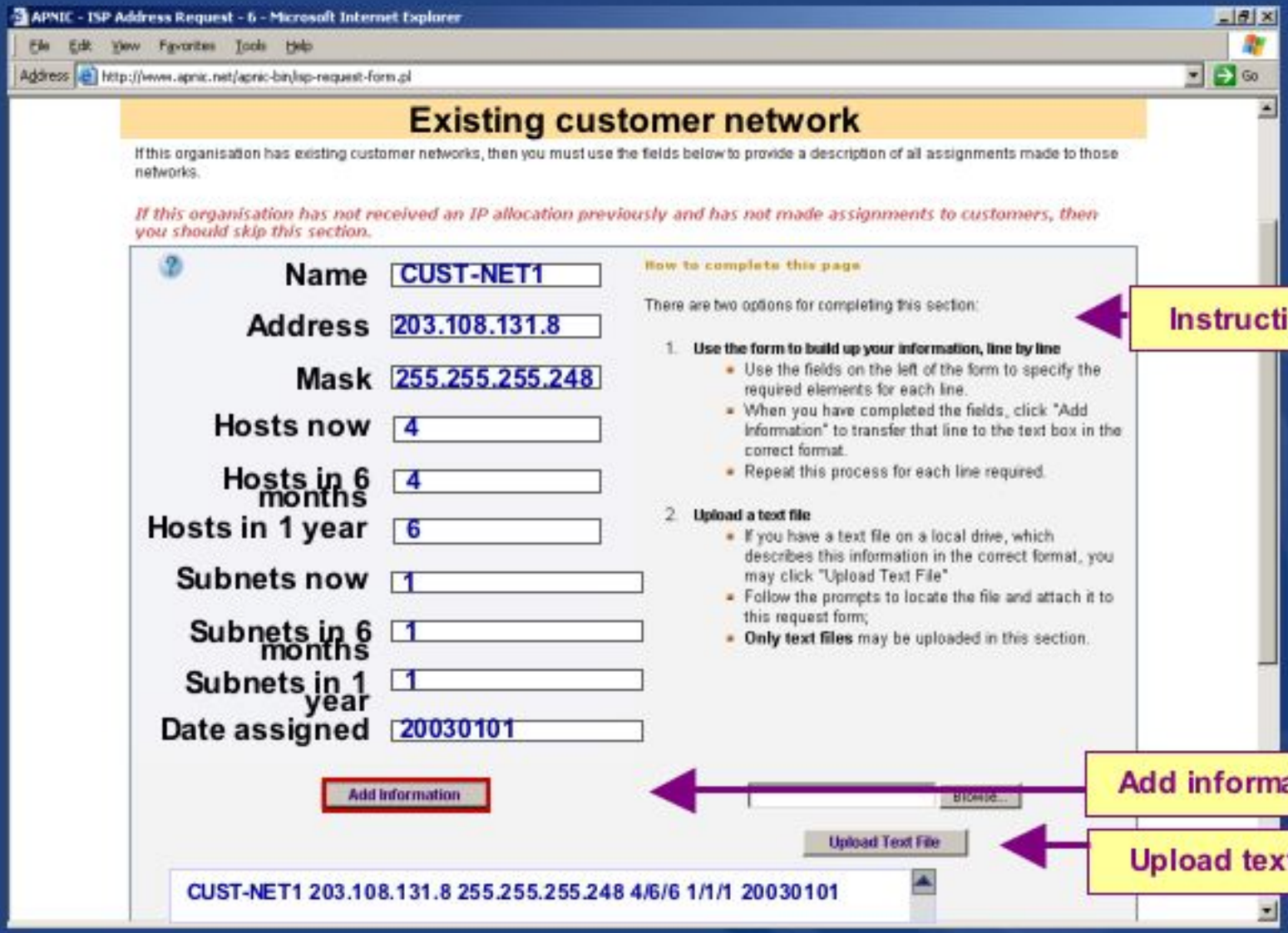

Internet connectivity type, Connection providers

# Network configuration




Supernets, Subnets, All 0s subnet, All 1s subnet…

# Existing customer network



# ISP address request evaluation



- 'Customer network' fields

## Registration

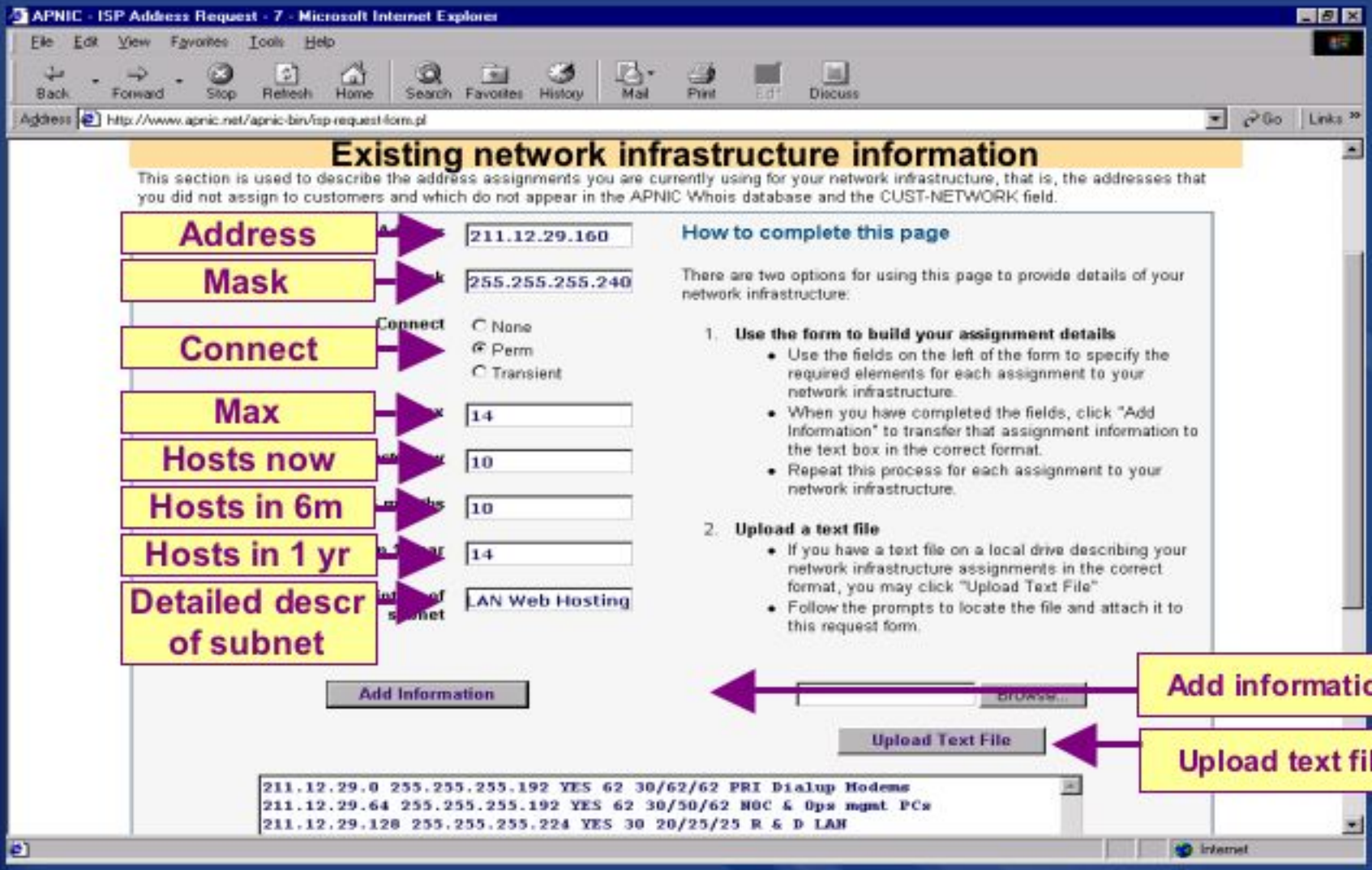
- Check all customer assignments are in the APNIC 'whois' database accurately

## Policy

- Prefix distribution of all customer assignments
- 'Classless' assignments NOT on /24 boundaries

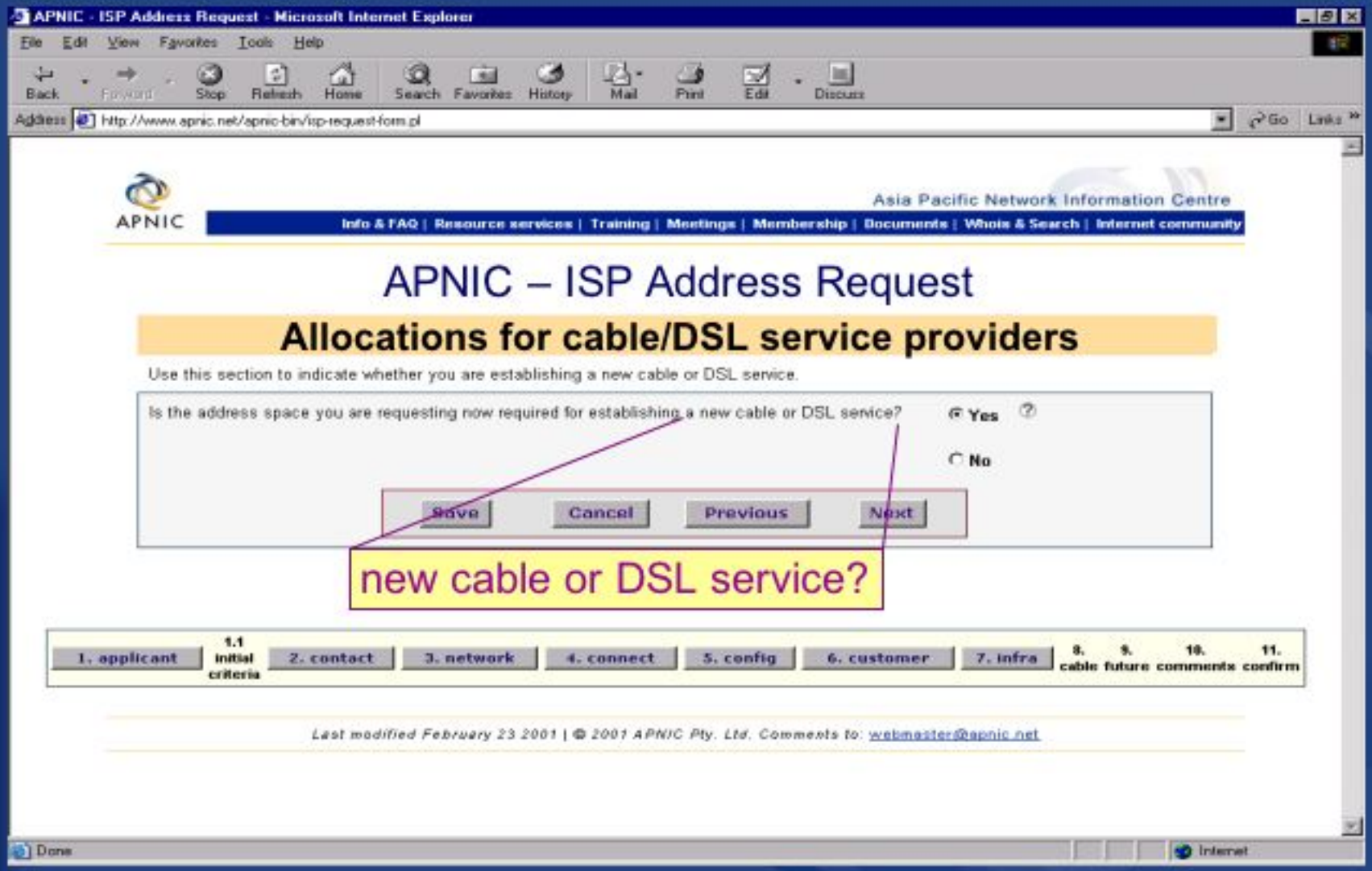
Asia Pacific Network Information Centre
APNIC

# Existing network infrastructure

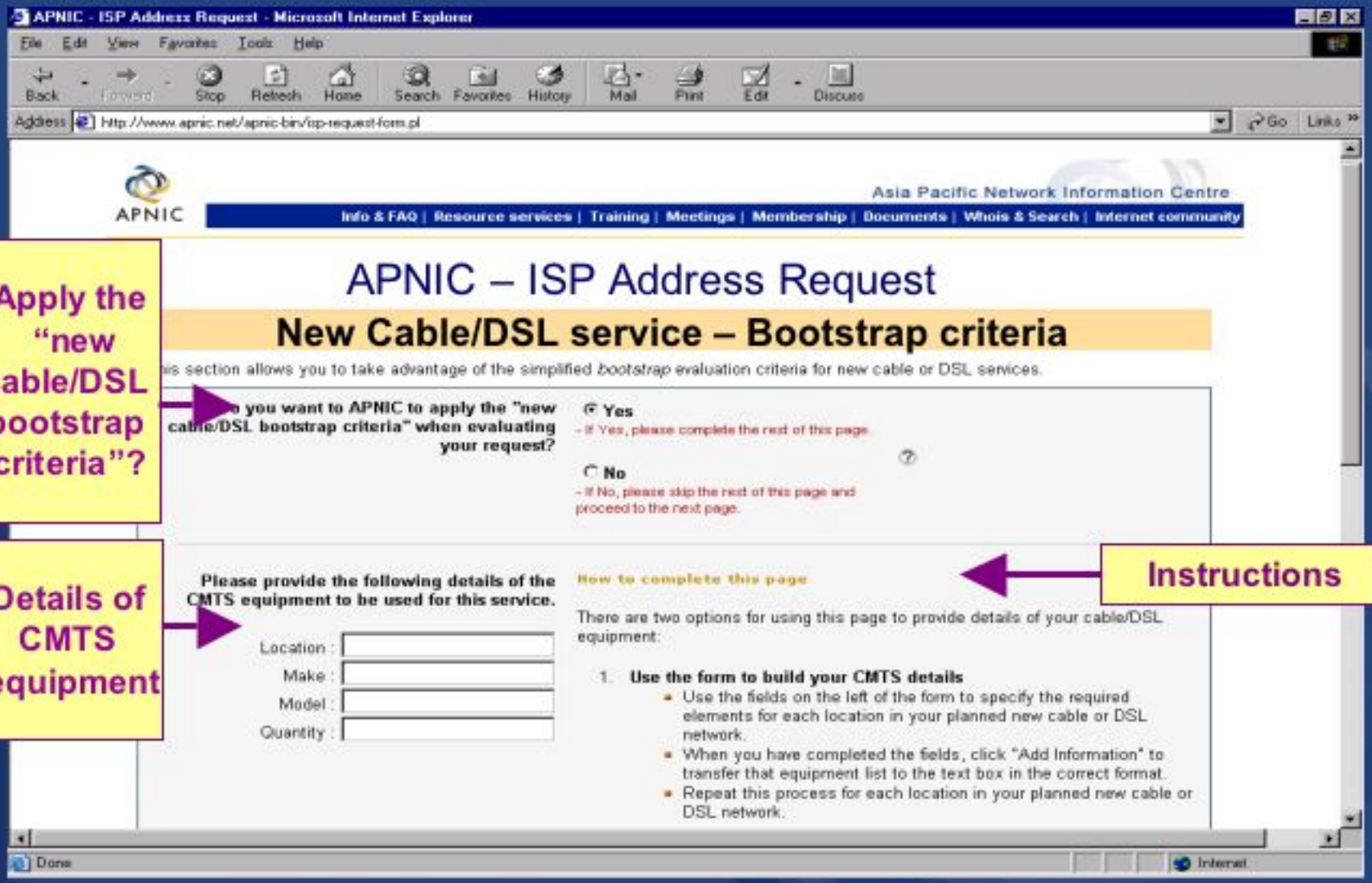



Address, Mask, Connect, Max, Hosts now, 6m, 1yr, description

# New cable/DSL services



# New cable/DSL services



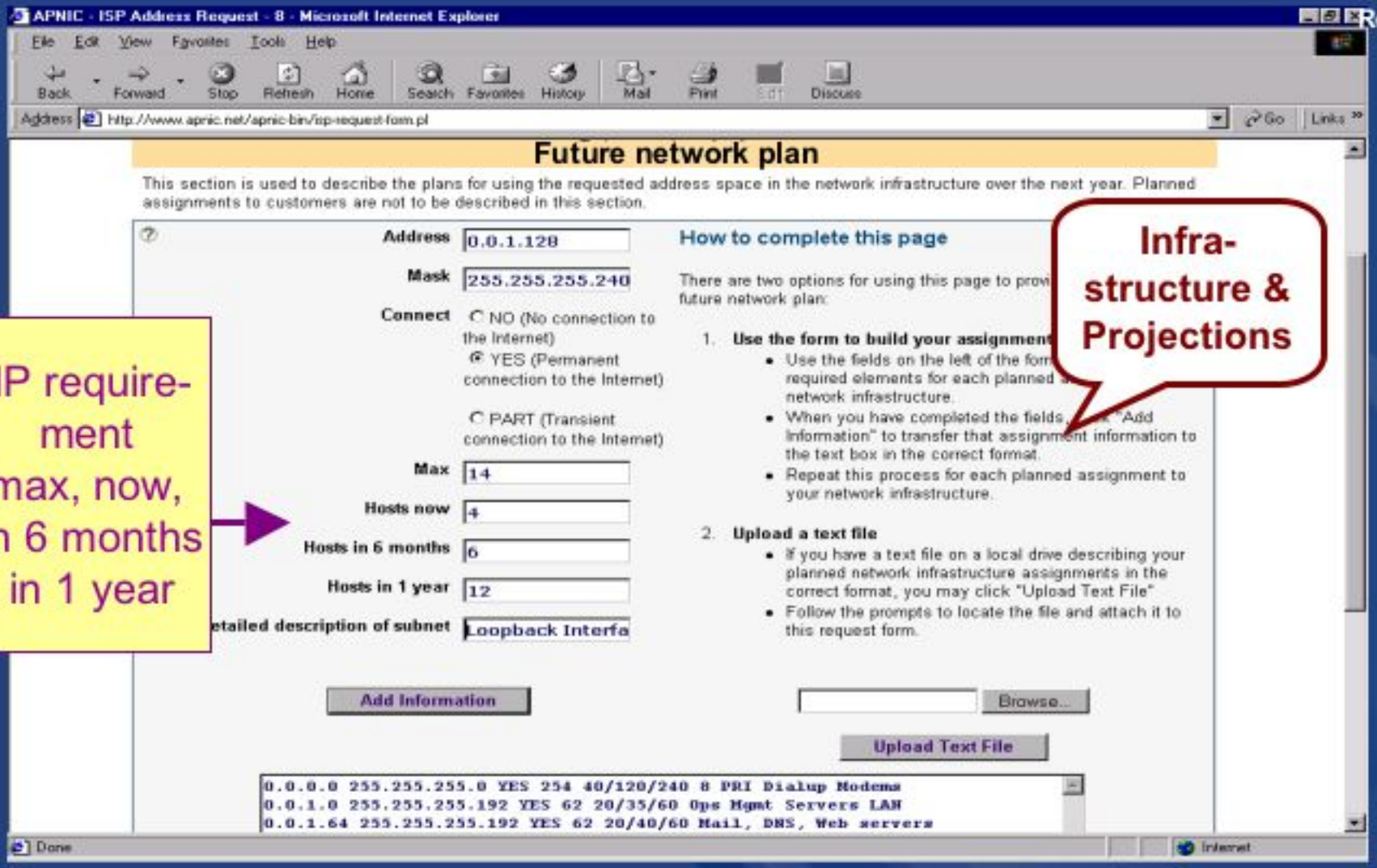

**Apply the "new cable/DSL bootstrap criteria"?**

**Details of CMTS equipment**

**Instructions**

Use the form to build your CMTS details…

# Future network plan




ISP Req

Infra-structure & Projections

IP require-ment (max, now, in 6 months in 1 year

Address, Mask, Connect, IP requirement, description

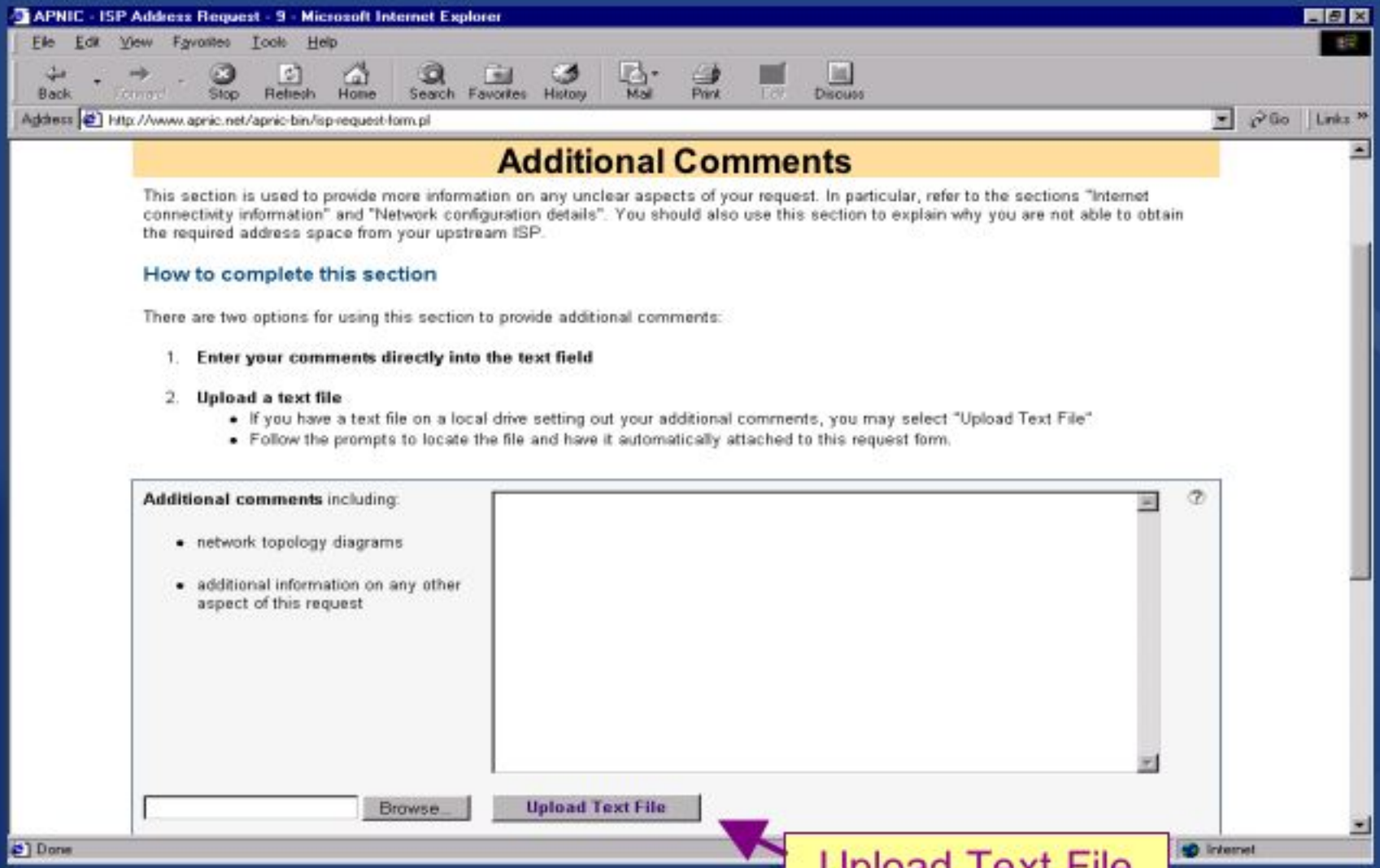
Asia Pacific Network Information Centre
APNIC

# ISP request evaluation

- 'Infrastructure' & 'network-plan' fields
  - 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
      - More on this to follow...

Asia Pacific Network Information Centre
APNIC

# Additional comments



# **Additional Info** - Topology, Deployment, Equipment & Services

- POP topology
  - Diagrams showing network / POP design
- Deployment plan
  - Give details of phases of deploying equipment
- Equipment and services
  - Specifications, number of ports
  - Details of how implement services
    - explain acronyms or special services
- Miscellaneous
  - Anything not covered by the form, anything unusual

# Additional info - Renumbering & return policy

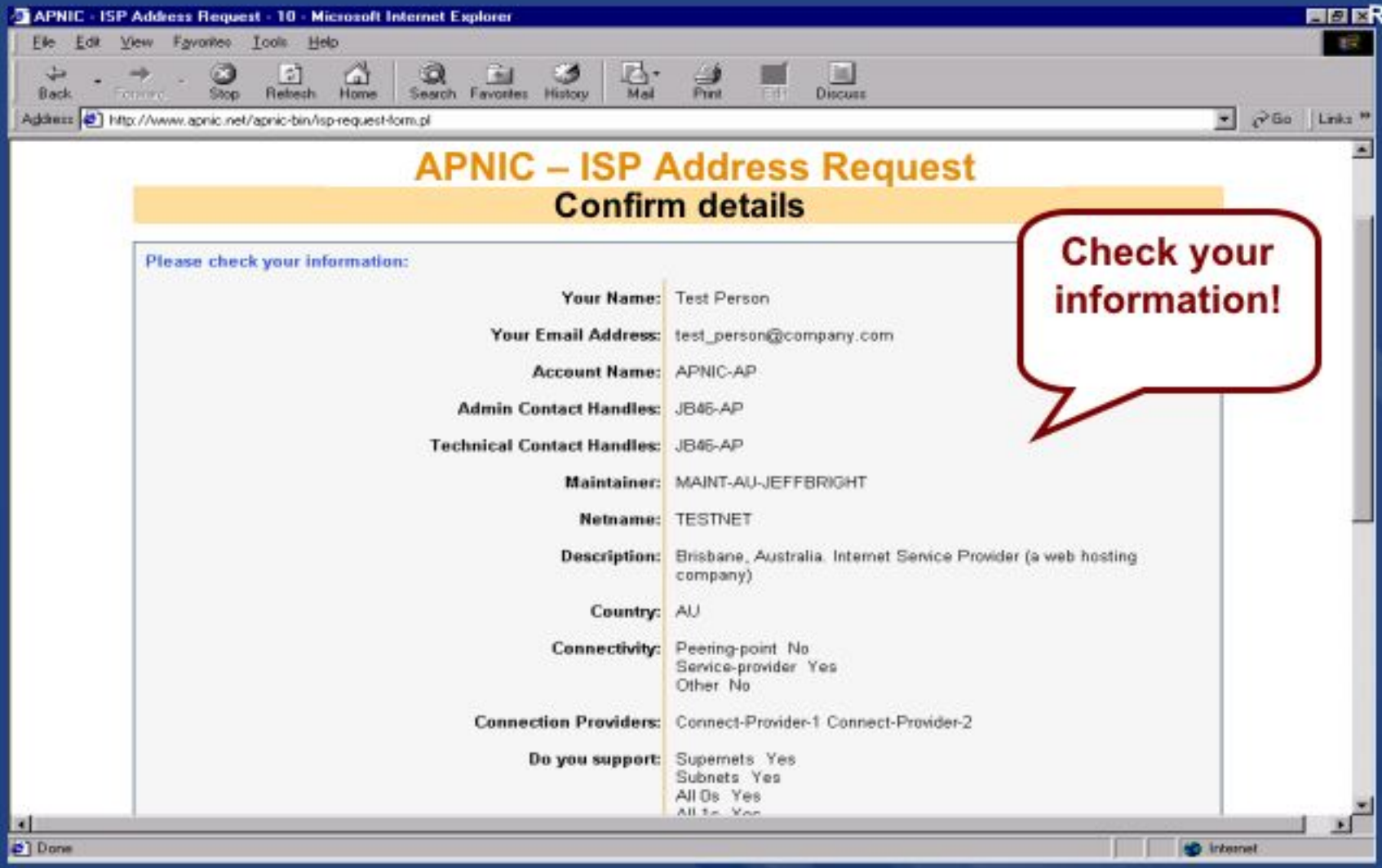
- Renumbering?
  - one-for-one exchange to assist renumbering
  - needs confirmation from upstream ISP to confirm renumbering will take place

- 'No Questions Asked' return prefix policy
  - swap 3 or more discontiguous prefixes (ISP or customers) for single prefix, no charge
    - ftp://ftp.apnic.net/apnic/docs/no-questions-policy
  - Form for returning addresses
    - ftp://ftp.apnic.net/apnic/docs/address-return-request

Asia Pacific Network Information Centre
APNIC

# Confirm details






Asia Pacific Network Information Centre
APNIC

# ISP address request - Checklist

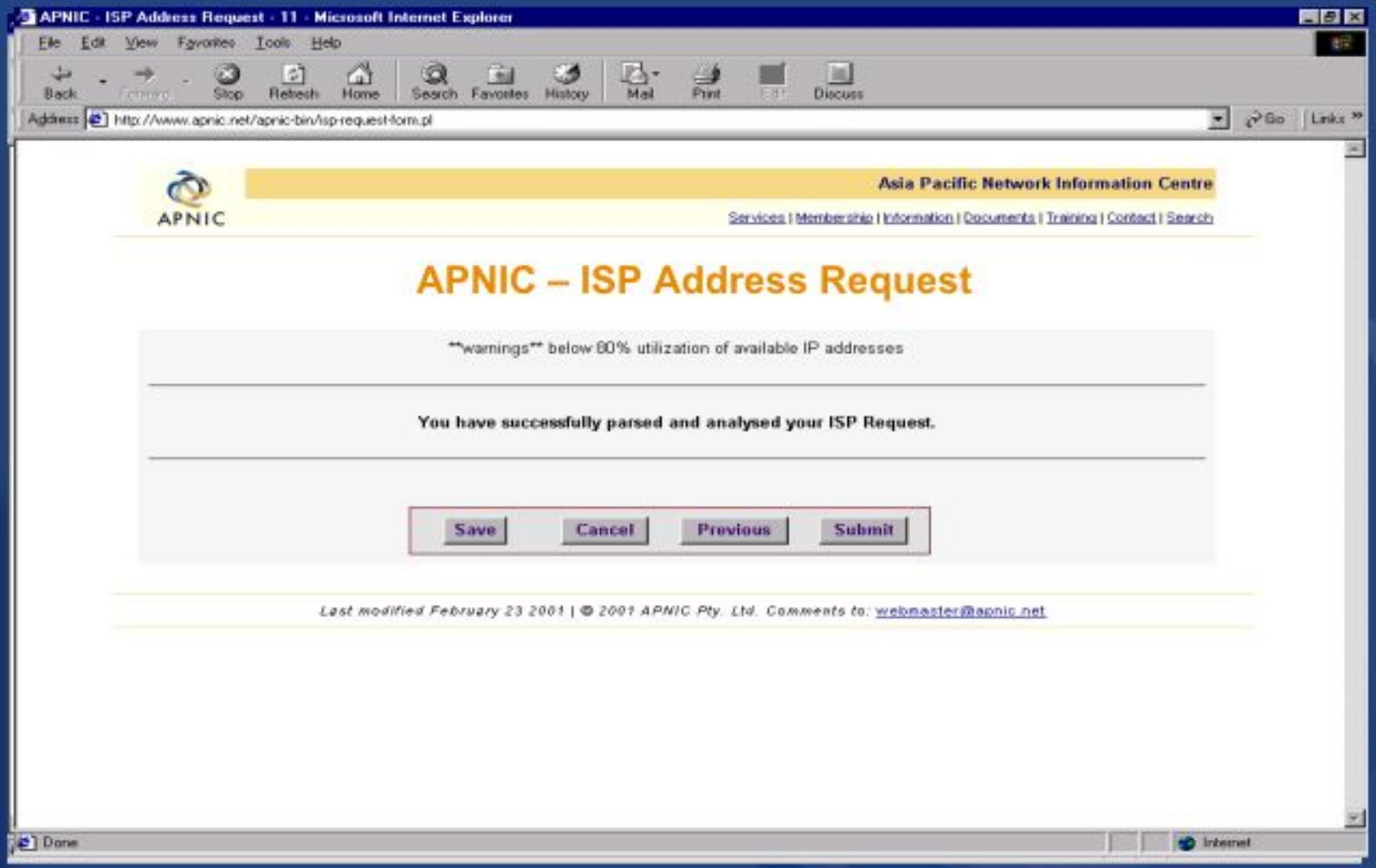


- ✓ All fields are syntactically correct
- ✓ Supplied documentation correct
  - format defined in the APNIC-084
- ✓ Provided all IP addresses currently held
- ✓ Updated all customer assignments in DB
  - Deleted objects that are no longer valid

Asia Pacific Network Information Centre
APNIC

# ISP address request - parsing



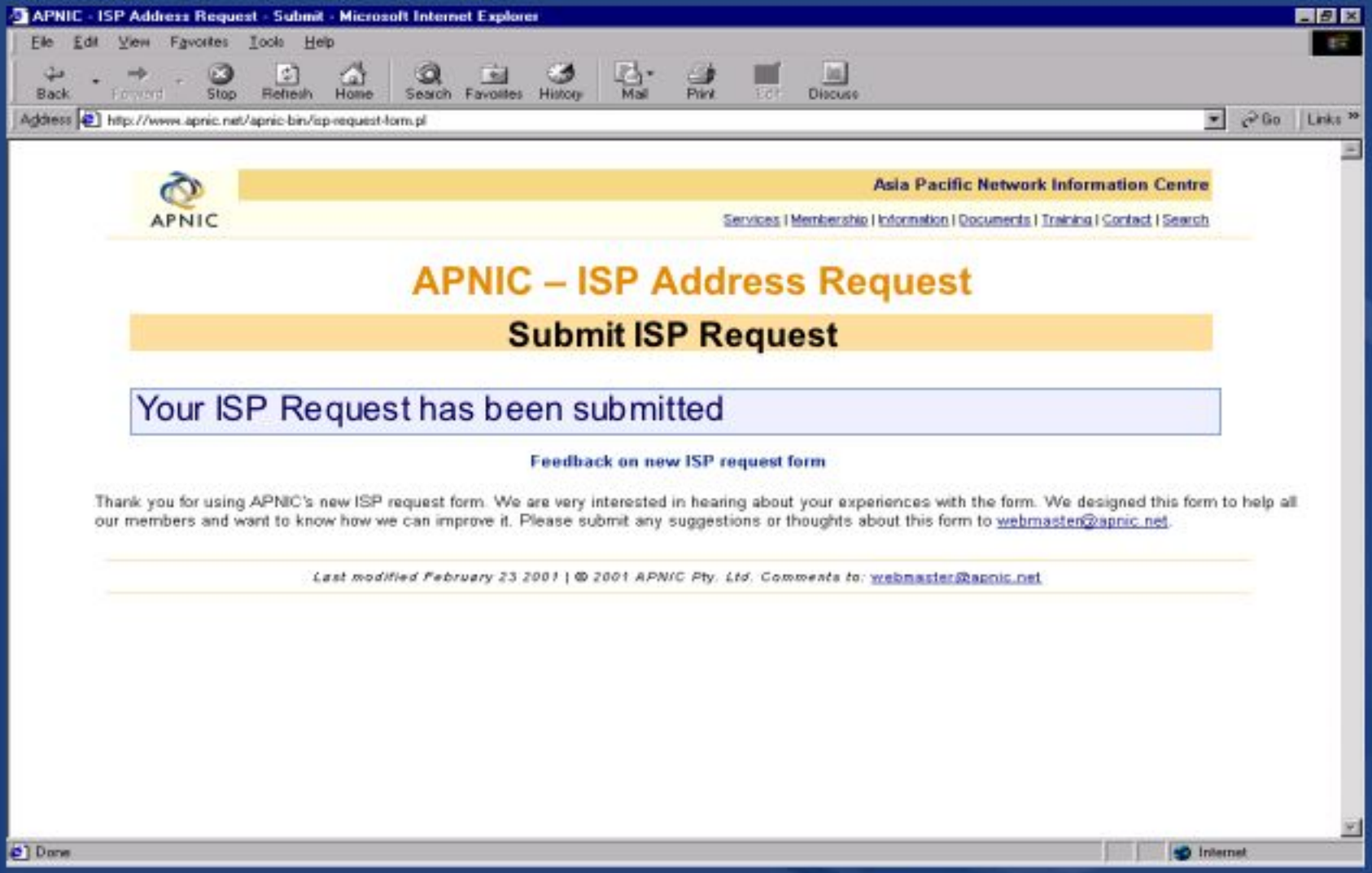



Successful parsing of ISP Request

Asia Pacific Network Information Centre
APNIC

# ISP address request - submission





# Questions ?

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Evaluation by APNIC - 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

Asia Pacific Network Information Centre
APNIC

# Cable, DSL services

- 1:1 contention ratio
  - Can be either statically or dynamically assigned
  - Means 1 IP address per customer
- Greater than 1:1 contention ratio
  - Preferred because conserves address space
- Choice of addressing is optional for members
  - dynamic addressing is encouraged

- Verification for DSL Services
  - Equipment details
    - Ex: BRAS, Number of ports
  - Purchase requests

Asia Pacific Network Information Centre
APNIC

# New Cable services

- Bootstrapping criteria for new cable service
  - Applies to startup providers commencing new cable service
  - Allocation size based on assumption that requestor will assign a /24 to each CMTS in their network
  - Complete additional information with make, model & quantity information
  - Purchase requests for equipments may be asked

Asia Pacific Network Information Centre
APNIC

# New Cable services

- Through 'infrastructure' description
  - Additional information needed
    - Head-end location, # Homes passed , Devices(CMTS), Capacity of CMR per CMTS , # Current Users # Assigned IP's for each CMTS, Additional CMTS in 6 months time, Growth rate/month
    - Example:

| Headend | Homespassed | Device | Capacity |
|---|---|---|---|
| Brisbane | 15000 | Motorola | 1000 |

| Current Users | IP | Device-Added | G-rate/Month |
|---|---|---|---|
| 750 | 800 | 1 | 1254 |

Asia Pacific Network Information Centre
APNIC

# Customer assignments

- Customer growth estimation
  - The invoice for the additional CMTS purchased for the expansion
- Required to report customer assignments greater than /30
  - Through second opinion process
  - Register the assignment in APNIC whois database

Asia Pacific Network Information Centre
APNIC

# Evaluation by APNIC - summary

- 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

Asia Pacific Network Information Centre
APNIC

# 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 /20 'slow start'
  - Exceptions made for very large networks but not common

Asia Pacific Network Information Centre
APNIC

# 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

Asia Pacific Network Information Centre
APNIC

# APNIC approval

ISP Req
- Eval

Dear xxxx

I am pleased to advise you that in response to your request for Internet resources, APNIC has allocated the following range of IPv4 addresses to the organisation belo

** IMPORTANT THINGS TO KNOW **

1. The address range allocated to your organisation is portable
If you change transit providers, the address range remains with your organisation.

2. Assignments and sub-allocations from this address range to customers are non-portable

Customers who cease connectivity with your organisation must return any addresses your organisation has assigned or sub-allocated to them.

3. Assignment Window (AW)
If the amount of address space your organisation wishes to assign or sub-allocate to a customer is greater than your assignment window then please email <hostmaster@apnic.net> for approval.

For more information on APNIC's new policy on sub-allocating space to customers, see: http://www.apnic.net/meetings/14/results.html

4. Aggregation
This new allocation should, wherever technically possible, be aggregated with any other address ranges the organisation announces to its upstream or transit ISP.

5. No guarantee of routability
APNIC cannot guarantee that any address space will be globally routable.

**Assignments & sub-allocations are non-portable**

**APNIC expectation: Announce allocation as single aggregate**

# Allocation object & contacts

ISP Req
- Eval

```
inetnum:     202.60.128.0 - 202.60.159.255
netname:     ROLTANET
descr:       Rolta India Limited
descr:       Rolta Center II
descr:       MIDC Marol
descr:       Andheri(East)- Mumbai-400 093
country:     IN
admin-c:     VS9-AP
tech-c:      SD34-AP
mnt-by:      APNIC-HM
mnt-lower:   MAINT-IN-SANTOSHDESAI
changed:     hostmaster@apnic.net 19990323
status:      ALLOCATED PORTABLE
source:      APNIC
```

```
person:      Vinay Sawarkar
address:     Rolta Center II, MIDC, Andheri,
address:     Mumbai-400 093
country:     IN
phone:       +91-22-832 7708
fax-no:      +91-22-836 5992
e-mail:      vinay@rolta.com
nic-hdl:     VS9-AP
mnt-by:      MAINT-IN-SANTOSHDESAI
changed:     vinay@rolta.com 20000526
source:      APNIC
```

```
person:      Santosh Desai
address:     Rolta Center II, MIDC, Andheri,
address:     Mumbai-400 093
country:     IN
phone:       +91-22-832 7708
fax-no:      +91-22-836 5992
e-mail:      santosh@rolta.com
nic-hdl:     SD34-AP
mnt-by:      MAINT-IN-SANTOSHDESAI
changed:     santosh@rolta.com 20000526
source:      APNIC
```

Contacts for network

Asia Pacific Network Information Centre
APNIC

# Questions ?

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# Internet Registry Procedures

## IP Address Management

# Revision of routing protocols

- Interior Gateway Protocol (IGP)
  - Examples are OSPF, EIGRP, ISIS
  - Used to find optimum route to a host in ISP network
  - Convergence becomes important with scaling
- Border Gateway Protocol (BGP)
  - Can be interior (iBGP) and exterior (eBGP)
  - Used to carry traffic across your network and to/from the Internet
  - Can use BGP attributes for routing policy

Asia Pacific Network Information Centre
APNIC

# Principles of addressing

- Separate customer & infrastructure address pools
  - Manageability
    - Different personnel manage infrastructure and assignments to customers
  - Scalability
    - Easier renumbering - customers are difficult, infrastructure is relatively easy

Asia Pacific Network Information Centre
APNIC

# Principles of addressing

- Further separate infrastructure
  - 'Dynamic' infrastructure for IGP
    - Carrying network infrastructure addresses used by a routing protocol where alternate paths to host exist
    - Eg. p2p addresses of backbone connections
    - Eg. router loopback addresses
  - 'Static' infrastructure
    - Static routing of infrastructure (where no alternative path exists)
    - Carry in iBGP

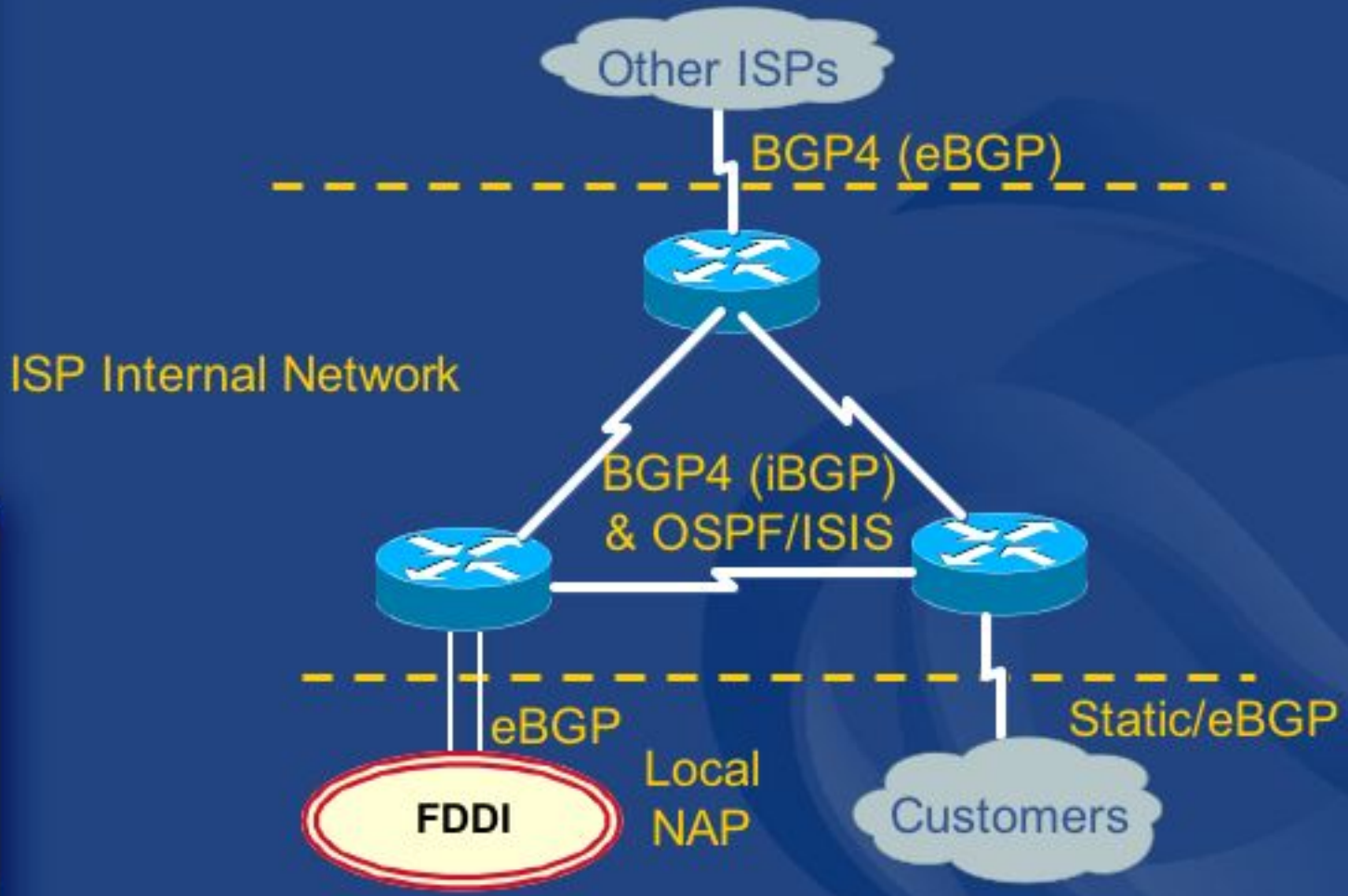
Asia Pacific Network Information Centre
APNIC

# Principles of addressing

- Further separate infrastructure
  - 'Static' infrastructure examples
    - RAS server address pools, CMTS
    - Virtual web and content hosting LANs
    - Anything where there is no dynamic route calculation
- Customer networks
    - Carry in iBGP , do not put in IGP
      - No need to aggregate address space carried in iBGP
      - Can carry in excess of 100K prefixes

Asia Pacific Network Information Centre
APNIC

# Hierarchy of routing protocols




Asia Pacific Network Information Centre
APNIC

# Management - simple network

- First allocation from APNIC
  - Infrastructure is known, customers are not
  - 20% free is trigger for next request

  - Grow usage of blocks from edges
  - Assign customers sequentially

Asia Pacific Network Information Centre
APNIC

# Management - simple network

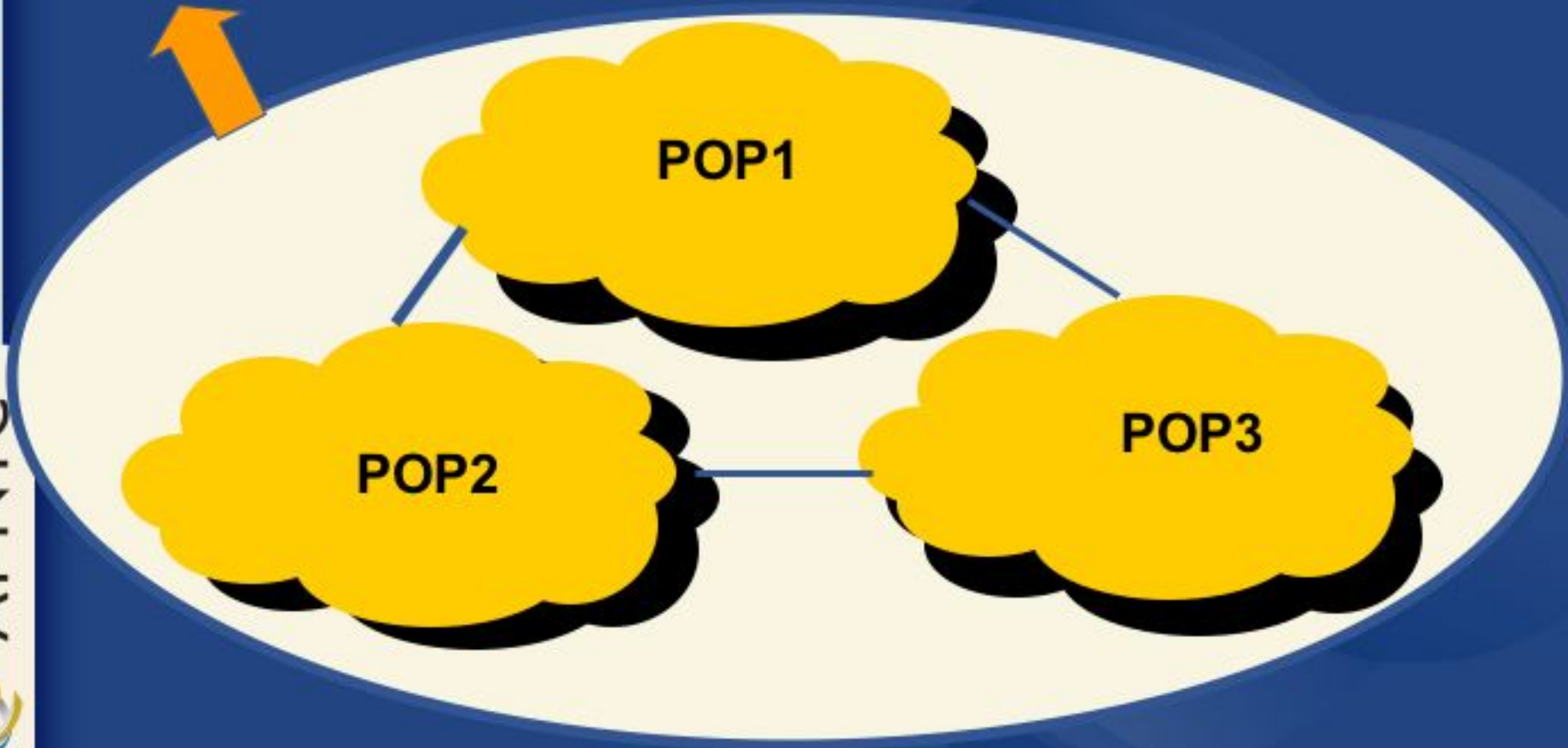
- If second allocation is contiguous

  - Reverse order of division of first block
  - Maximise contiguous space for infrastructure
    - Easier for debugging
  - Customer networks can be discontiguous

Asia Pacific Network Information Centre
APNIC

# Management - many POPs

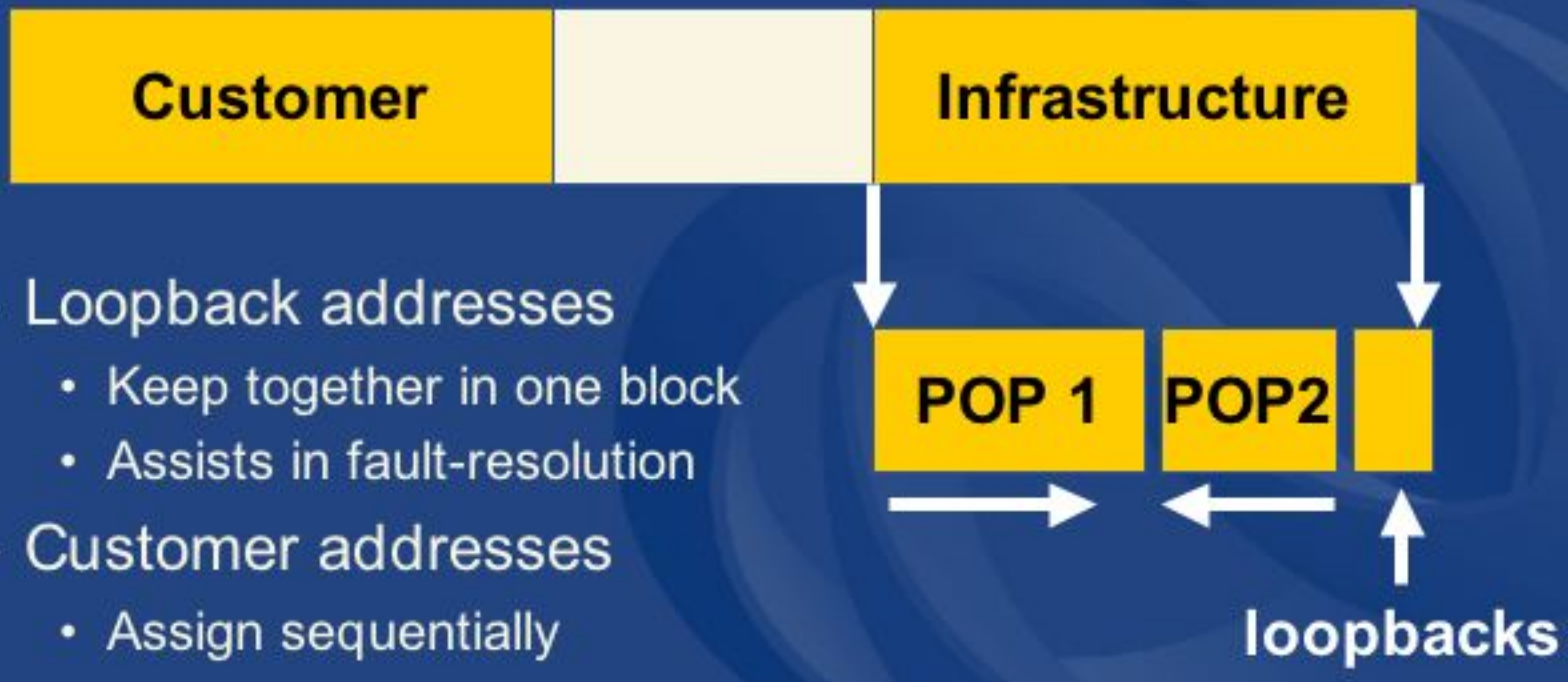
- WAN link to single transit ISP




Asia Pacific Network Information Centre
APNIC

# Management - many POPs

- POP sizes
  - Choose address pool for each POP according to need




  - Loopback addresses
    - Keep together in one block
    - Assists in fault-resolution
  - Customer addresses
    - Assign sequentially

Asia Pacific Network Information Centre
APNIC

# Management - many POPs

- /20 minimum allocation not enough for all your POPs?
  - Deploy addresses on infrastructure first
- Common mistake:
  - Reserving customer addresses on a per POP basis
- Do not constrain network plans due to lack of address space
  - Re-apply once address space has been used

Asia Pacific Network Information Centre
APNIC

# Questions ?

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC



# Second opinion request

- Assignment Window
- Second Opinion Request Form
- Evaluation

# What is an assignment window?



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

- All members have an AW
  - Starts at zero, increases as member gains experience in address management
- Second opinion process
  - Customer assignments require a 'second-opinion' when proposed assignment size is larger than members AW

Asia Pacific Network Information Centre
APNIC

# Assignment window

- Size of assignment window
  - Evaluated after about 5 2nd-opinion requests
  - Increased as member gains experience and demonstrates understanding of policies
    - Prefix length normally reduced by 1 bit at a time
    - Assignment window may be reduced, in rare cases
- Why an assignment window?
    - Monitoring ongoing progress and adherence to policies
    - Mechanism for member education

# Why assignment window?

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

FAQ

- http://www.apnic.net/faq/awfaq.html

Asia Pacific Network Information Centre
APNIC

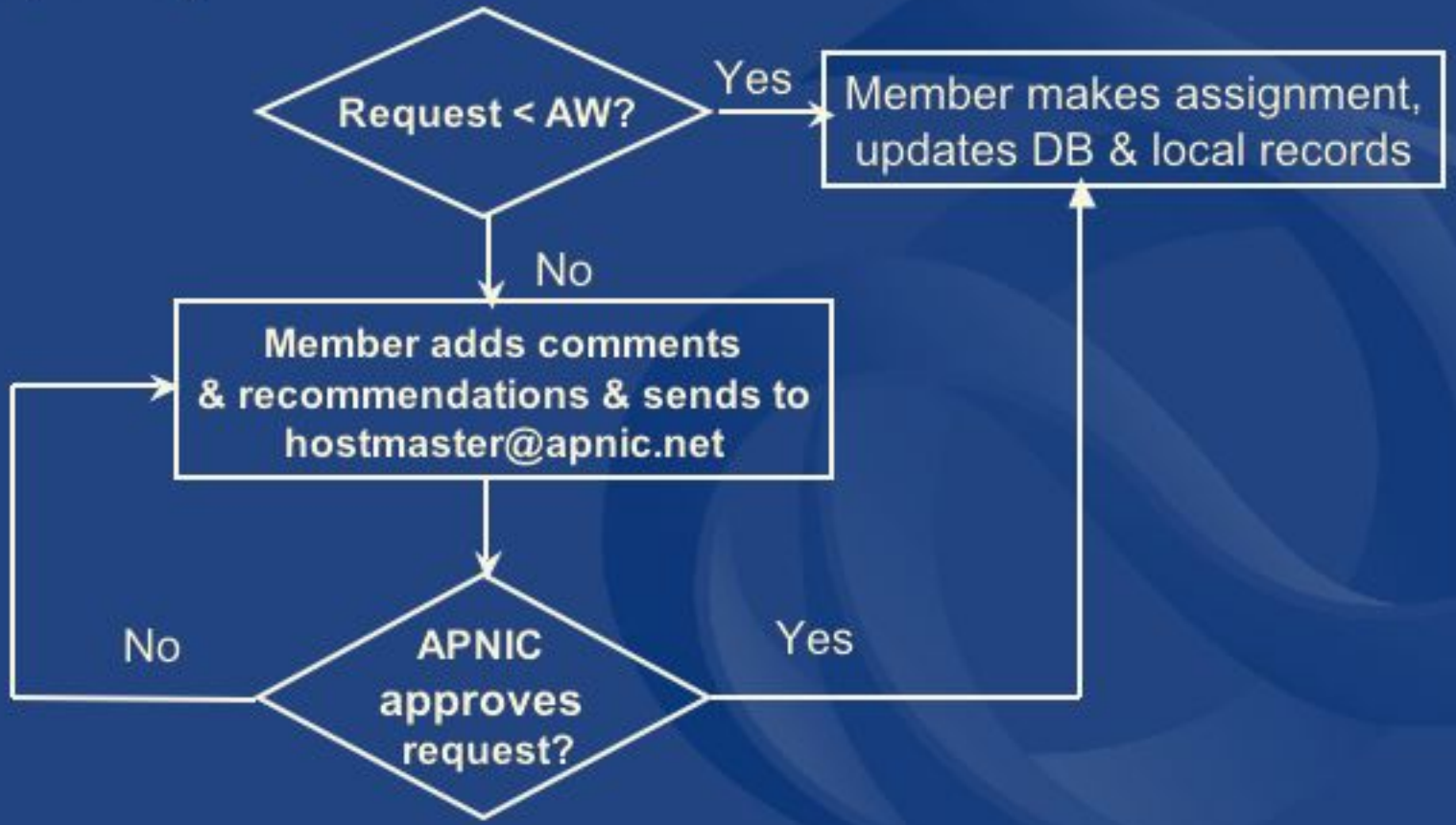
# Assignment window process

Step 1 - Member and customer complete 2nd Opinion Request form

Step 2 - Member evaluates customers requirements

iteration

Step 3 - Assignment Window procedure




Asia Pacific Network Information Centre
APNIC

# Second opinion request form

Used to seek approval for:

- IPv4 assignments & sub-allocations
- Multiple/additional IPv6 /48s to a single customer

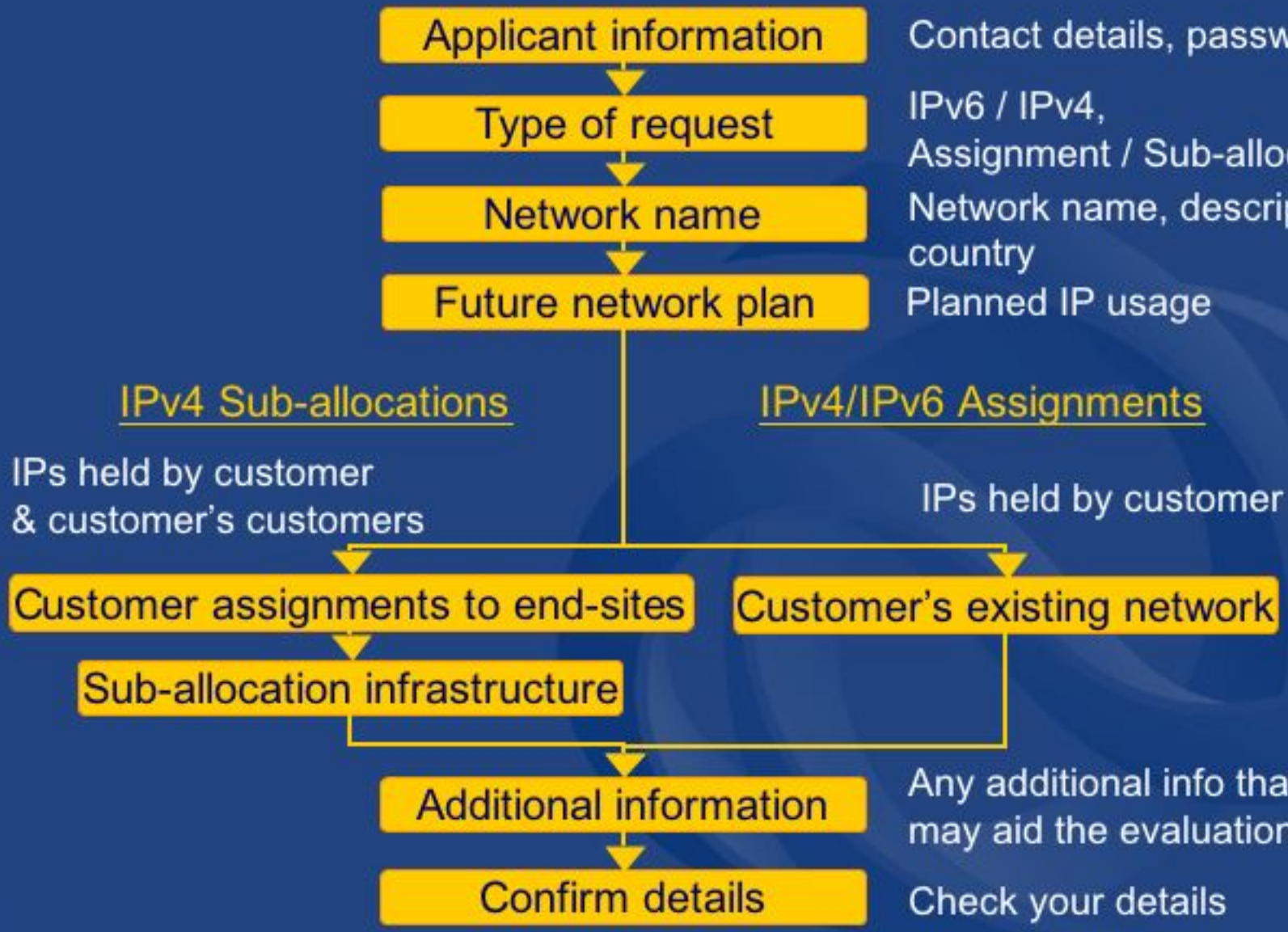
Before you start:

- Separate form for each request
- Help buttons available
- Form can be saved by use of password

Asia Pacific Network Information Centre
APNIC

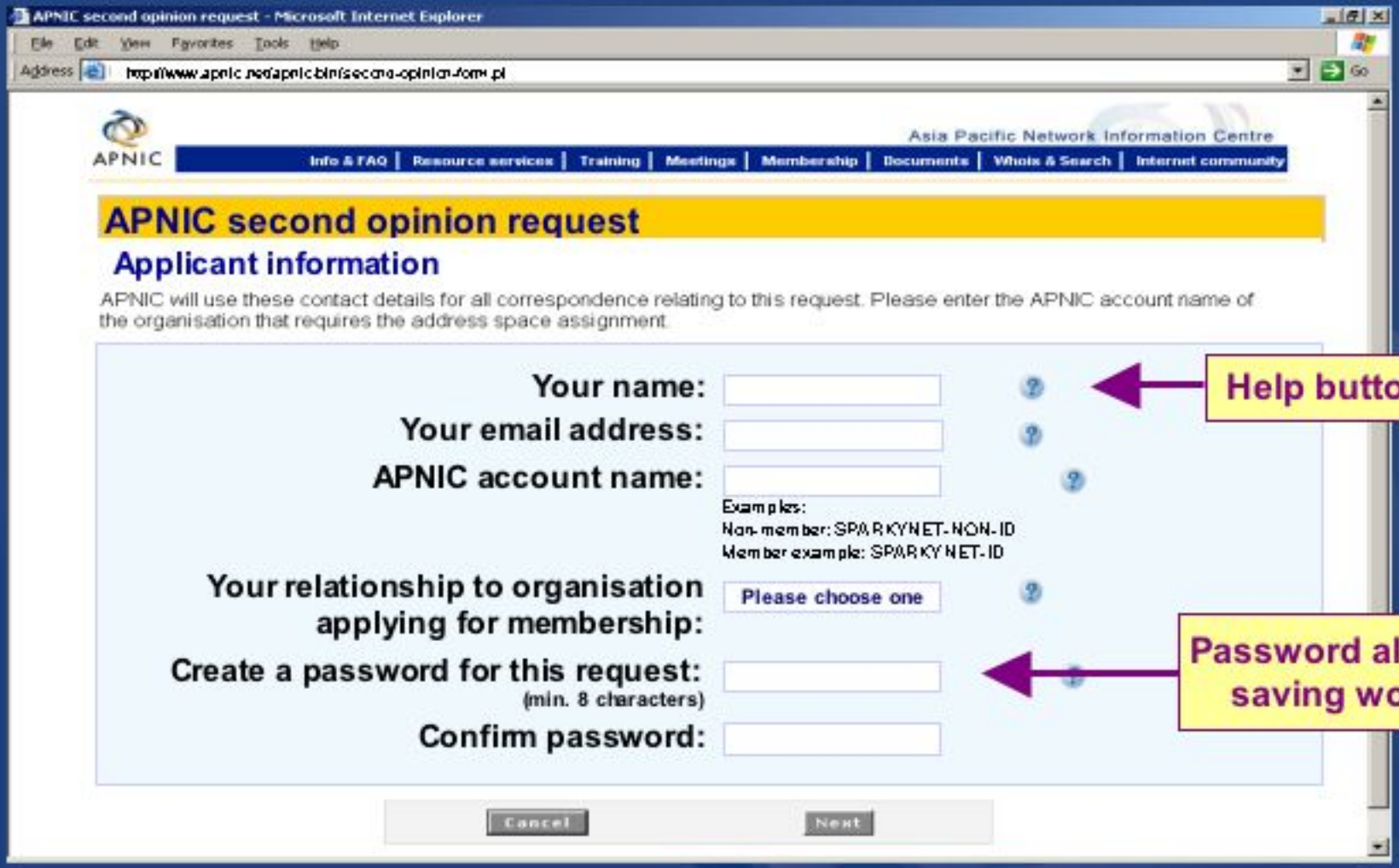
# Overview of 2nd opinion form





# Applicant information

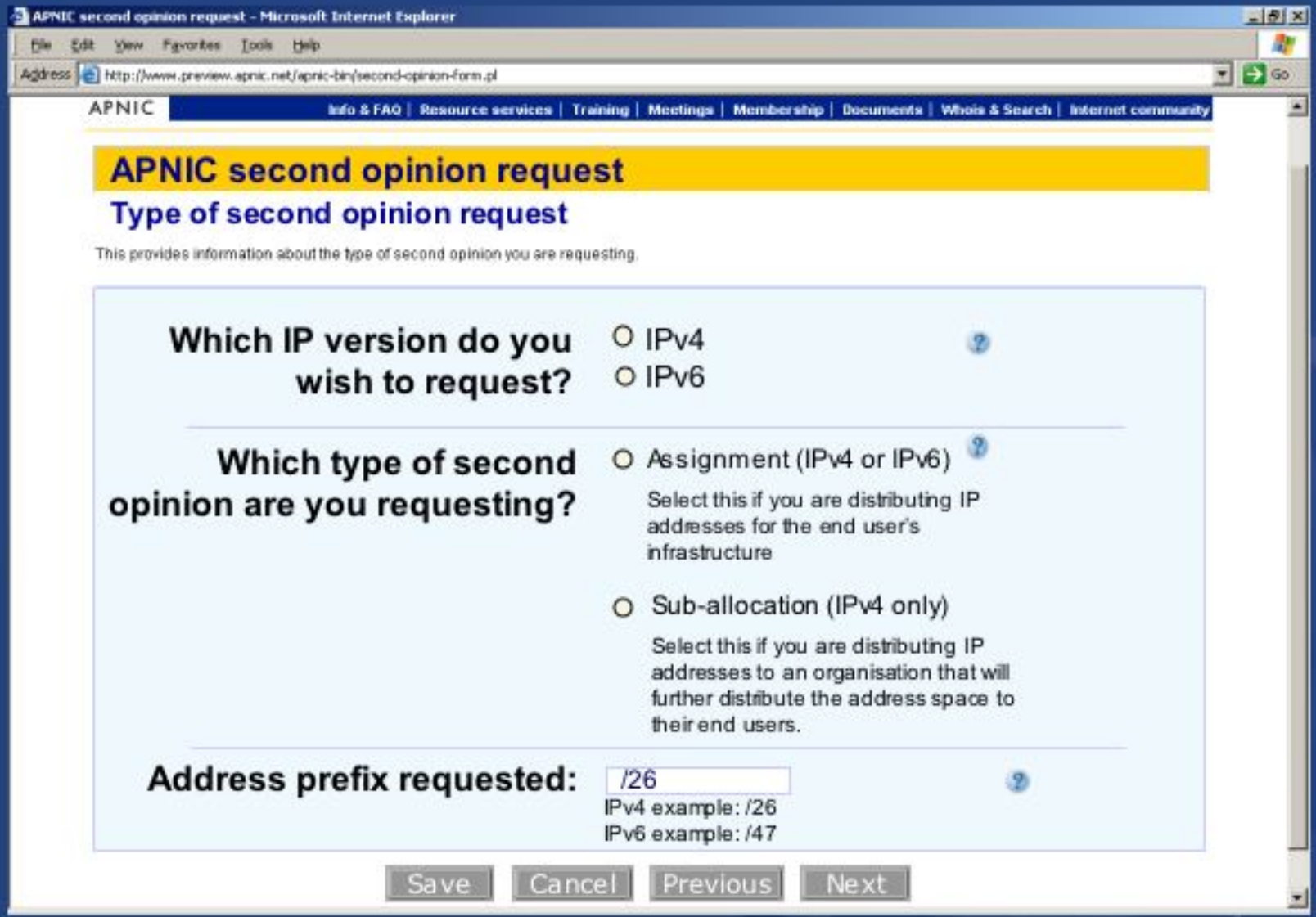





http://www.apnic.net/apnic-bin/second-opinion-request.pl

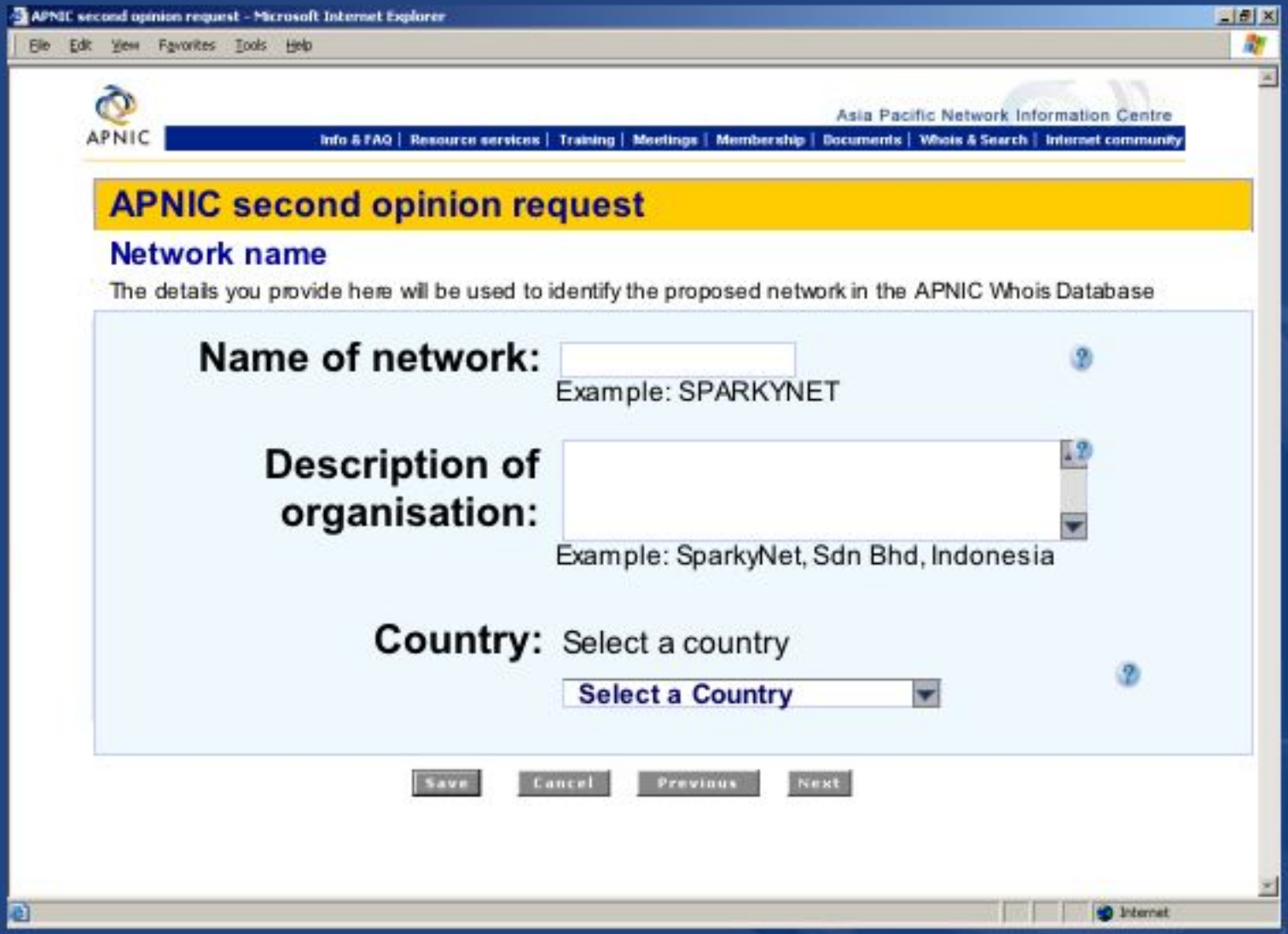
# Type of 2nd opinion request





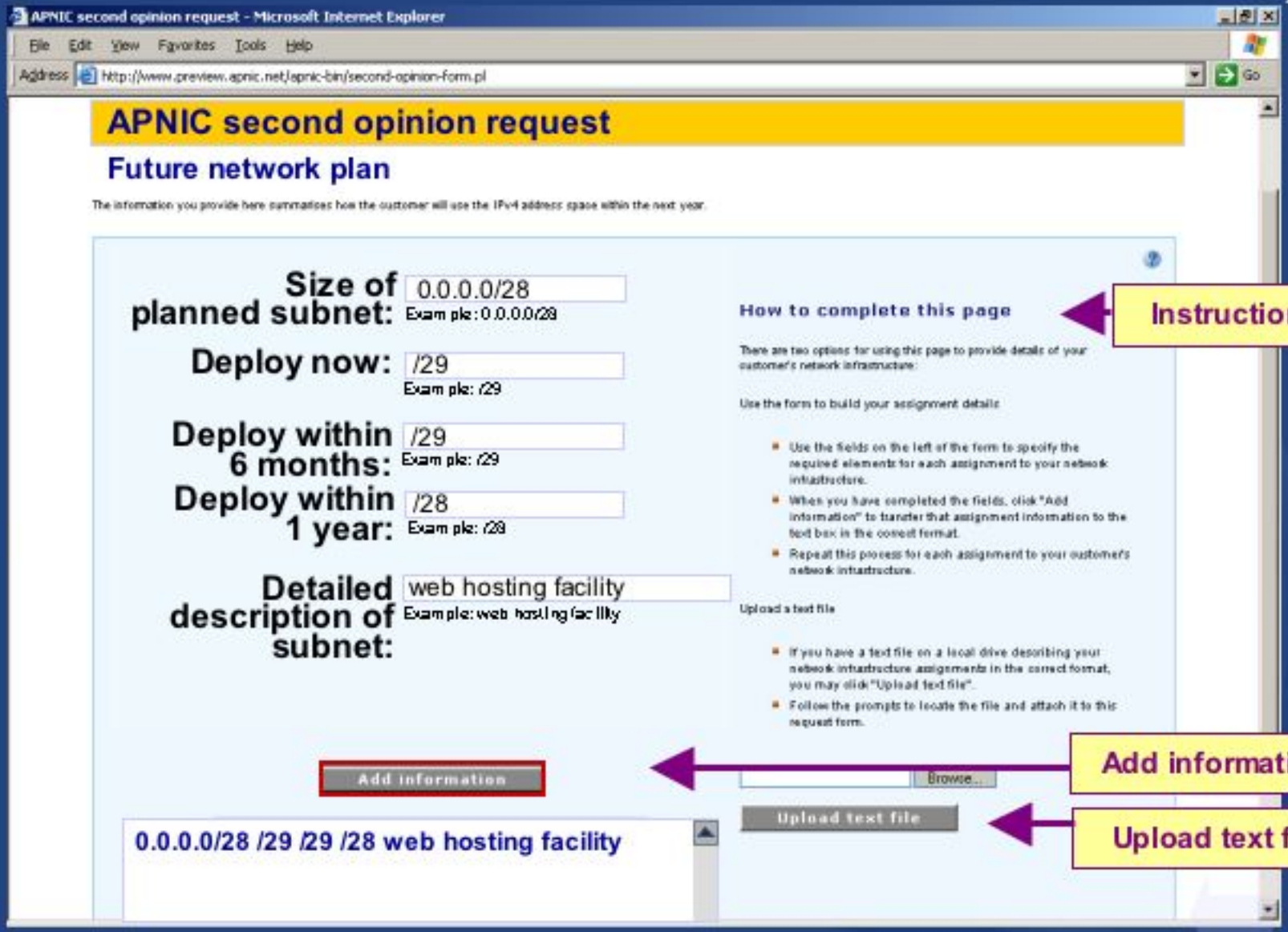

Asia Pacific Network Information Centre
APNIC

# Network name



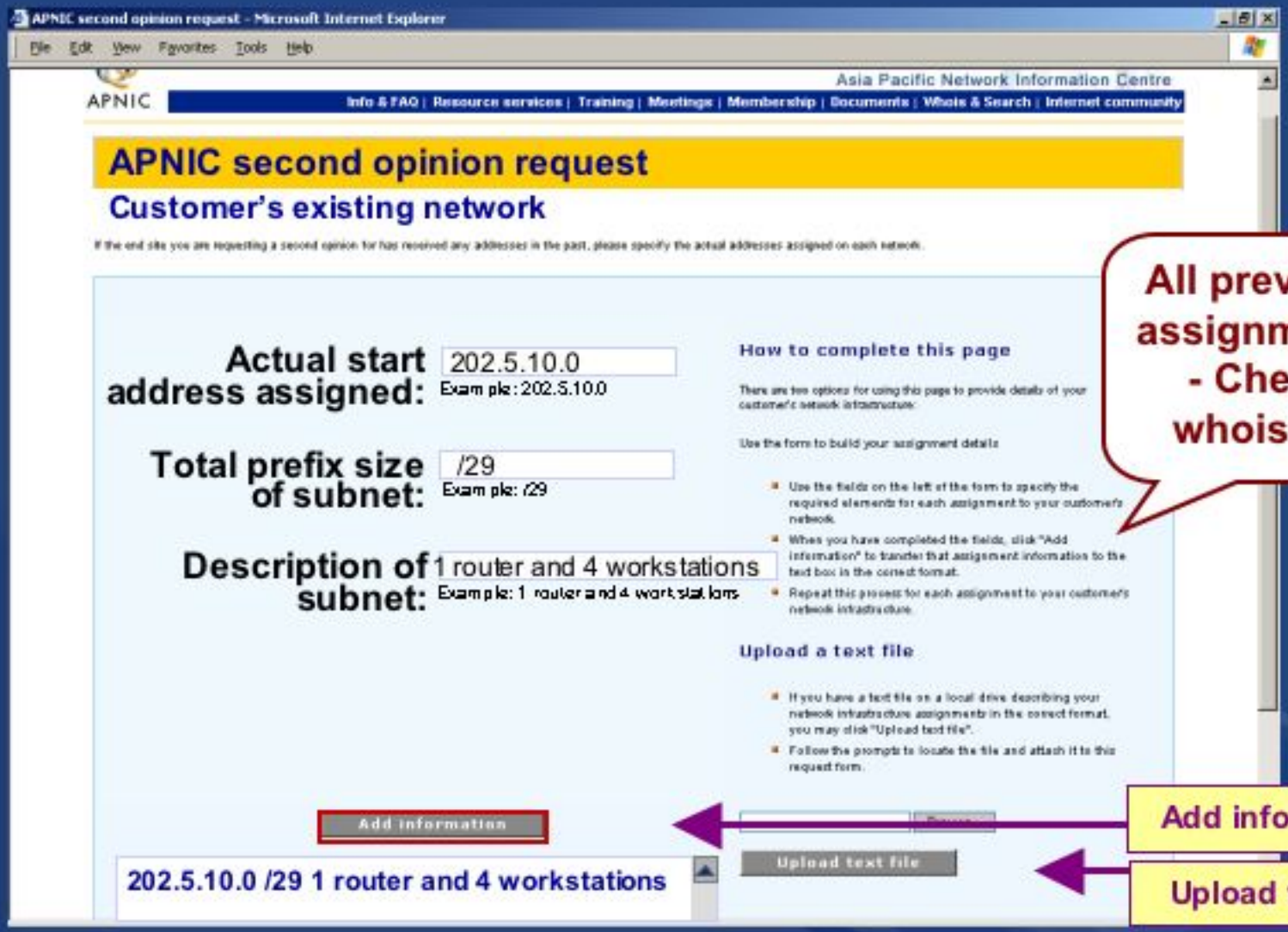
# Future network plan





# Customer's existing network
## - IPv4 assignment request

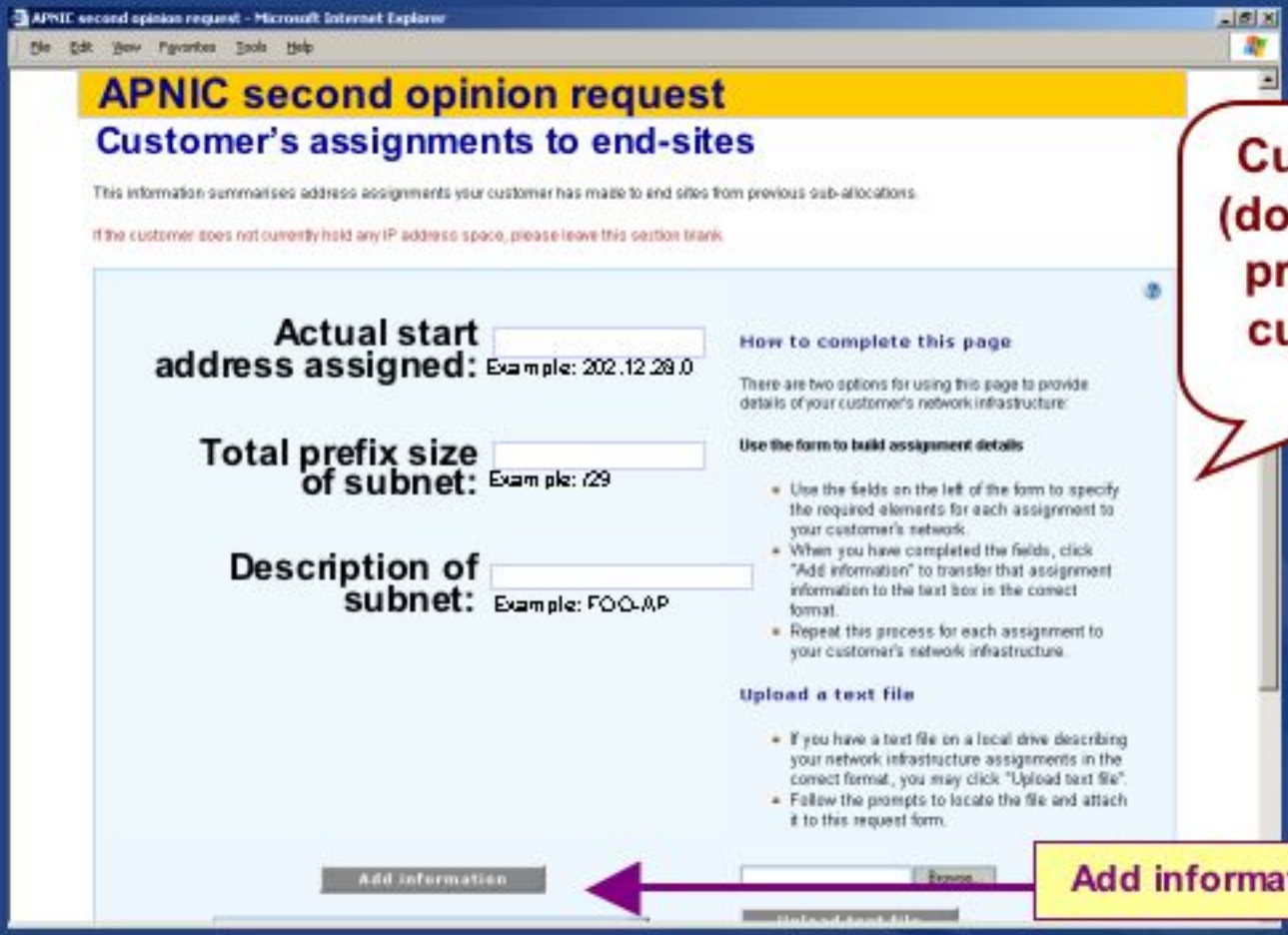




# Customer's assignments to end-sites

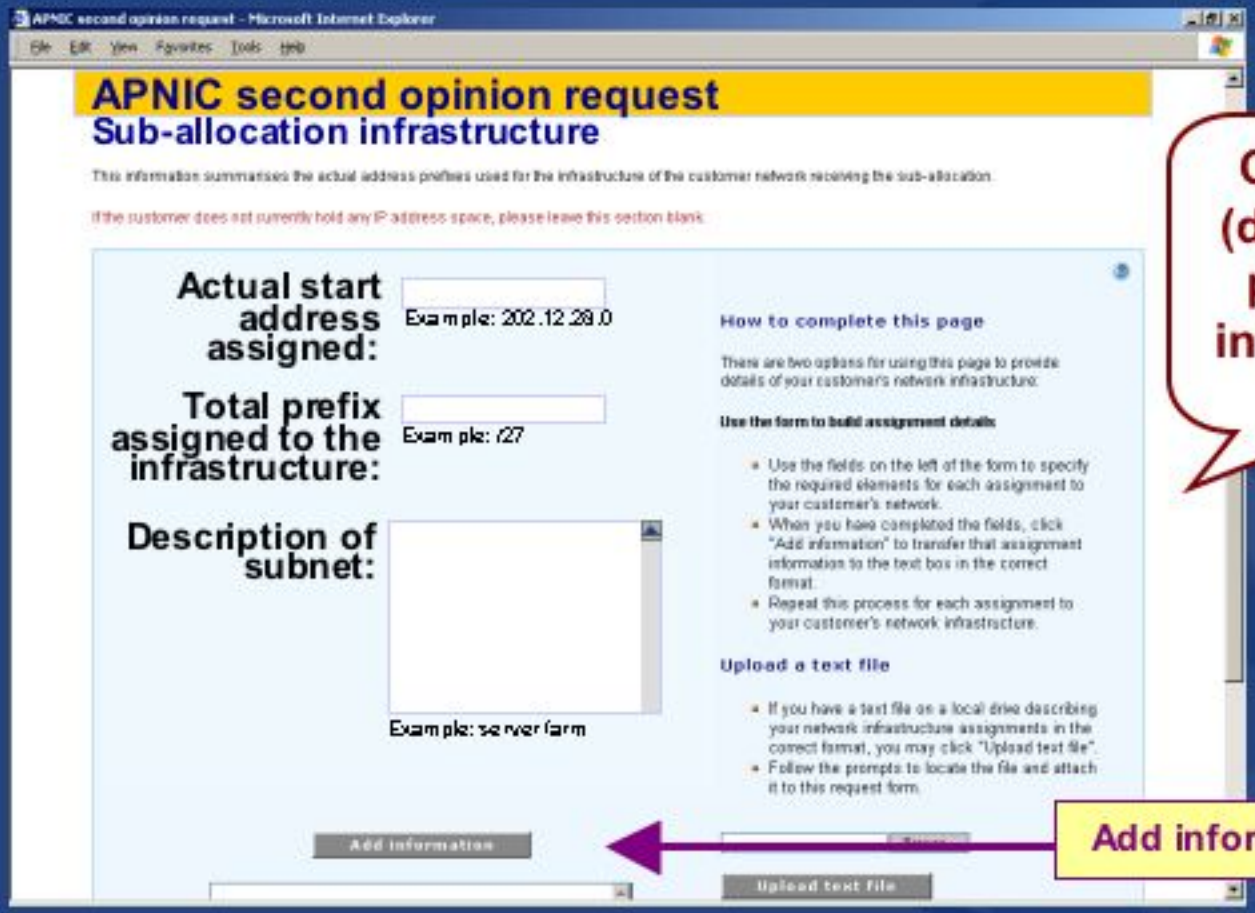


- Sub Allocation Request



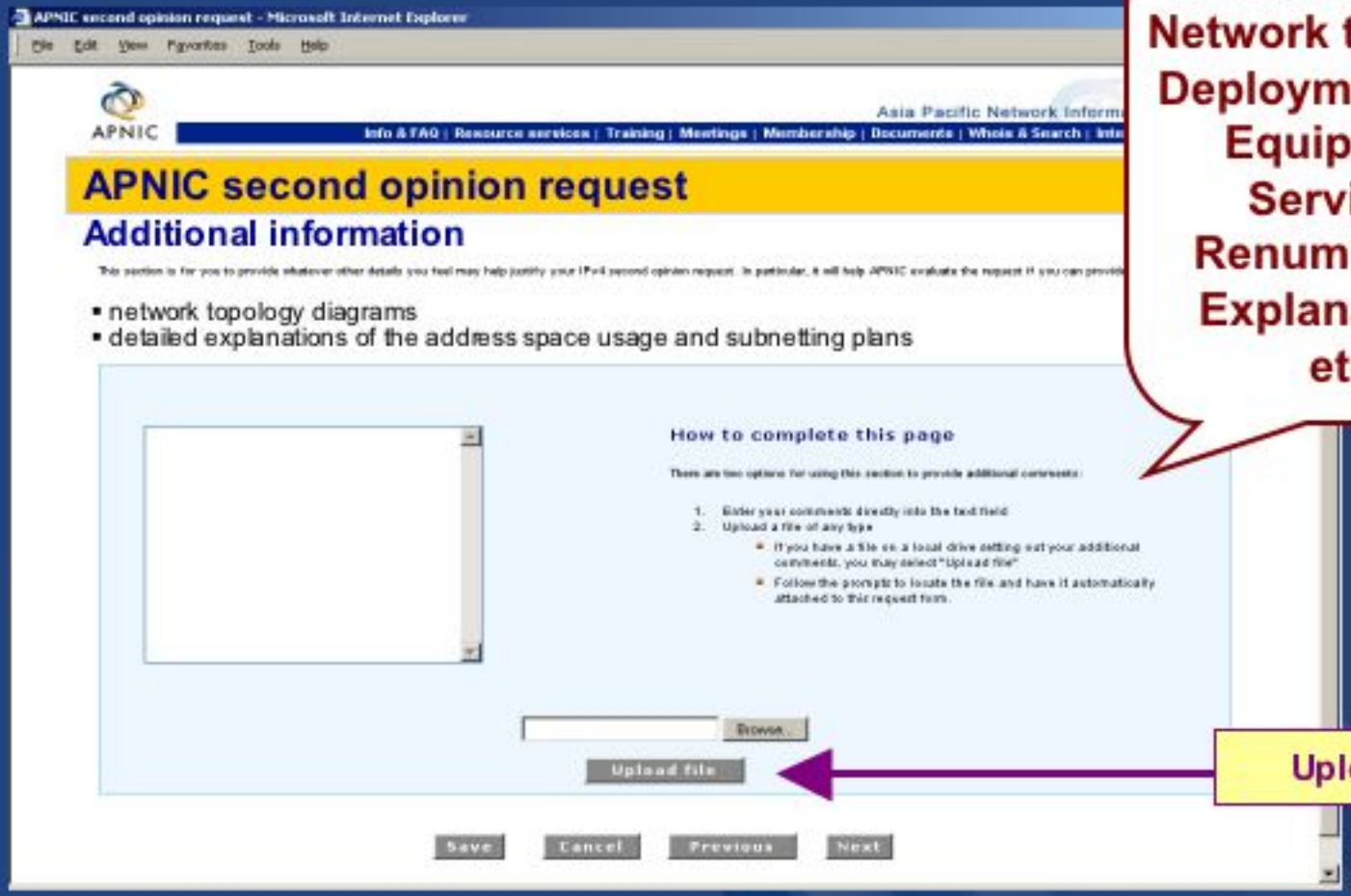
# Sub-allocation infrastructure

- Sub-Allocation Request



# Additional information





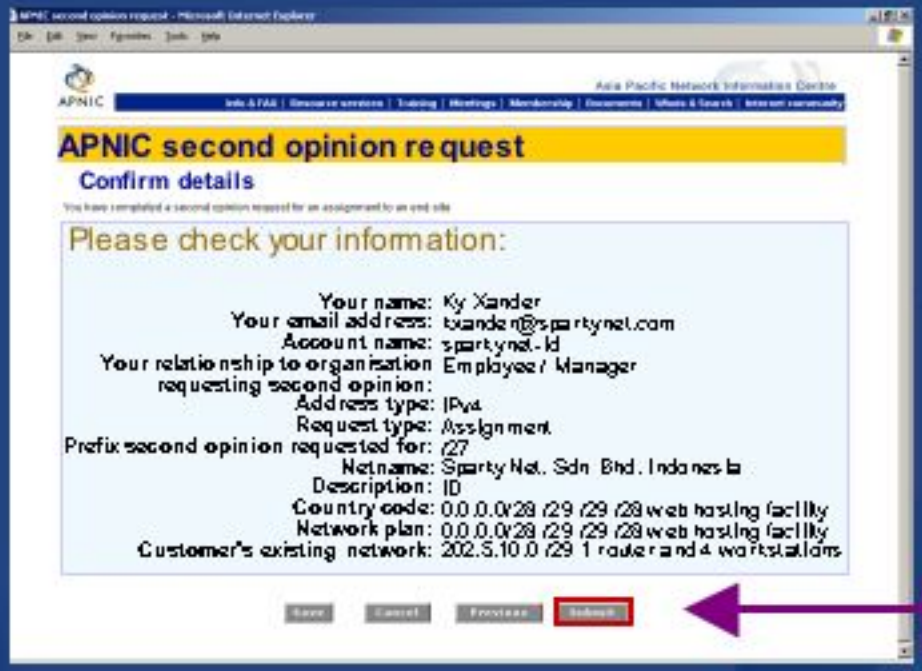

Network design
Network topology
Deployment plan
Equipment
Services
Renumbering
Explanations
etc

Upload File

Asia Pacific Network Information Centre
APNIC

# Confirm details & submit






- Check your request
- Click Submit
- Confirmation is also sent via email

**Submit**

- Request submitted!

Asia Pacific Network Information Centre
APNIC

# 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?

Asia Pacific Network Information Centre
APNIC

# 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

Asia Pacific Network Information Centre
APNIC

# Questions ?

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# The APNIC Database

## Protection and Updating

# 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

Asia Pacific Network Information Centre
APNIC

# Creating a maintainer object

1. Fill out webform
   - Provide:
     - Admin-c & tech-c
     - password
     - email address etc
2. Completed form will be sent to you
3. Forward request to maint-request@apnic.net
4. Maintainer will be created manually
   - Manual verification by APNIC Hostmasters
5. Update your person object with mntner

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

Asia Pacific Network Information Centre
APNIC

# Database protection

- Authorisation
  - "mnt-by" references a mntner object
    - Can be found in all database objects
    - "mnt-by" should be used with every object!
- Authentication
  - Updates to an object must pass authentication rule specified by its maintainer object

Asia Pacific Network Information Centre
APNIC

# Authorisation mechanism

DB 2

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

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Authentication methods

- 'auth' attribute
  - <none>
    - Strongly discouraged!
  - Crypt-PW
    - Crypt (Unix) password encryption
    - Use web page to create your maintainer
  - PGP – GNUPG
    - Strong authentication
    - Requires PGP keys
  - MD5
    - Soon 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

```
Inetnum:     203.146.96.0 - 203.146.127.255
netname:     LOXINFO-TH
descr:       Loxley Information Company Ltd.
Descr:       304 Suapah Rd, Promprab,Bangkok
country:     TH
admin-c:     KS32-AP
tech-c:      CT2-AP
mnt-by:      APNIC-HM
mnt-lower:   LOXINFO-IS
changed:     hostmaster@apnic.net 19990714
source:      APNIC
```

Only APNIC can change this object

# Authentication/Authorisation

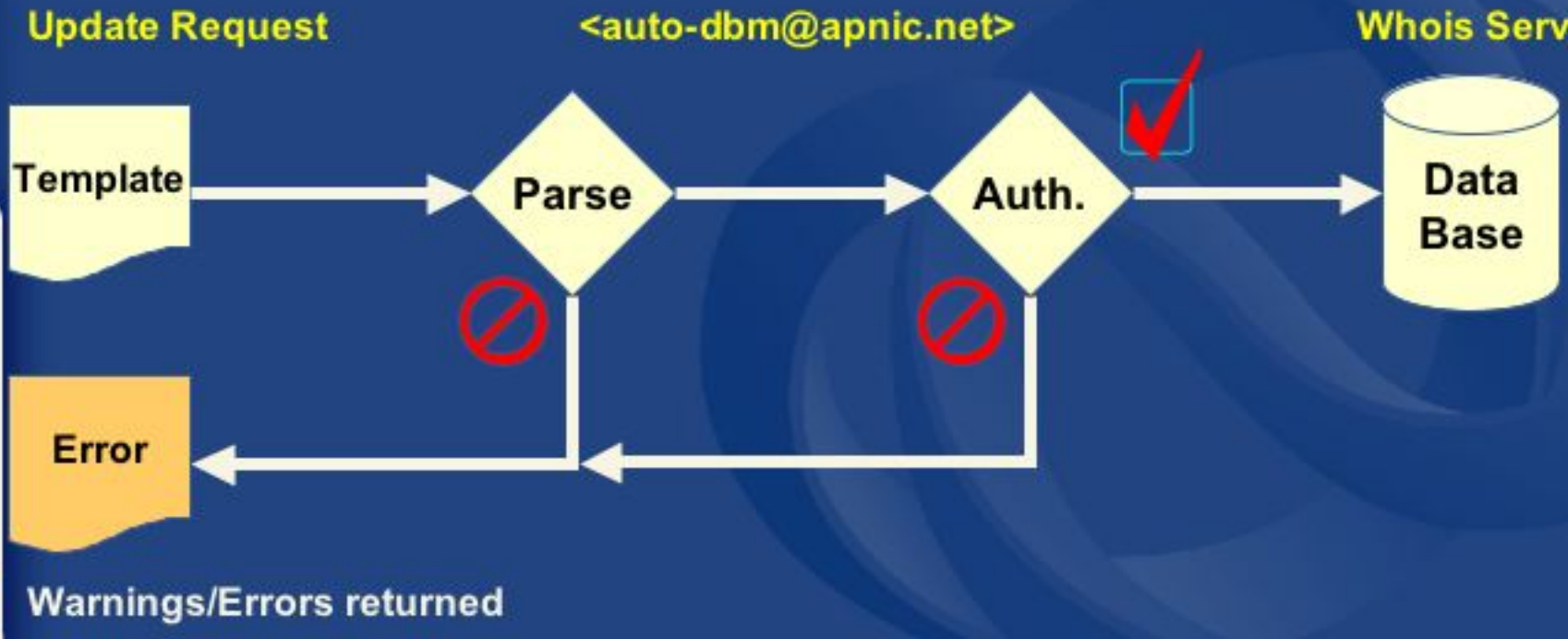
– Member assignment to customer
  • Created and maintained by APNIC member

```
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

# Database update process

- Email requests to <auto-dbm@apnic.net>
- Each request contains an object template




Asia Pacific Network Information Centre
APNIC

# Database update process

Template

- Update transactions
  - Create a new object
  - Change an object
  - Delete an object

- Updates are submitted by email
  - E-mail to: <auto-dbm@apnic.net>
- Email message contains template representing new or updated object

Asia Pacific Network Information Centre
APNIC

# Database update - web

- Creates a template through the web form
  - Template will be sent to you by email
  - This should be forwarded to:

<auto-dbm@apnic.net>

  - Common error
    - to reply to the email
      - (Adds extra character in front of each line)

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

# Authorisation

- Parser checks the maintainer object referenced in “mnt-by” attribute

- Failed Authorisation
  - Template NOT corrected
  - object NOT accepted
    - Automatic email notification sent
      - to requestor
    - Automatic email notification sent
      - to “notify” address

Asia Pacific Network Information Centre
APNIC

# Database update process

- Successful update
  - If Parse and Auth. steps succeed, database is updated
  - Confirmation by email to requestor

- Mirror to public server
  - Updates mirrored to “whois.apnic.net”
    - may take up to 60 minutes

Asia Pacific Network Information Centre
APNIC

# Updating an existing object

- Change relevant fields
- Add your maintainer password
- Update the changed attribute
- Email updated object to:

<auto-dbm@apnic.net>

- Note
  - Primary keys cannot be modified

Asia Pacific Network Information Centre
APNIC

# Deleting an object

- Copy object as-is in database into email
- Add your maintainer password
- Leave the changed attribute

```
inetnum:      202.182.224.0 - 202.182.225.255
netname:      SONY-HK
...
mnt-by:       MAINT-CNS-AP
changed:      ph@macroview.com 19990617
source:       APNIC
password:     x34zky
delete:       no longer required me@company.com
```

Note: Referenced objects cannot be deleted (02/99)

# Forgotten the password ?

## Requires legal documentation

Unfortunately we cannot change the password for the maintainer until we have received a fax with your company's letterhead confirming the request to modify the password.

In the fax, please include the following:

0. Attention: APNIC Database Administration Department
1. The APNIC Account name of your company and your personal nic handle. If you do not have an APNIC account, then please state 'NON-MEM'.
2. The current maintainer object which is to be modified, as obtained from 'whois –h whois.apnic.net MAINTAINER-OBJECT'
3. The new password/authorisation for the maintainer.
4. The signature of a contact for the maintainer.

**Confirmation by fax required on company letter head**

We do not recommend using personal names for maintainer objects

Asia Pacific Network Information Centre
APNIC

# Questions ?

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# Reverse DNS Delegation

## Registry Procedures

# Overview

- Reverse DNS Delegation
- APNIC & Member responsibilities
- Reverse network delegations (/16)
- Reverse network delegations (/24)
- Subnet delegations
- Delegation procedures

Asia Pacific Network Information Centre
APNIC

# 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

Asia Pacific Network Information Centre
APNIC

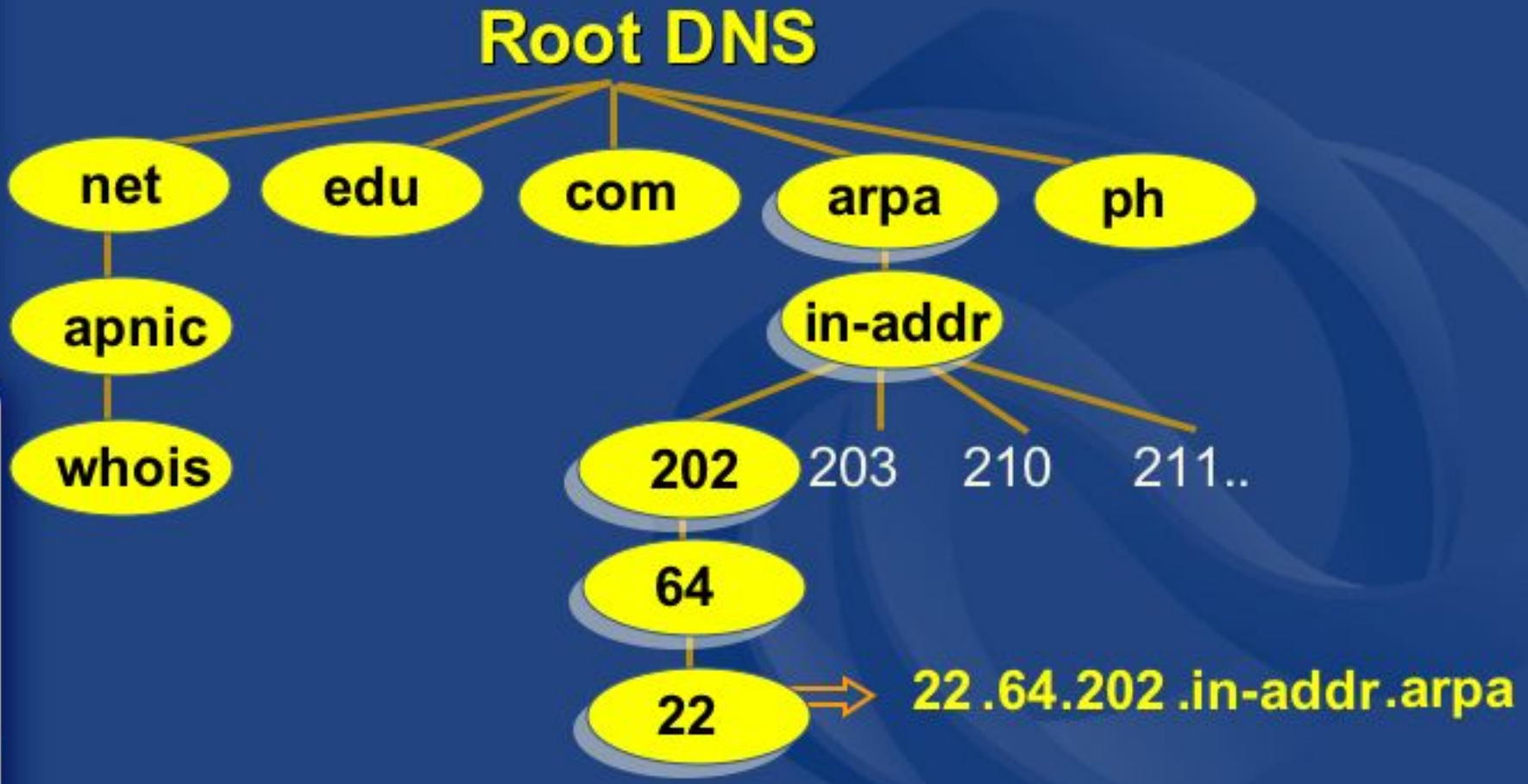
# In-addr.arpa

- Hierarchy of IP addresses
  - Uses 'in-addr.arpa' domain
    - INverse ADDRess
- IP addresses:
  - Less specific to More specific
    - 210.56.14.1
- Domain names:
  - More specific to Less specific
    - delhi.vsnl.net.in
  - Reversed in in-addr.arpa hierarchy
    - 14.56.210.in-addr.arpa

Asia Pacific Network Information Centre
APNIC

# Reverse DNS delegation

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



# Reverse DNS - why bother?

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

Asia Pacific Network Information Centre
APNIC

# Member responsibilities

- Are to
  - Be familiar with APNIC procedures
  - Ensure that addresses are reverse-mapped
  - Maintain nameservers for allocations
  - Minimise “pollution” of DNS
    - syntax or configuration errors
- Are not to
  - Manage reverse delegation of zones for addresses not (yet) assigned or allocated

Asia Pacific Network Information Centre
APNIC

# /16 network delegations

If a member has a /16 allocated, APNIC will delegate the entire zone to the member

- APNIC requirements are
  - Entire /16 is allocated to organisation
  - Member manages network delegations to customers
  - Member's NS is primary
  - Other secondary servers are recommended
    - Recommend asking APNIC to secondary zone

Asia Pacific Network Information Centre
APNIC

# /24 network delegations

If a member has an allocation smaller than a /16 (eg. /19) then APNIC delegates each /24 separately

- APNIC requirements are
  - Each /24 address is assigned or allocated
  - One NS set up as primary
  - At least one other NS set up as secondary

Asia Pacific Network Information Centre
APNIC

# Subnet delegations

Reverse delegation is also possible for a /24 shared by more than one customer

- APNIC requirements
  - Same as for network delegations; we reverse delegate the entire /24
  - Read "classless in-addr.arpa delegation"
    - http://ftp.apnic.net/ietf/rfc/rfc2000/rfc2317.txt

Asia Pacific Network Information Centre
APNIC

# Delegation procedures

- Upon allocation, member is asked if they want /24 place holder domain objects with member maintainer
  - Gives member direct control
- Standard APNIC database object,
  - can be updated through online form or via email.
- Nameserver/domain set up verified before being submitted to the database.
- Protection by maintainer object
  - (current auths: NONE, CRYPT-PW, PGP).
- Zone file updated 2-hourly

Asia Pacific Network Information Centre
APNIC

# Example 'domain' object

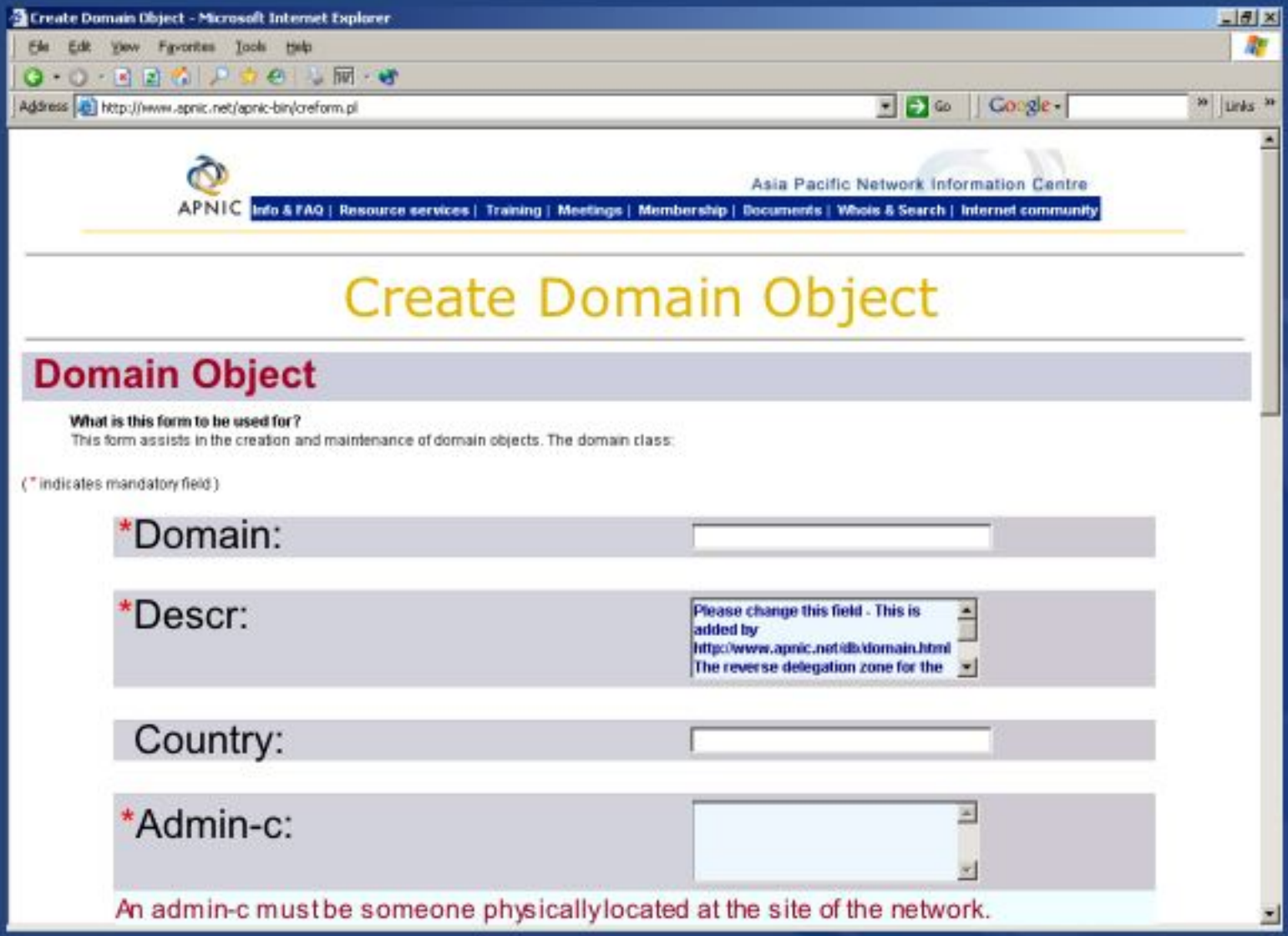
| | |
|---|---|
| domain: | 124.54.202.in-addr.arpa |
| descr: | co-located server at mumbai |
| country: | IN |
| admin-c: | VT43-AP |
| tech-c: | IA15-AP |
| zone-c: | IA15-AP |
| nserver: | dns.vsnl.net.in |
| nserver: | giasbm01.vsnl.net.in |
| mnt-by: | MAINT-IN-VSNL |
| changed: | gpsingh@vsnl.net.in 20010612 |
| source: | APNIC |

# Delegation procedures

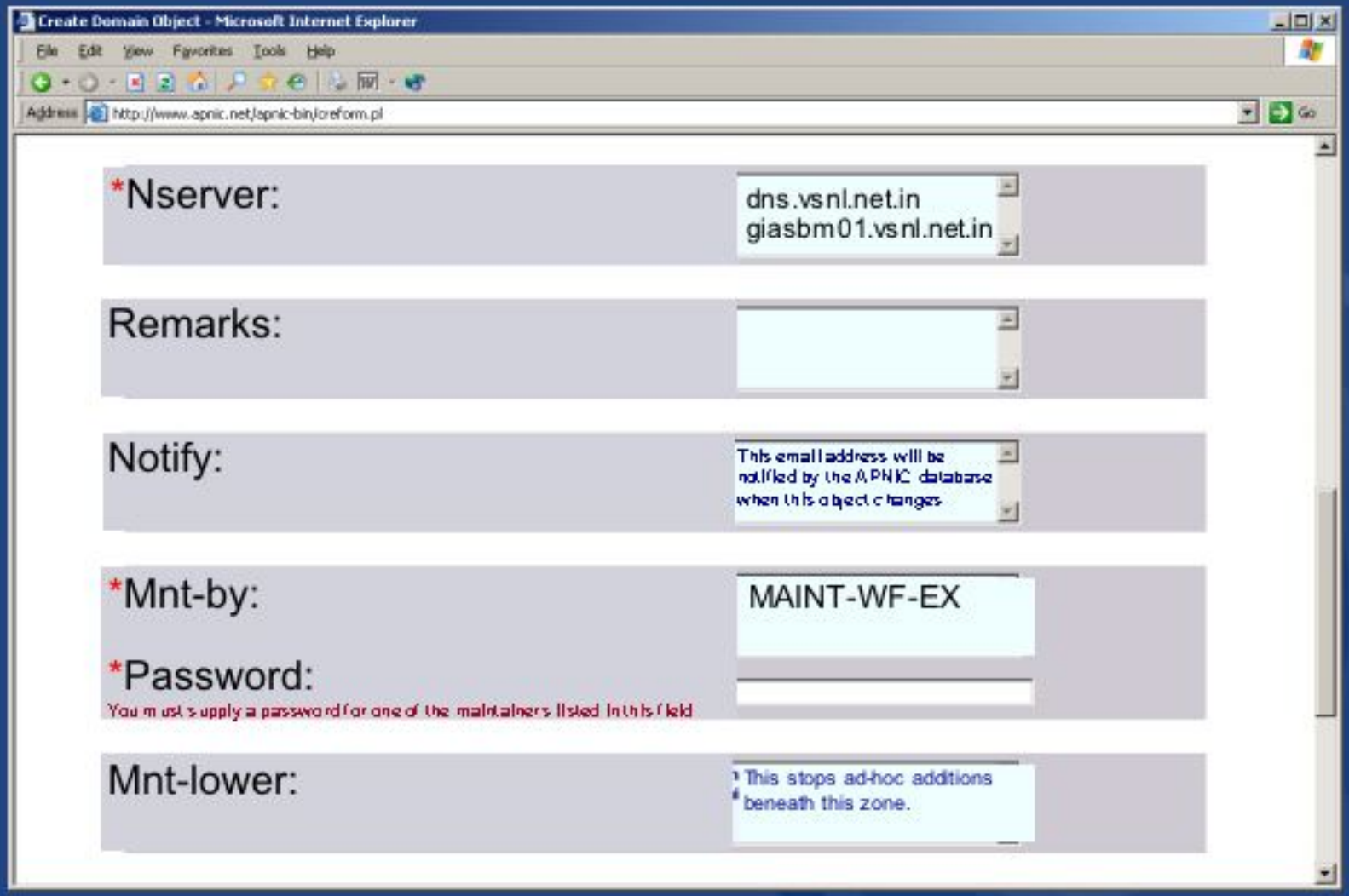
- Complete the documentation
  - http://www.apnic.net/db/domain.html
- On-line form interface
  - Real time feedback
  - Gives errors, warnings in zone configuration
    - serial number of zone consistent across nameservers
    - nameservers listed in zone consistent
  - Uses database 'domain' object
    - examples of form to follow..

Asia Pacific Network Information Centre
APNIC

# Reverse DNS request form



# Request form



# 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

Asia Pacific Network Information Centre
APNIC

# Online errors (also via email)

Domain Update Results - Microsoft Internet Explorer

File Edit View Go Favorites Help

Please wait while your request is processed.
Parsing and validating your submission …

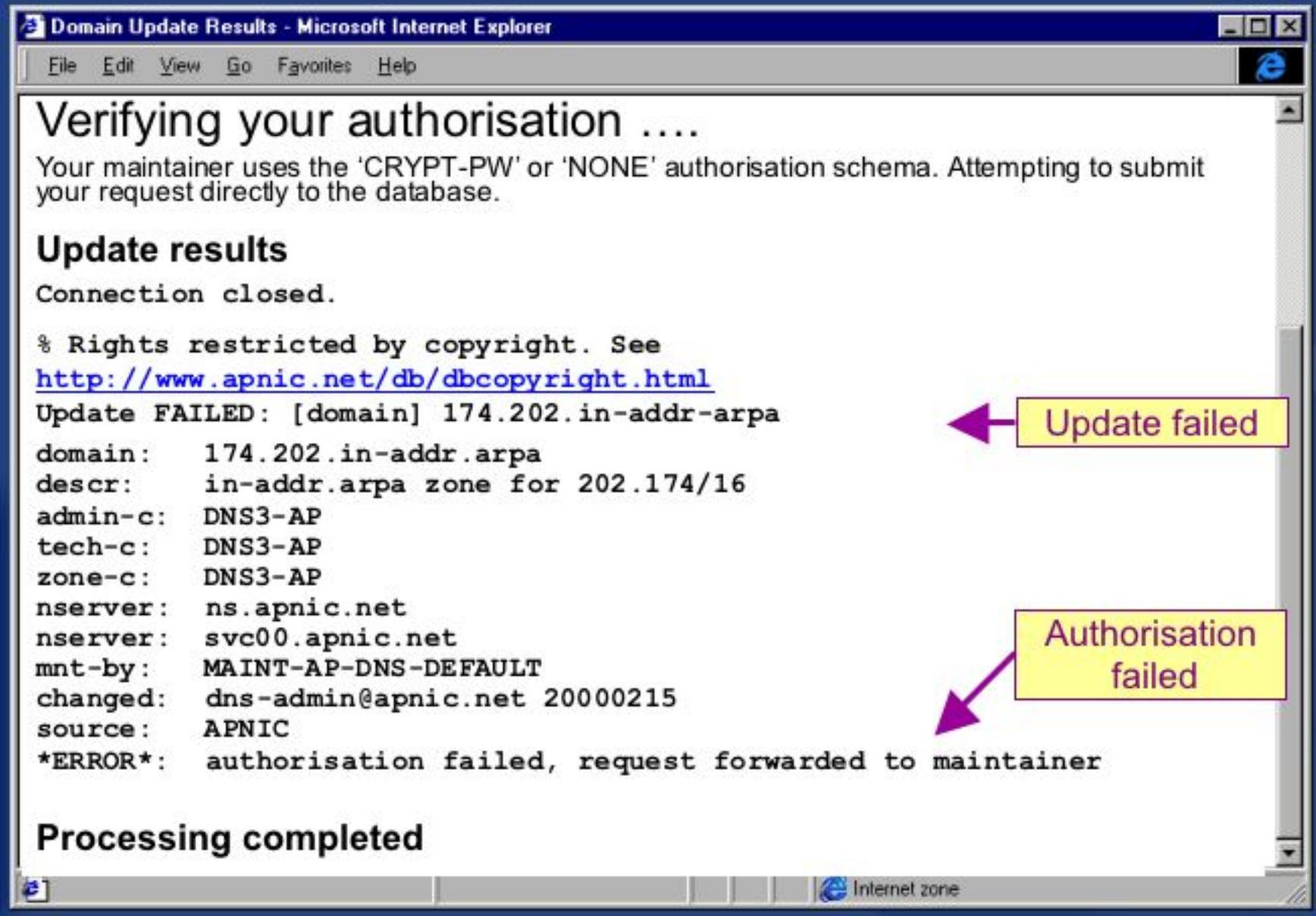
## Errors encountered

Your update request was unable to be completed due to the following errors. Please correct them and try again. If the error is temporary in nature, correct the error and 'Reload' this page (possibly this frame).

- *ERROR*. SOA on "ns.apnic.net" does not match SOA on "svc00.apnic.net". All nservers must respond with the same SOA.
- *ERROR*. NS RR for ns.telstra.net found on svc00.apnic.net but not in supplied template.
- *ERROR*. NS RR for ns.telstra.net found on svc00.apnic.net but not in supplied template.
- *ERROR*. NS RR for ns.telstra.net found on ns.apnic.net but not in supplied template.
- *ERROR*. NS RR for ns.telstra.net found on ns.apnic.net but not in supplied template.
- *ERROR*. cross-check of listed NS RR failed.

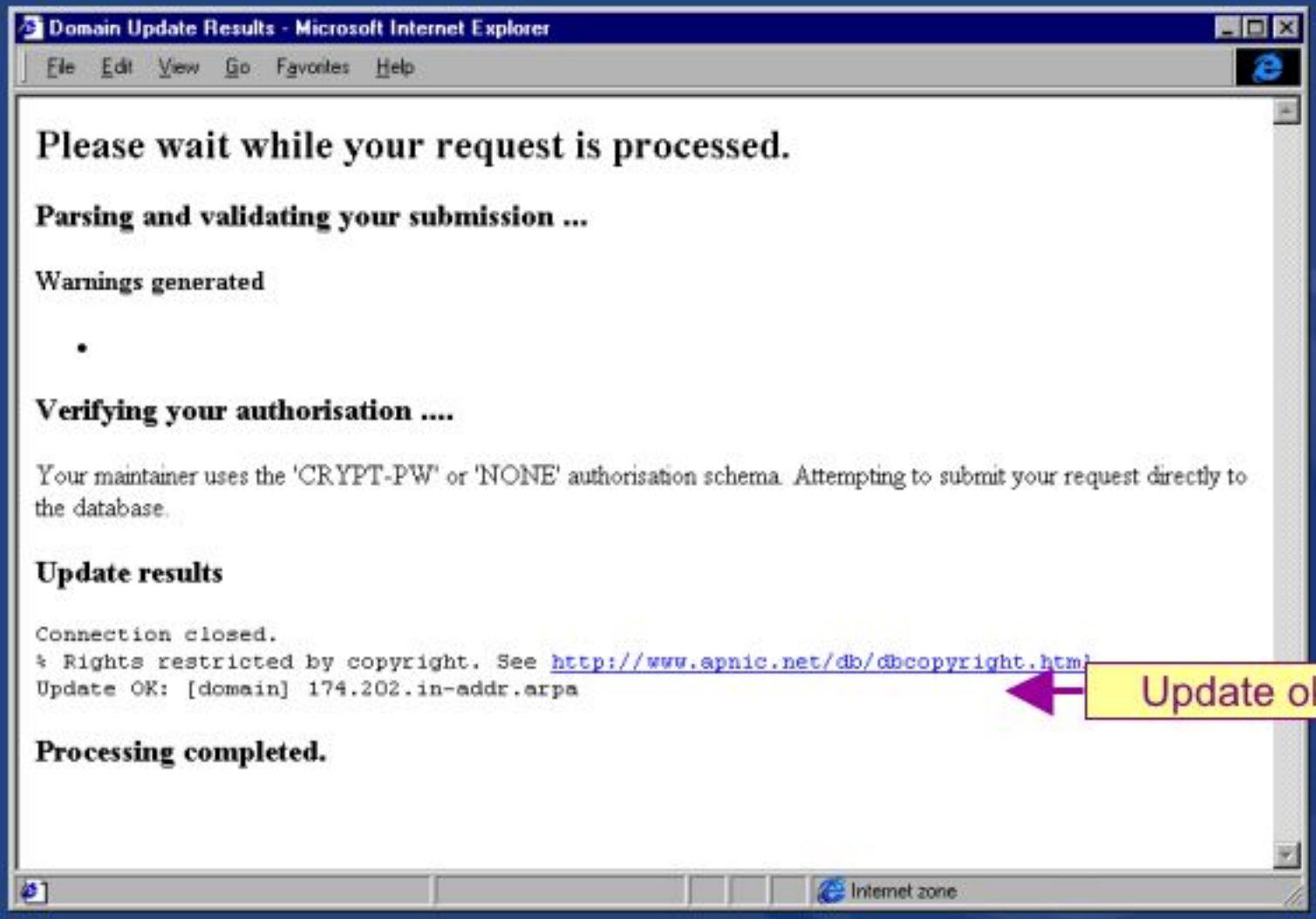
Internet zone

# Request submission error




Asia Pacific Network Information Centre
APNIC

# Successful update



Asia Pacific Network Information Centre
APNIC



# Questions?

- Are all your zones, and your customer zones registered?

Asia Pacific Network Information Centre
APNIC



# Database Administrivia

Role objects and advanced queries

# 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
  - More info on role objects:
    - http://www.apnic.net/db/role.html

Asia Pacific Network Information Centre
APNIC

# Role object - example

- Contains contact info for several contacts

| Attributes | Values |
|---|---|
| **role:** | OPTUS IP ADMINISTRATORS |
| address: | 101 Miller Street North Sydney |
| country: | AU |
| phone: | +61-2-93427681 |
| phone: | +61-2-93420813 |
| fax-no: | +61-2-9342-0998 |
| fax-no: | +61-2-9342-6122 |
| e-mail: | noc@optus.net.au |
| admin-c: | NC8-AP |
| tech-c: | NC8-AP |
| tech-c: | SC120-AP |
| nic-hdl: | OA3-AP |
| mnt-by: | MAINT-OPTUSCOM-AP |
| source: | APNIC |

Asia Pacific Network Information Centre
APNIC

# Creating a role object

- Whois –t role
  - Gives role object template
- Complete all fields
  - With the nic-hdls of all contacts in your organisation
- Send to

<auto-dbm@apnic.net>

Asia Pacific Network Information Centre
APNIC

# Replacing contacts in the DB
## - *Using person objects*



Asia Pacific Network Information Centre
APNIC

*K. Xander is leaving my organisation. Z. Ulrich replaces 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*



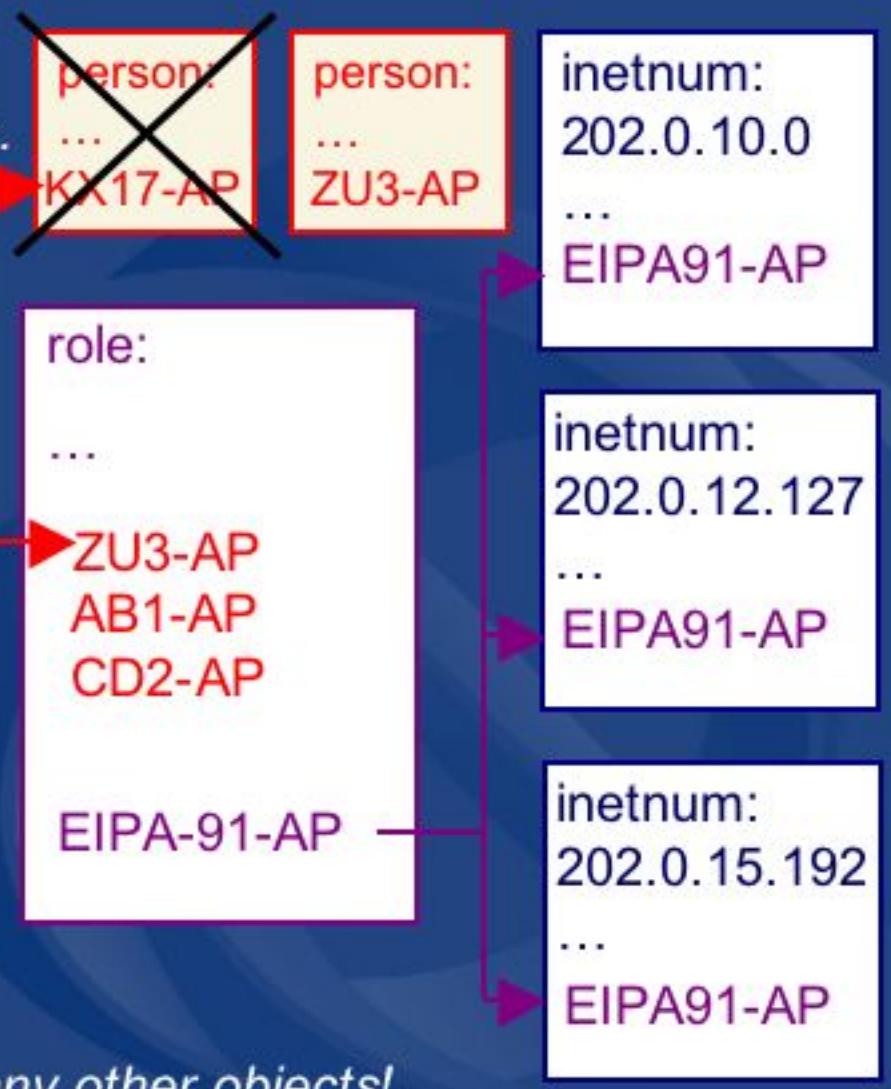
*K. Xander is leaving my organisation. Z. Ulrich replaces him.*

*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!*

Asia Pacific Network Information Centre
APNIC

# Summary

- Use **role objects** for all your contacts
  - Easier to administer your contacts
  - Keep the role object up-to-date

Asia Pacific Network Information Centre
APNIC

# Questions ?

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC



# Autonomous System Numbers

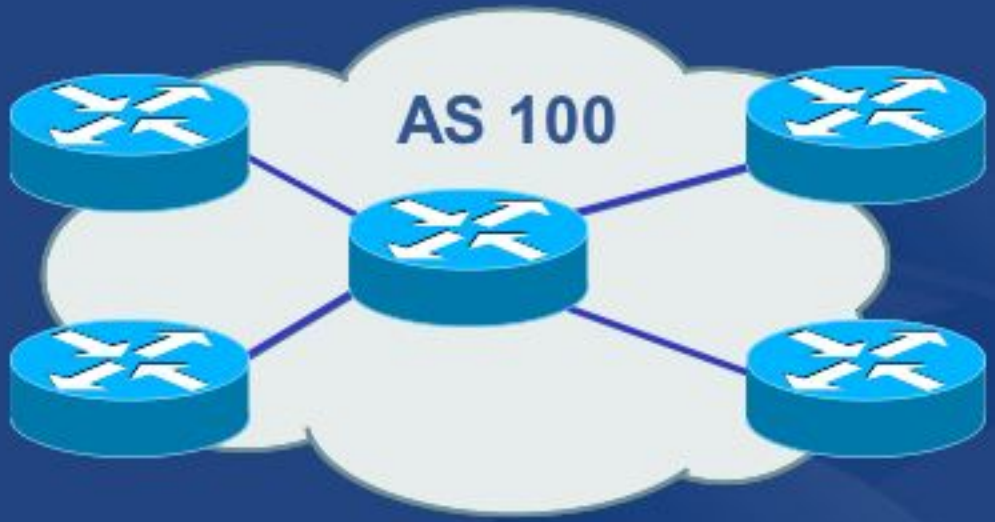
## Procedures

# Overview

- What is an AS?
- Guidelines and procedures
- Application form (documentation)
- Policy expression

Asia Pacific Network Information Centre
APNIC

# What is an Autonomous System?




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

Asia Pacific Network Information Centre
APNIC

# 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

- Recommended reading!
  - RFC1930: Guidelines for creation, selection and registration of an Autonomous System

Asia Pacific Network Information Centre
APNIC

# 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

Asia Pacific Network Information Centre
APNIC

# Requesting an ASN

- Complete the request form
  - web form available:
    - http://www.apnic.net/db/aut-num.html

- Request form is parsed - real time
  - Must include routing policy
    - multiple import and export lines
  - Is checked for syntactical accuracy
    - based on RPSL (rfc2622)
  - Peers verified by querying routing table
  - [NO-PARSE] will not send request to parser

Asia Pacific Network Information Centre
APNIC

# Requesting an ASN - customers

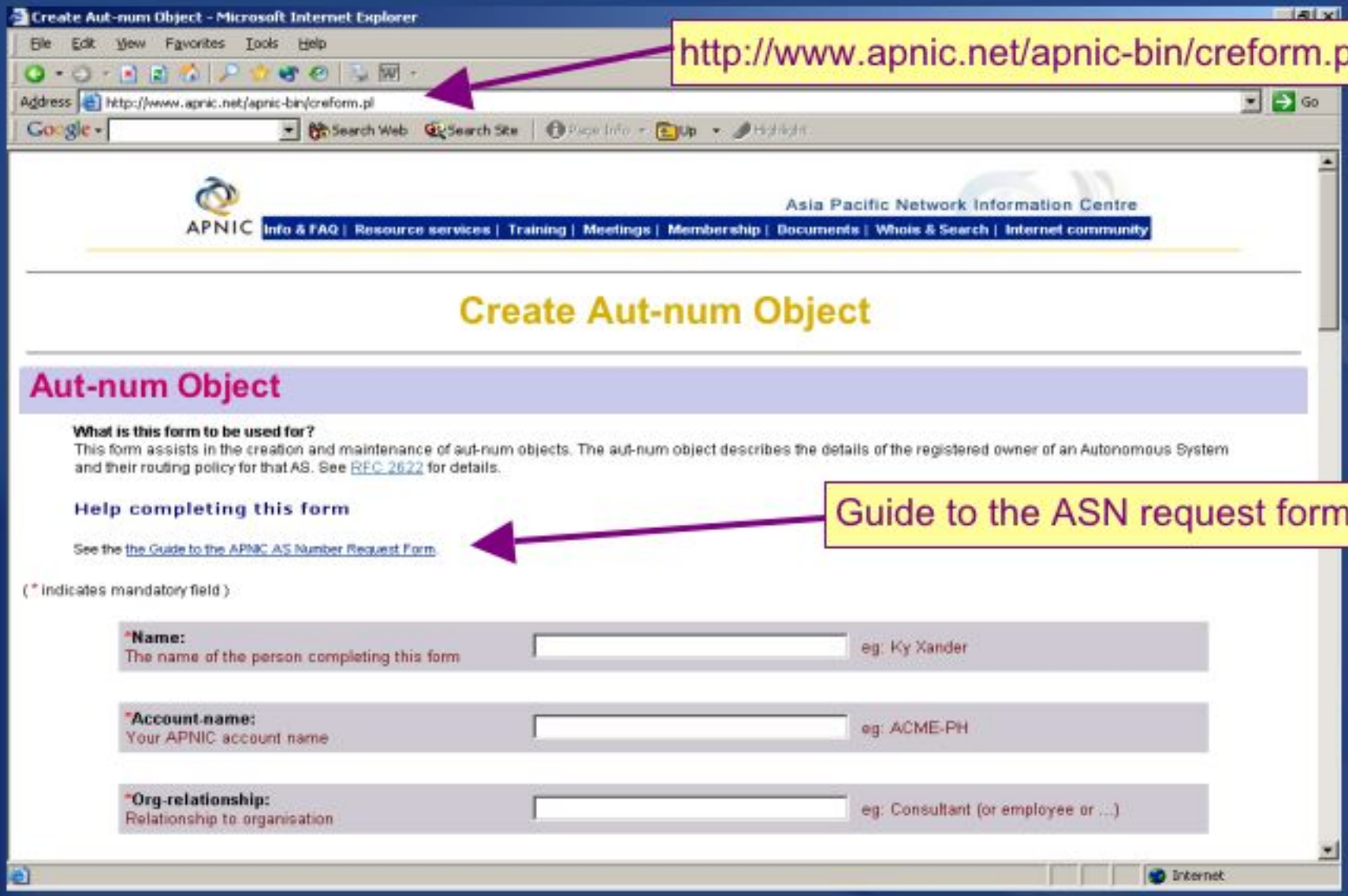
1. Requested directly from APNIC
   - AS number is "portable"
2. Requested via member
   - ASN is "non-portable"
   - ASN returned if customer changes provider

New policy as of Nov-02

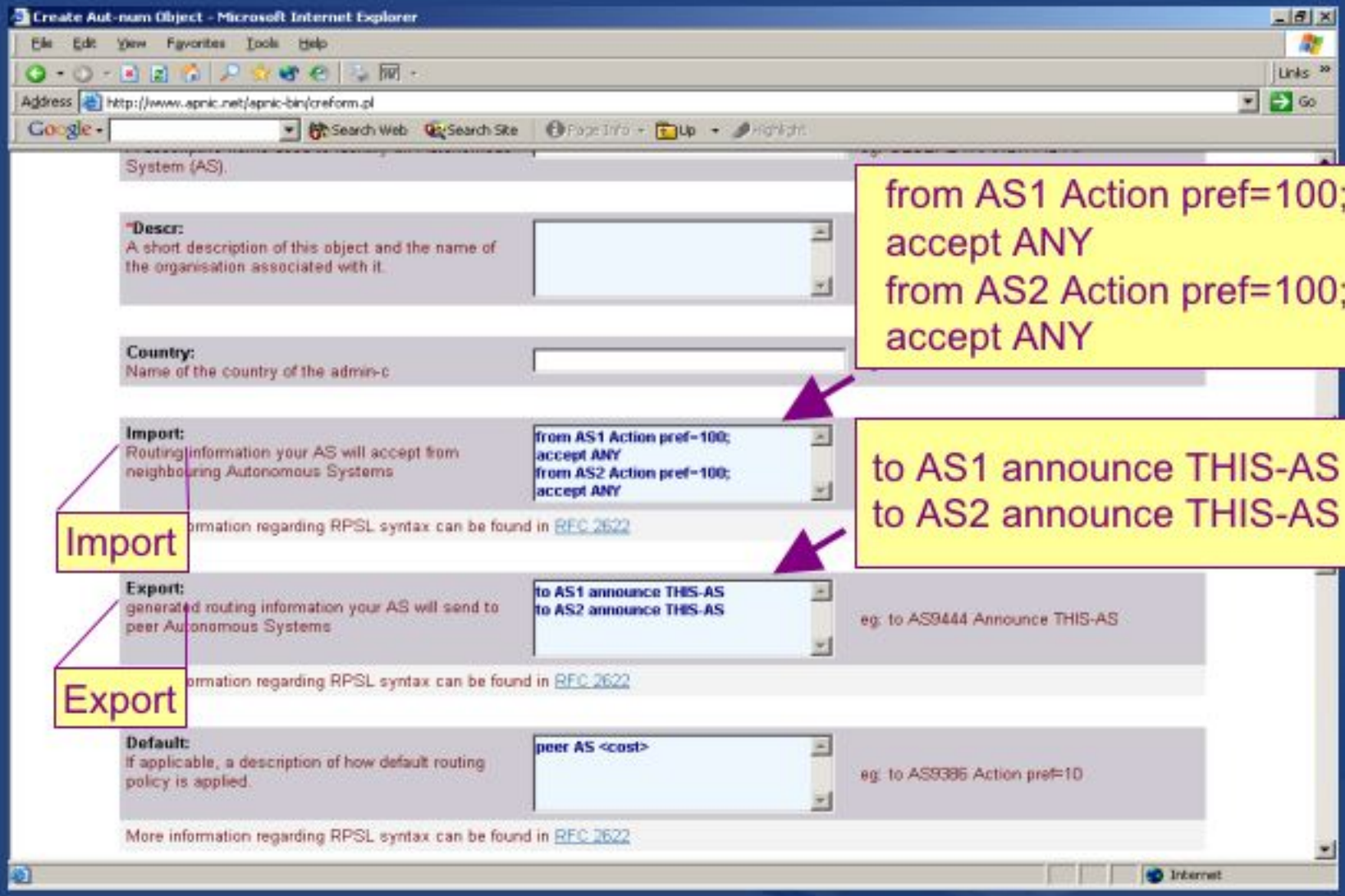
- Transfers of ASNs
  - Need legal documentation (mergers etc)
  - Should be returned if no longer required

Asia Pacific Network Information Centre
APNIC

# ASN request form



# Request form – routing policy



# 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:** | **rom 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**

Asia Pacific Network Information Centre
APNIC

# Questions ?

- Want to learn more about RPSL and routing policy?
  - *Come to the IRR tutorial tomorrow, Tuesday!*

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC



# IPv6

## Overview, Policies & Procedures

# IPv6 address policy - goals

- Efficient address usage
  - Avoid wasteful practices
- Aggregation
  - Hierarchical distribution
  - Aggregation of routing information
  - Limiting no of routing entries advertised into the Internet
- Minimise overhead
  - Associated with obtaining address space
- Registration, Uniqueness, Fairness & consistency

Asia Pacific Network Information Centre
APNIC

# IPv6 initial allocation criteria

- Be an LIR
  - Not be an end site
- Plan for at least 200 /48 assignments to other organisations within 2 years
- Plan to provide IPv6 connectivity to organisations and to end sites

Asia Pacific Network Information Centre
APNIC

# IPv6 allocation policy - initial allocation

- First allocation size ('Slow start')
  - /32 if no previous assignment history
    - Large allocation facilitates the creation of hierarchy within allocation
  - Larger possible if technically justified
    - Previous assignment history taking into account
  - Existing /35 holders
    - Eligible to have /35 expanded to a /32

Asia Pacific Network Information Centre
APNIC

# IPv6 assignments

- /48s assignments per end site
  - /64 only one subnet
  - /128 only one device connecting
- Multiple /48s
  - Should be reviewed by RIR/NIR
  - Second opinion process follows
- ISP infrastructure
  - /48 per POP

Asia Pacific Network Information Centre
APNIC

# Portable IPv6 assignments for IXPs

- 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

New policy as of Dec-02

Asia Pacific Network Information Centre
APNIC

# References

- IPv6 Resource Guide
  - http://www.apnic.net/services/ipv6_guide.html
- IPv6 Policy Document
  - http://www.apnic.net/policies.html
- IPv6 Address request form
  - http://ftp.apnic.net/apnic/docs/ipv6-alloc-request

FAQ

- http://www.apnic.net/info/faq/IPv6-FAQ.html

Asia Pacific Network Information Centre
APNIC

# Questions ?

- *More IPv6 to be discussed in the IPv6 technical SIG on Wednesday*

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC



# Summary

What we have covered today

# Summary - responsibilities

- As an APNIC member and custodian of address space
  - Be aware of your responsibilities
  - Register customer assignments in APNIC database
    - Keep this data up-to-date & accurate
  - Educate your customers
  - Document your network in detail
    - Keep local records
  - Register reverse DNS delegations

# Summary

- "Do the right thing"
  - Think about routing table size & scalability of Internet
  - Encourage renumbering
  - Announce aggregate prefixes
  - Think global not local

Asia Pacific Network Information Centre
APNIC

APRICOT 2003 Taipei

# Thank you !!

Your feedback is appreciated

Asia Pacific Network Information Centre
APNIC



# Supplementary Reading

# Introduction

- Regional Registry web sites
  - APNIC
    - http://www.apnic.net
  - ARIN
    - http://www.arin.net
  - RIPE NCC
    - http://www.ripe.net
- APNIC past meetings
    - http://www.apnic.net/meetings

# Introduction

- APNIC members
  - http://www.apnic.net/members.html
- Membership
  - Membership procedure http://www.apnic.net/membersteps.html
  - Membership application form http://www.apnic.net/apnic-bin/membership-application.pl
  - Membership fees http://www.apnic.net/docs/corpdocs/FeeSchedule.htm

# Member services helpdesk

- One point of contact for all member enquiries
  - Extended operating hours
    - 9:00 am to 7:00 pm (Australian EST, UTC + 10 hrs)
- More personalised service
  - Range of languages
    - including Cantonese, Filipino, Mandarin, Thai, Vietnamese etc.
- Faster response and resolution of queries
    - such as IP resource applications, status of requests, obtaining help in completing application forms, membership enquiries, billing issues & database enquiries

# Introduction to APNIC & IR Policies

- Classless techniques
- CIDR
  - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1517-19.txt
  - Network Addressing when using CIDR ftp://ftp.uninett.no/pub/misc/eidnes-cidr.ps.Z
  - Variable Length Subnet Table http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1878.txt
- Private Address Space
  - Address Allocation for Private Internets
    - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1918.txt
  - Counter argument: Unique addresses are good
    - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1817.txt

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# APNIC Mailing Lists

- apnic-talk
  - Open discussion relevant to APNIC community and members
    - e.g. policies, procedures etc
- apnic-announce
  - Announcements of interest to the AP community
- ipv6-registry
  - IPv6 allocation and assignment policies
- http://www.apnic.net/net_comm/lists/
- subscribe via <majordomo@apnic.net>
- archives at http://ftp.apnic.net/apnic/mailing-lists

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# The RIR System

- "Development of the Regional Internet Registry System"
  - Internet Protocol Journal
    - Short history of the Internet
  - http://www.cisco.com/warp/public/759/ipj_4-4/ipj_4-4_regional.html

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Policies & the Policy Environment

- Policy Documentation
  - Policies for address space management in the Asia Pacific region
    - http://www.apnic.net/docs/policy/add-manage-policy.html
  - RFC2050: Internet Registry IP allocation Guidelines
    - http://ftp.apnic.net/ietf/rfc/rfc2000/rfc2050.txt

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

Asia Pacific Network Information Centre
APNIC



# Address Request Procedures

- Addressing Guidelines
  - Designing Addressing Architectures for Routing & Switching Howard C. Berkowitz
- Address Request Forms
  - ISP Address Request Form http://www.apnic.net/services/ipv4/
  - Second-opinion Request Form
  - http://cgi.apnic.net/apnic-bin/second-opinion-request.pl
  - No Questions Asked http://ftp.apnic.net/apnic/docs/no-questions-policy

# APNIC Database

- APNIC Database Documentation
  - http://ftp.apnic.net/apnic/docs/database-update-info
  - http://ftp.apnic.net/apnic/docs/maintainer-request
  - http://www.apnic.net/apnic-bin/maintainer.pl
  - http://www.apnic.net/services/whois_guide.html
- RIPE Database Documentation

- Database 'whois' Client
  - http://ftp.apnic.net/apnic/dbase/tools/ripe-dbase-client.tar.gz
  - http://www.apnic.net/apnic-bin/whois2.pl

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Person Object Template

| | | | |
|---|---|---|---|
| person: | [mandatory] | [single] | [lookup key] |
| address: | [mandatory] | [multiple] | [ ] |
| country: | [optional] | [single] | [ ] |
| phone: | [mandatory] | [multiple] | [ ] |
| fax-no: | [optional] | [multiple] | [ ] |
| e-mail: | [mandatory] | [multiple] | [lookup 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] | [ ] |

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Role Object Template

| | | | |
|---|---|---|---|
| role: | [mandatory] | [single] | [lookup key] |
| address: | [mandatory] | [multiple] | [ ] |
| country: | [optional] | [single] | [ ] |
| phone: | [mandatory] | [multiple] | [ ] |
| fax-no: | [optional] | [multiple] | [ ] |
| e-mail: | [mandatory] | [multiple] | [lookup key] |
| trouble: | [optional] | [multiple] | [ ] |
| admin-c: | [mandatory] | [multiple] | [inverse key] |
| tech-c: | [mandatory] | [multiple] | [inverse 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] | [ ] |

# Maintainer Object Template

| | | | |
|---|---|---|---|
| mntner: | [mandatory] | [single] | [primary/look-up key] |
| descr: | [mandatory] | [multiple] | [ ] |
| country: | [optional] | [single] | [ ] |
| admin-c: | [mandatory] | [multiple] | [inverse key] |
| tech-c: | [optional] | [multiple] | [inverse key] |
| upd-to: | [mandatory] | [multiple] | [inverse key] |
| mnt-nfy: | [optional] | [multiple] | [inverse key] |
| auth: | [mandatory] | [multiple] | [ ] |
| remarks: | [optional] | [multiple] | [ ] |
| notify: | [optional] | [multiple] | [inverse key] |
| mnt-by: | [mandatory] | [multiple] | [inverse key] |
| referral-by: | [mandatory] | [single] | [inverse key] |
| changed: | [mandatory] | [multiple] | [ ] |
| source: | [mandatory] | [single] | [ ] |

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Inetnum Object Template

| | | | |
|---|---|---|---|
| inetnum: | [mandatory] | [single] | [primary/look-up key] |
| netname: | [mandatory] | [single] | [lookup key] |
| descr: | [mandatory] | [multiple] | [ ] |
| country: | [mandatory] | [multiple] | [ ] |
| admin-c: | [mandatory] | [multiple] | [inverse key] |
| tech-c: | [mandatory] | [multiple] | [inverse key] |
| rev-srv: | [optional] | [multiple] | [inverse key] |
| status: | [mandatory] | [single] | [ ] |
| remarks: | [optional] | [multiple] | [ ] |
| notify: | [optional] | [multiple] | [inverse key] |
| mnt-by: | [mandatory] | [multiple] | [inverse key] |
| mnt-lower: | [optional] | [multiple] | [inverse key] |
| mnt-routes: | [optional] | [multiple] | [inverse key] |
| mnt-irt: | [optional] | [multiple] | [inverse key] |
| changed: | [mandatory] | [multiple] | [ ] |
| source: | [mandatory] | [single] | [ ] |

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Aut-num Object Template

| | | | |
|---|---|---|---|
| aut-num: | [mandatory] | [single] | [primary/look-up key] |
| as-name: | [mandatory] | [single] | [ ] |
| descr: | [mandatory] | [multiple] | [ ] |
| country: | [optional] | [single] | [ ] |
| member-of: | [optional] | [multiple] | [ ] |
| import: | [optional] | [multiple] | [ ] |
| export: | [optional] | [multiple] | [ ] |
| default: | [optional] | [multiple] | [ ] |
| remarks: | [optional] | [multiple] | [ ] |
| admin-c: | [mandatory] | [multiple] | [inverse key] |
| tech-c: | [mandatory] | [multiple] | [inverse key] |
| cross-mnt: | [optional] | [multiple] | [inverse key] |
| cross-nfy: | [optional] | [multiple] | [inverse key] |
| notify: | [optional] | [multiple] | [inverse key] |
| mnt-lower: | [optional] | [multiple] | [inverse key] |
| mnt-routes: | [optional] | [multiple] | [inverse key] |
| mnt-by: | [mandatory] | [multiple] | [inverse key] |
| changed: | [mandatory] | [multiple] | [ ] |
| source: | [mandatory] | [single] | [ ] |

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Domain Object Template

| | | | |
|---|---|---|---|
| domain: | [mandatory] | [single] | [primary/look-up key] |
| descr: | [mandatory] | [multiple] | [ ] |
| country: | [optional] | [single] | [ ] |
| admin-c: | [mandatory] | [multiple] | [inverse key] |
| tech-c: | [mandatory] | [multiple] | [inverse key] |
| zone-c: | [mandatory] | [multiple] | [inverse key] |
| nserver: | [mandatory] | [multiple] | [inverse key] |
| sub-dom: | [optional] | [multiple] | [inverse key] |
| dom-net: | [optional] | [multiple] | [ ] |
| remarks: | [optional] | [multiple] | [ ] |
| notify: | [optional] | [multiple] | [inverse key] |
| mnt-by: | [mandatory] | [multiple] | [inverse key] |
| mnt-lower: | [optional] | [multiple] | [inverse key] |
| refer: | [optional] | [single] | [ ] |
| changed: | [mandatory] | [multiple] | [ ] |
| source: | [mandatory] | [single] | [ ] |

APRICOT 2003 Taipei
Asia Pacific Network Information Centre
APNIC

# Reverse DNS

- Request Forms
  - http://www.apnic.net/db/revdel.html
  - http://www.apnic.net/db/domain.html
- Classless Delegations
  - http://ftp.apnic.net/ietf/rfc/rfc2000/rfc2317.txt
- Common DNS configuration errors
  - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1537.txt

# Reverse DNS

- Domain name structure and delegation
  - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1591.txt
- Domain administrators operations guide
  - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1033.txt
- Taking care of your domain
  - ftp://ftp.ripe.net/ripe/docs/ripe-114.txt
- Tools for DNS debugging
  - http://ftp.apnic.net/ietf/rfc/rfc2000/rfc2317.txt

# AS Assignment Procedures

- Guidelines for the creation, selection, and registration of an AS
  - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1930.txt
- Routing Policy Specification Language (RPSL)
  - http://ftp.apnic.net/ietf/rfc/rfc2000/rfc2280.txt

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# IPv6

- IPv6 Address Allocation & Assignment Policy
  - http://ftp.apnic.net/apnic/docs/ipv6-address-policy
- IPv6 Address request form
  - http://ftp.apnic.net/apnic/docs/ipv6-alloc-request
- FAQ
  - http://www.apnic.net/info/faq/IPv6-FAQ.html

# IPv6: HD Ratio 0.8

| IPv6 prefix | Site addr bits | Total site addrs in /48s | Threshold | Util% |
|---|---|---|---|---|
| 42 | 6 | 64 | 28 | 43.5% |
| 36 | 12 | 4096 | 776 | 18.9% |
| 35 | 13 | 8192 | 1351 | 16.5% |
| 32 | 16 | 65536 | 7132 | 10.9% |
| 29 | 19 | 524288 | 37641 | 7.2% |
| 24 | 24 | 16777216 | 602249 | 3.6% |
| 16 | 32 | 4294967296 | 50859008 | 1.2% |
| 8 | 40 | 1099511627776 | 4294967296 | 0.4% |
| 3 | 45 | 35184372088832 | 68719476736 | 0.2% |

RFC3194 “The Host-Density Ratio for Address Assignment Efficiency”

Asia Pacific Network Information Centre
APNIC
APRICOT 2003 Taipei

# Other Supplementary Reading

- Operational Content Books
  - ISP Survival Guide - Geoff Huston
- BGP Table
  - http://www.telstra.net/ops/bgptable.html
  - http://www.merit.edu/ipma/reports
  - http://www.merit.edu/ipma/routing_table/mae-east/prefixlen.990212.html
  - http://www.employees.org/~tbates/cidr.hist.plot.html
- Routing Instability
  - http://zounds.merit.net/cgi-bin/do.pl

Asia Pacific Network Information Centre
APNIC



# Other Supplementary Reading

- Routing & Mulithoming
  - Internet Routing Architectures - Bassam Halabi
  - BGP Communities Attribute
    - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1997.txt
    - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1998.txt
  - Multihoming
    - Using a Dedicated AS for Sites homed to a Single Provider http://ftp.apnic.net/ietf/rfc/rfc2000/rfc2270.txt

# Other Supplementary Reading

- Filtering
  - Egress Filtering
    http://www.cisco.com/public/cons/isp
  - Network Ingress Filtering: Defeating Denial of Service Attacks which employ IP Source Address Spoofing
    http://ftp.apnic.net/ietf/rfc/rfc2000/rfc2267.txt
- Dampening
  - case studies at
    http://www.cisco.com/warp/public/459/16.html
- Traceroute Server
  - http://nitrous.digex.net

# Other Supplementary Reading

- Renumbering
  - Network Renumbering Overview: Why Would I Want It and What Is It Anyway?
    - http://ftp.apnic.net/ietf/rfc/rfc2000/rfc2071.txt
  - Procedures for Enterprise Renumbering
    - http://www.isi.edu/div7/pier/papers.html
- NAT
  - The IP Network Address Translator
    - http://ftp.apnic.net/ietf/rfc/rfc1000/rfc1631.txt