APNIC Whois Database and Internet Routing Registry

Hong Kong Internet Community – Technical Session

September 2, 2013

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APNIC

IP Address Management

APNIC

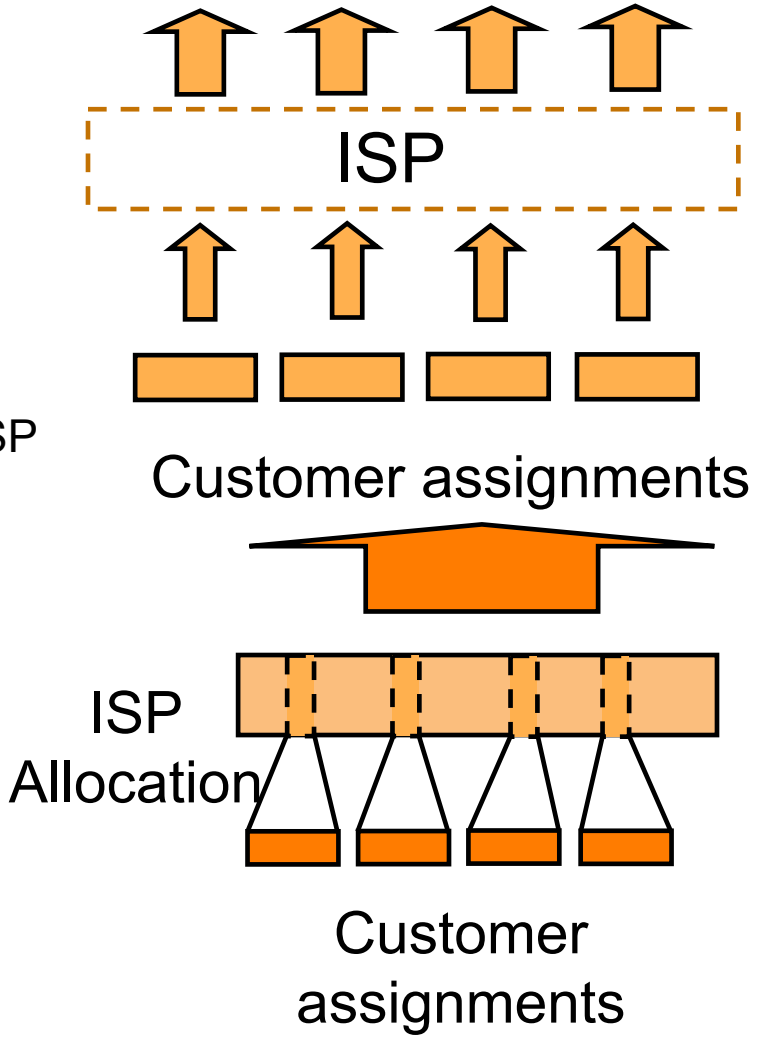
Allocation and Assignment

- 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

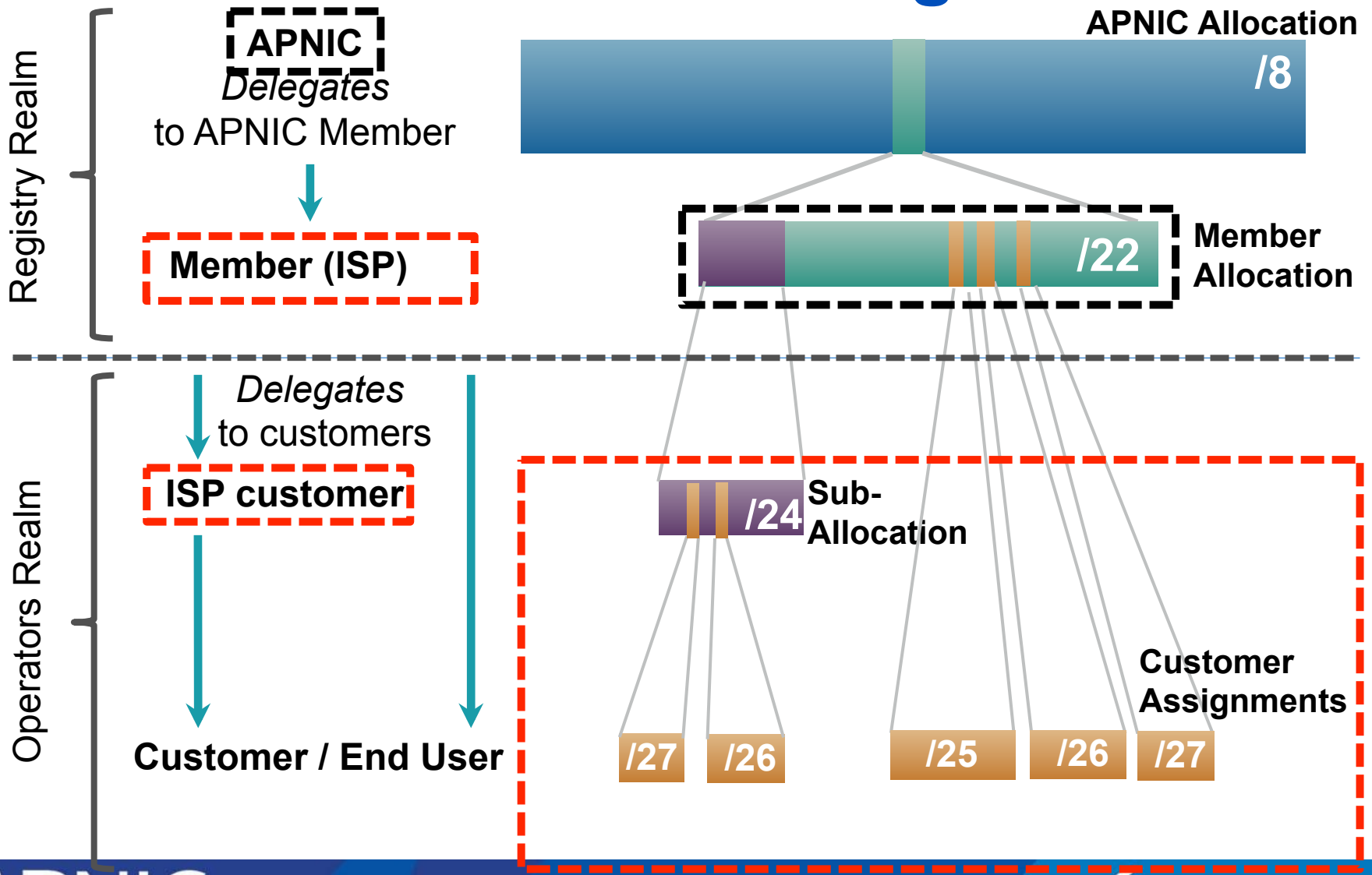
- Assignment
  - "A block of address space used to address an operational network"
    - May be provided to ISP customers, or used for an ISP's infrastructure ('self-assignment')

Portable and Non-portable

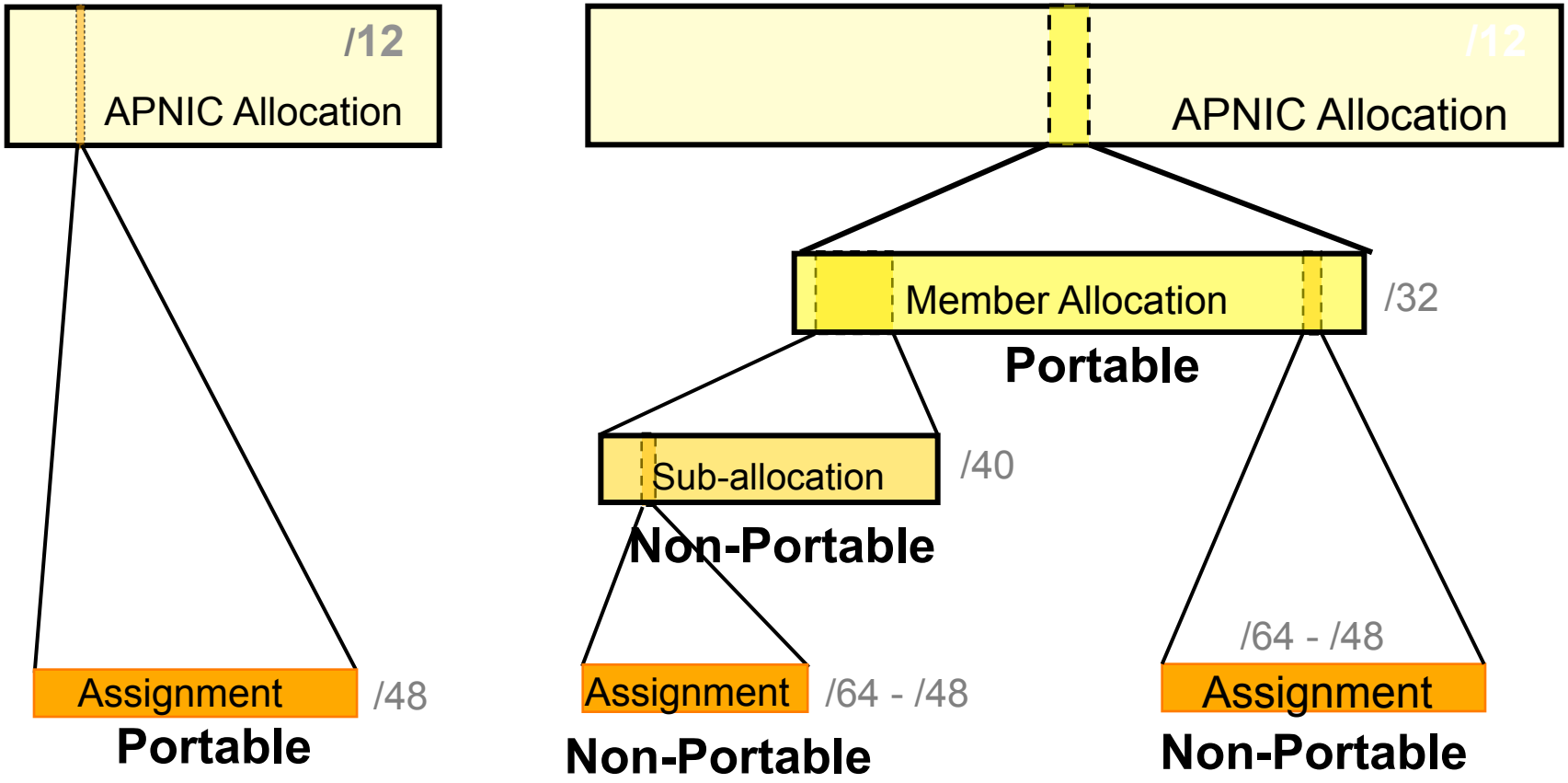
- Portable Allocations
  - Allocations made by APNIC
- Non Portable Allocations
  - Allocations made by APNIC Members
- Portable Assignments
  - Customer addresses independent from ISP
  - Keeps addresses when changing ISP
  - Bad for size of routing tables
  - Bad for QoS: routes may be filtered, flap-dampened
- Non-portable Assignments
  - Customer uses ISP's address space
  - Must renumber if changing ISP
  - Helps scale the Internet effectively



How IP Addresses are Delegated



Address Management Hierarchy



The APNIC Whois Database

APNIC

The APNIC Whois Database

- Holds IP address records within the AP region
- Can use this database to track down the source of the network abuse
  - IP addresses, ASNs, Reverse Domains, Routing policies
- Can find contact details of the relevant network administrators
  - not the individual users
  - use administrators log files to contact the individual involved

Resource Registration

- As part of the membership agreement with APNIC, all members are required to register their resources in the APNIC Whois database.
- Members must keep records up to date:
  - Whenever there is a change in contacts
  - When new resources are received
  - When resources are sub-allocated or assigned

Whois Object Types

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

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

How to use APNIC Whois

- Web browser
  - http://www.apnic.net/whois
- Whois client or query tool
  - whois.apnic.net
- Identify network contacts from the registration records
  - IRT (Incident Response Team) if present
  - Contact persons: “tech-c” or “admin-c”

Inetnum / Inet6num Objects

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

APNIC Whois Registration

```
inetnum:        192.168.0.0 - 192.168.3.255
netname:        ISPNET
descr:          ISP network Pty Ltd
country:        AU
admin-c:        IA01-AP
tech-c:         IT03-AP
status:         ALLOCATED PORTABLE
mnt-by:         APNIC-HM
mnt-lower:      MAINT-ISPNET-AP
mnt-irt:        IRT-ISPNET
remarks:        -+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
remarks:        This object can only be updated by APNIC hostmasters.
remarks:        To update this object, please contact APNIC
remarks:        hostmasters and include your organisation's account
remarks:        name in the subject line.
remarks:        -+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
changed:        hm-changed@apnic.net 20090120
source:         APNIC
```

APNIC Whois Registration

```
person:         ISPNet administrator
address:        Milton QLD 4064
country:        AU
e-mail:         admin@ispnet.net
phone:          +61 7 3858 3000
fax-no:         +61 7 3858 3100
nic-hdl:        IA01-AP
notify:         admin@ispnet.net
mnt-by:         MAINT-ISPNET-AP
changed:        admin@ispnet.net 20100217
source:         APNIC

person:         ISPNet tech-support
address:        Milton QLD 4064
country:        AU
phone:          +61 7 3858 3000
fax-no:         +61 7 3858 3100
e-mail:         tech@ispnet.net
nic-hdl:        IT03-AP
notify:         tech@ispnet.net
mnt-by:         MAINT-ISPNET-AP
changed:        tech@ispnet.net 20100217
source:         APNIC
```

APNIC Whois Registration

```
inetnum:        192.168.2.0 - 192.168.3.255
netname:        CustNet
descr:          ISPNet Customer
country:        AU
admin-c:        IA01-AP
tech-c:         IT03-AP
status:         ASSIGNED NON-PORTABLE
mnt-by:         MAINT-ISPNET-AP
mnt-irt:        IRT-ISPNET
changed:        admin@ispnet.net 20101120
source:         APNIC
```

APNIC Whois Registration

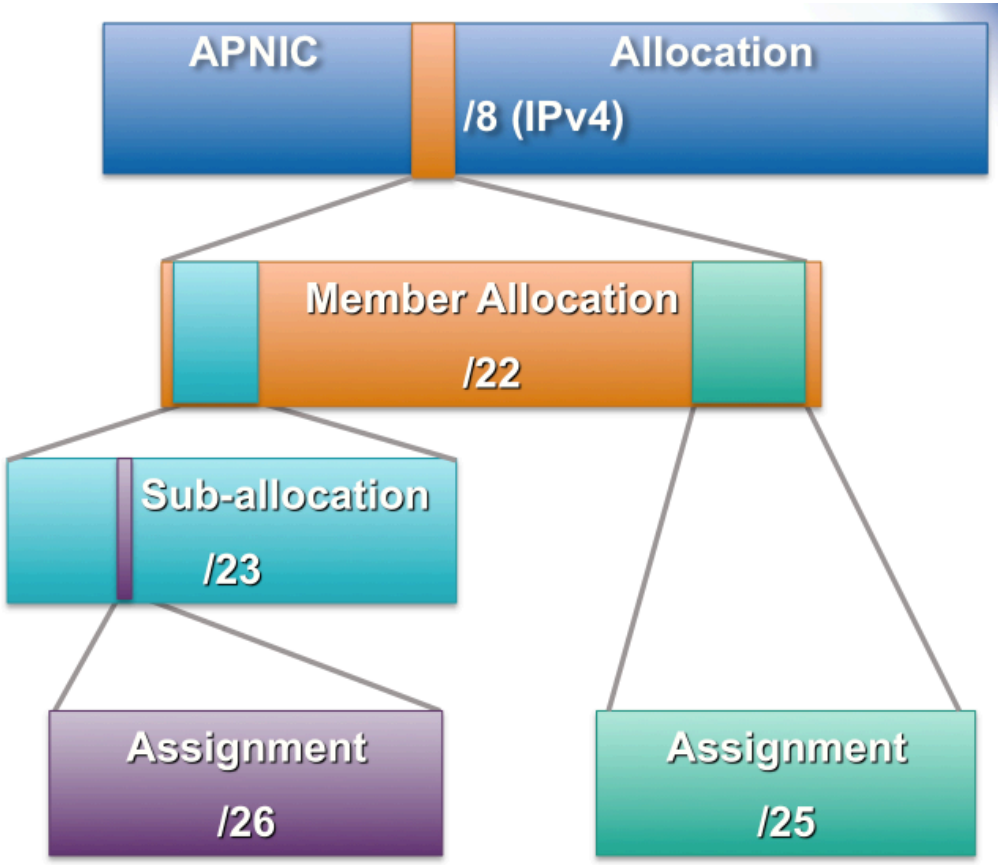
```
irt:            IRT-ISPNET
address:        Brisbane, Australia
phone-no:       +61-7-38583000
fax-no:         +61-7-38583100
email:          tech@ispnet.net
abuse-mailbox:  abuse@ispnet.net
admin-c:        IA01-AP
tech-c:         IT03-AP
auth:           X509-5
mnt-by:         MAINT-ISPNET-AP
changed:        tech@ispnet.net 20101108
source:         APNIC
```

Maintainer Hierarchy Diagram

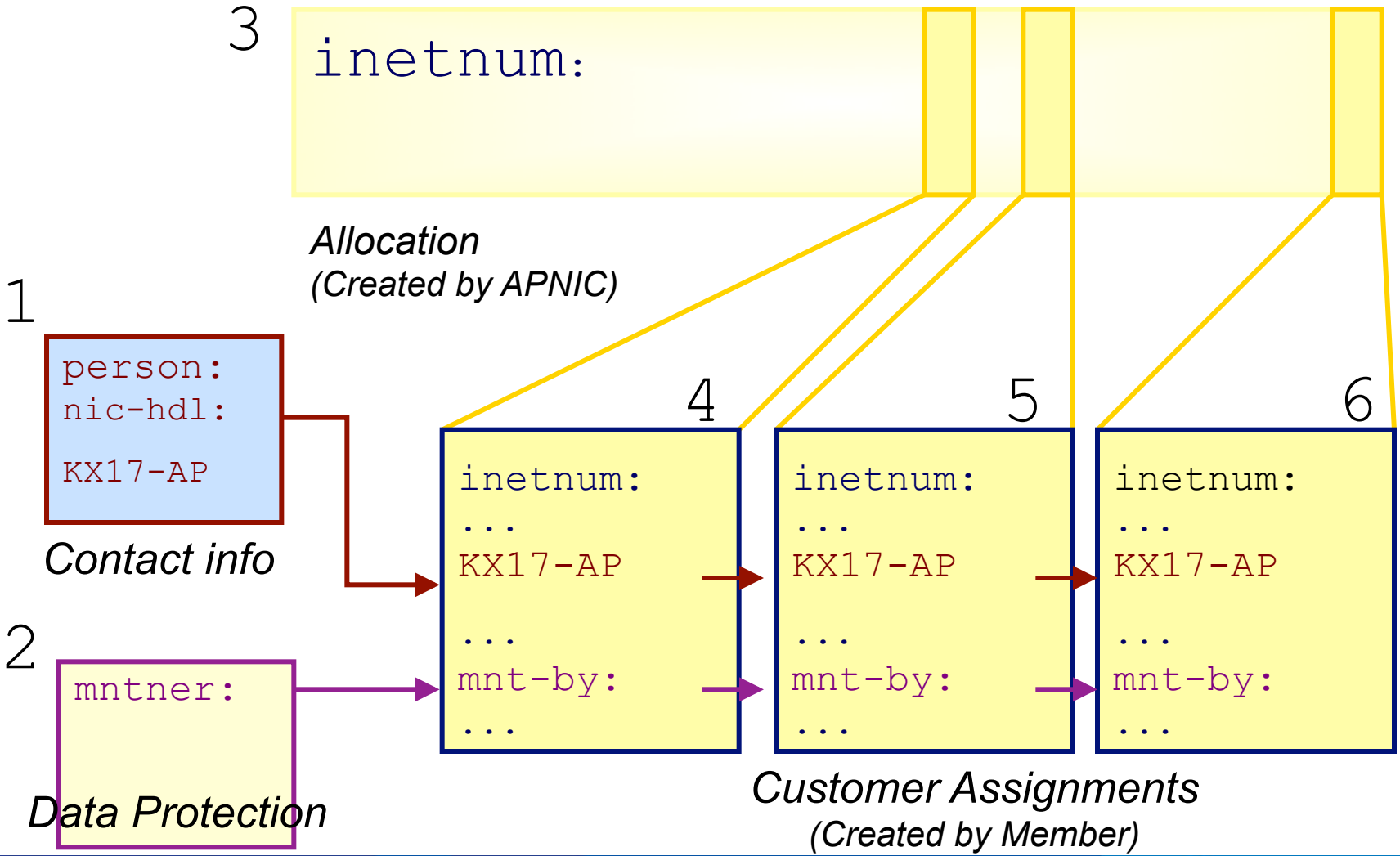
Allocated to APNIC:
Maint-by can only be changed by IANA

Allocated to Member:
Maint-by can only be changed by APNIC

Sub-allocated to Customer:
Maint-by can only be changed by Member



Using the Whois – step by step



Whois Database Queries

– Flags used for inetnum queries

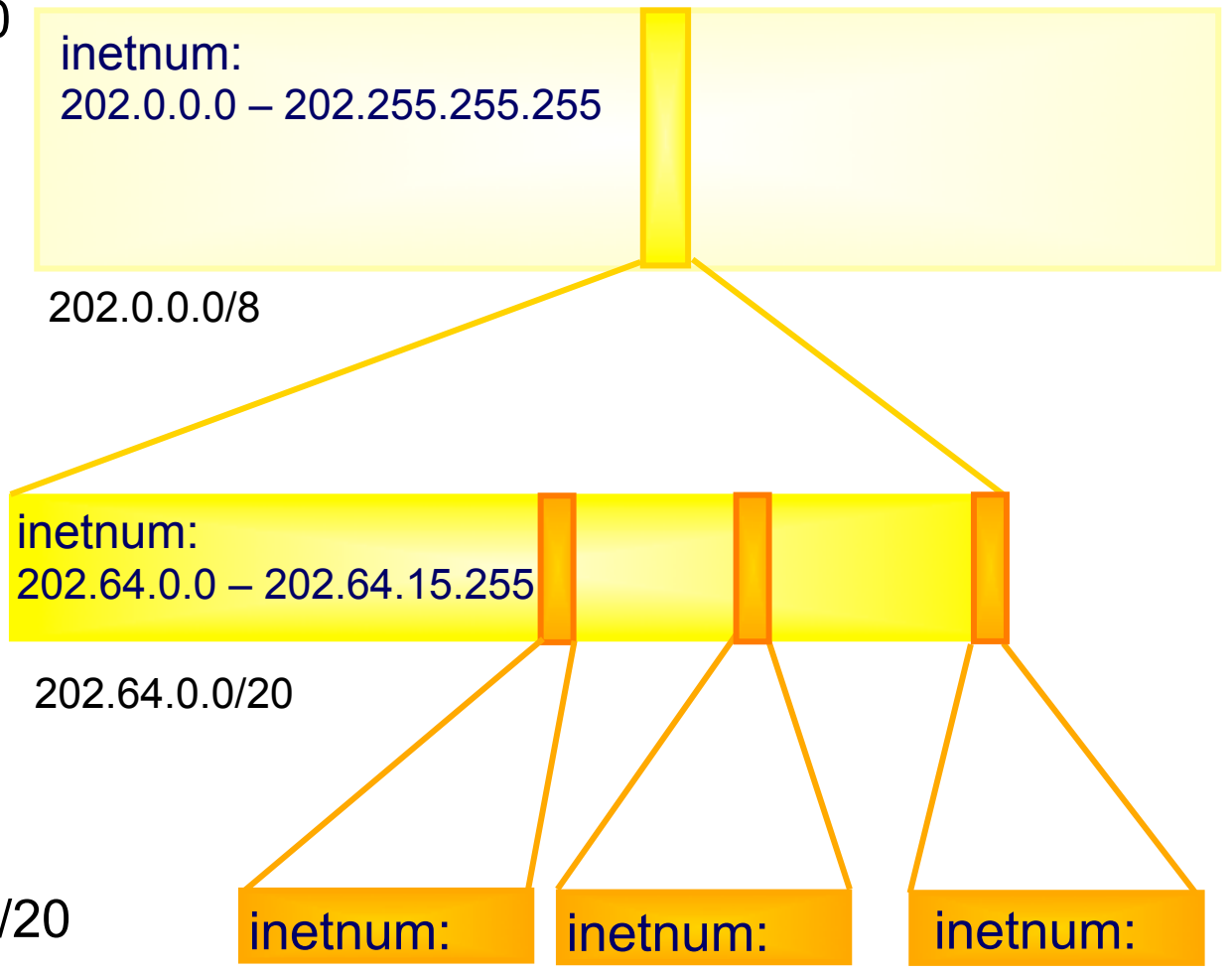
None find exact match

- l find one level less specific matches
- L find all less specific matches
- m find first level more specific matches
- M find all More specific matches
- x find exact match (if no match, nothing)
- d enables use of flags for reverse domains
- r turn off recursive lookups

Whois Database Query - inetnum

whois -L 202.64.0.0 /20

Less specific →
(= bigger block)



More specific →
(= smaller blocks)

Customer Privacy

- Public data
  - Includes portable addresses (inetnum objects), and other objects e.g.route objects
  - Public data: must be visible
- Private data
  - Can include non-portable addresses (inetnum objects)
  - Members have the option to make private data visible
- Customer assignments
  - Can be changed to be public data (public data is an optional choice)

Database Protection

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

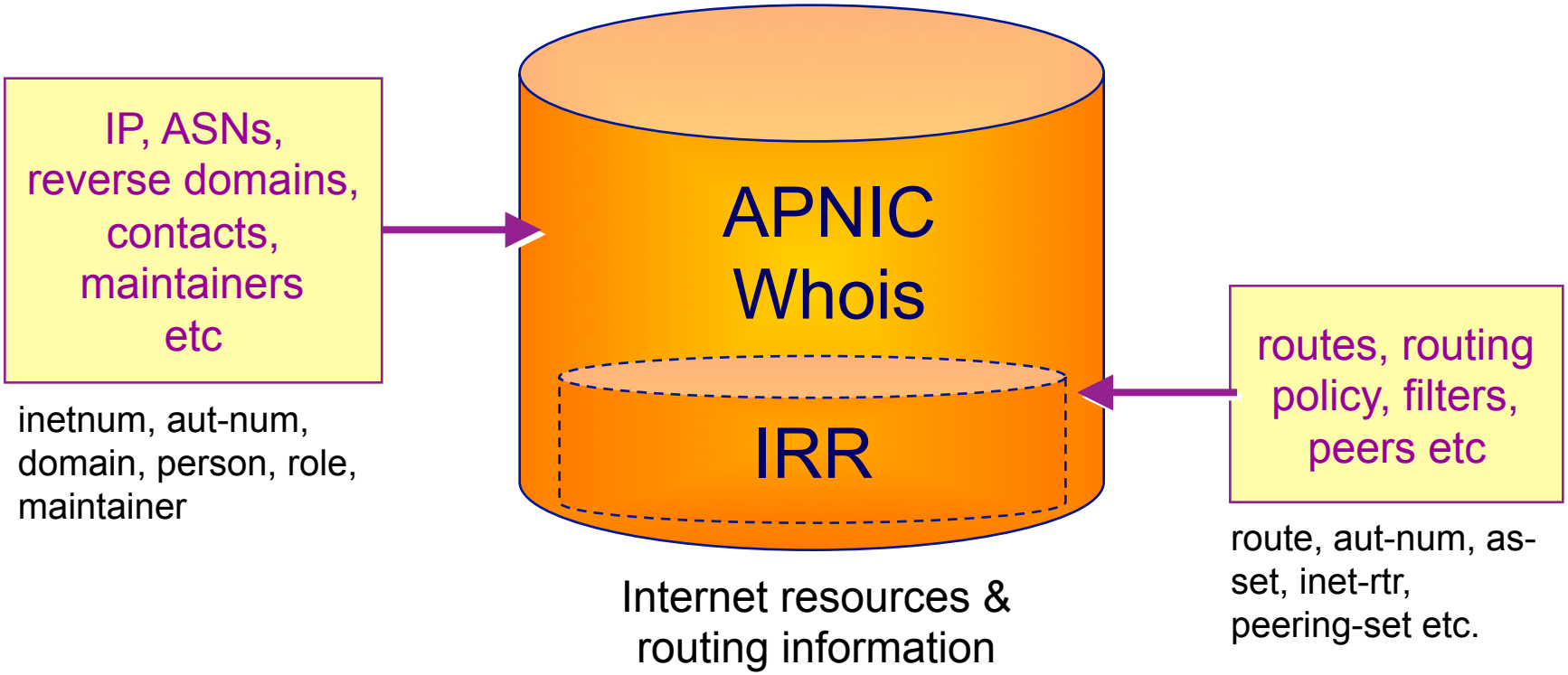
- Authentication
  - Updates to an object must pass authentication rule specified by its maintainer object

APNIC Whois Database & the Internet Routing Registry

- APNIC Whois Database
  - Two databases in one
- Public Network Management Database
  - “Whois” info about networks & contact persons
    - IP addresses, AS numbers etc
- Routing Registry
  - contains routing information
    - routing policy, routes, filters, peers etc.
  - APNIC RR is part of the global IRR

Integration of Whois and the IRR

- Integrated APNIC Whois Database & Internet Routing Registry



The Internet Routing Registry (IRR)

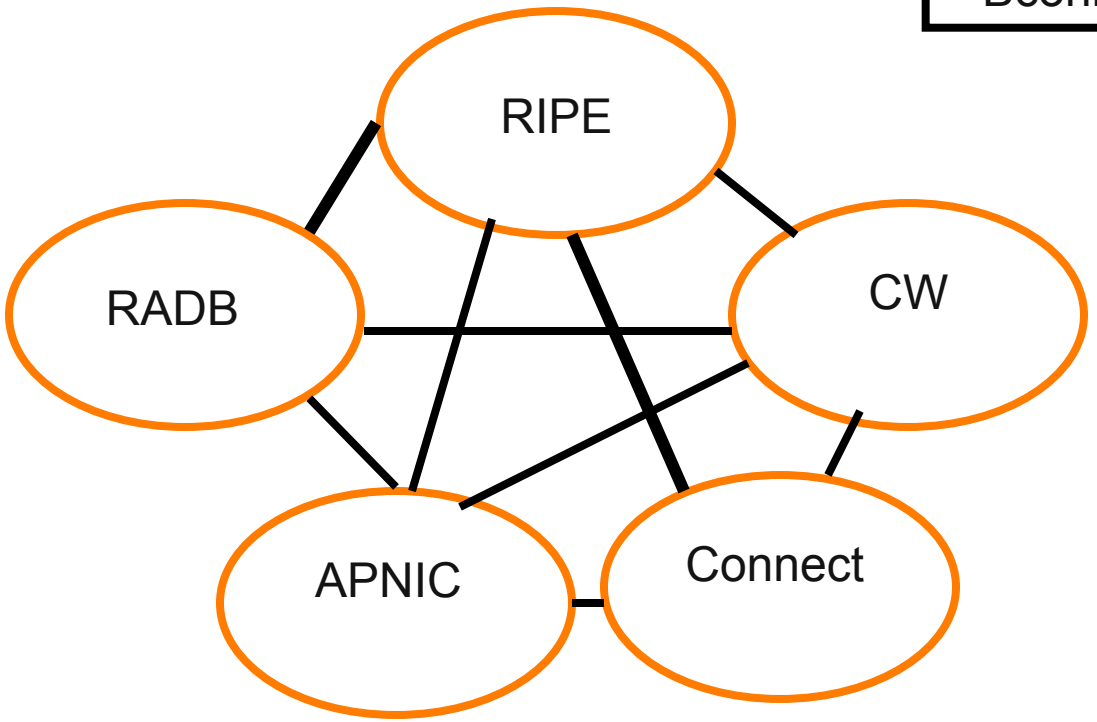
APNIC

What is a Routing Registry?

- A repository (database) of Internet routing policy information
  - Autonomous Systems exchanges routing information via BGP
  - Exterior routing decisions are based on policy based rules
  - However BGP does not provides a mechanism to publish/ communicate the policies themselves
  - RR provides this functionality
- Routing policy information is expressed in a series of objects
- Stability and consistency of routing
  - Network operators share information

What is a Routing Registry?

ARIN, ArcStar, FGC, Verio, Bconnex, Optus, Telstra, ...

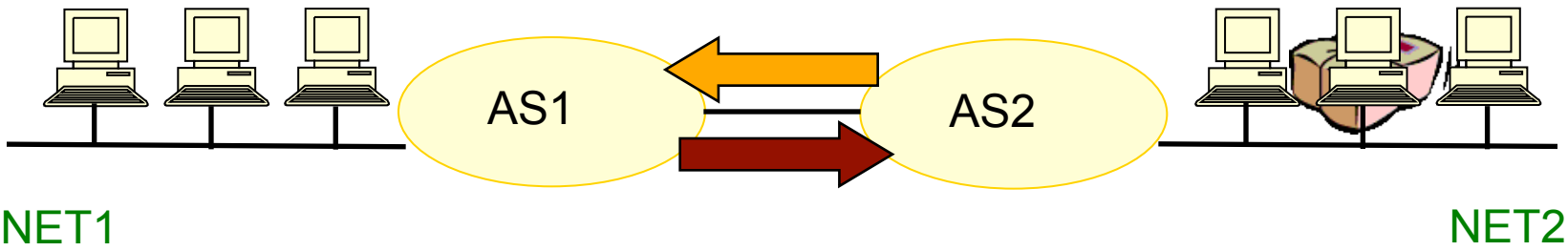


IRR = APNIC RR + RIPE DB + RADB + C&W + ARIN + …

What is Routing Policy?

- Description of the routing relationship between autonomous systems
  - Who are my BGP peers?
    - Customer, peers, upstream
  - What routes are:
    - Originated by each neighbour?
    - Imported from each neighbour?
    - Exported to each neighbour?
    - Preferred when multiple routes exist?
  - What to do if no route exists?
  - What routes to aggregate?

Representation of Routing Policy



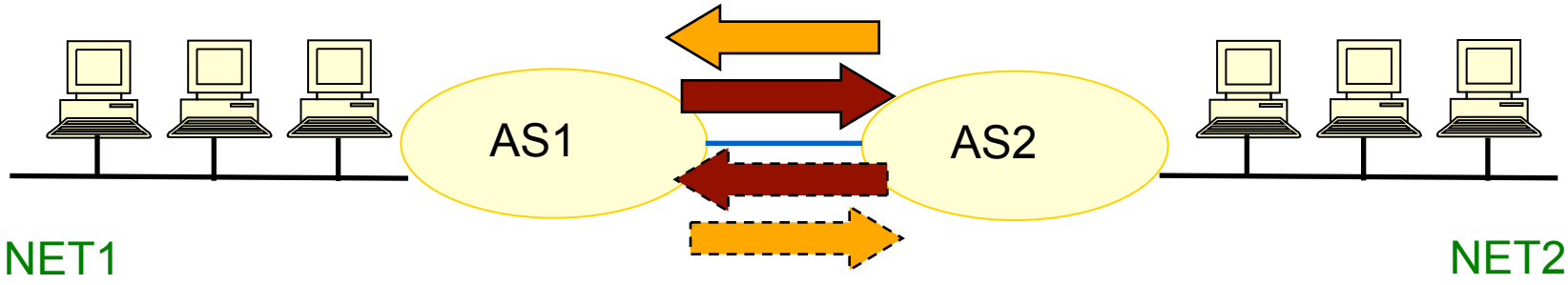
In order for traffic to flow from NET2 to NET1 between AS1 and AS2:

AS1 has to announce NET1 to AS2 via BGP

And AS2 has to accept this information and use it

Resulting in packet flow from NET2 to NET1

Representation of Routing Policy



In order for traffic to flow towards from NET1 to NET2:

AS2 must announce NET2 to AS1

And AS1 has to accept this information and use it

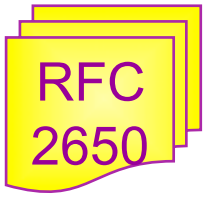
Resulting in packet flow from NET 1 to NET2

RPSL

- Routing Policy Specification Language
  - Object oriented language
    - Based on RIPE-181
  - Structured whois objects

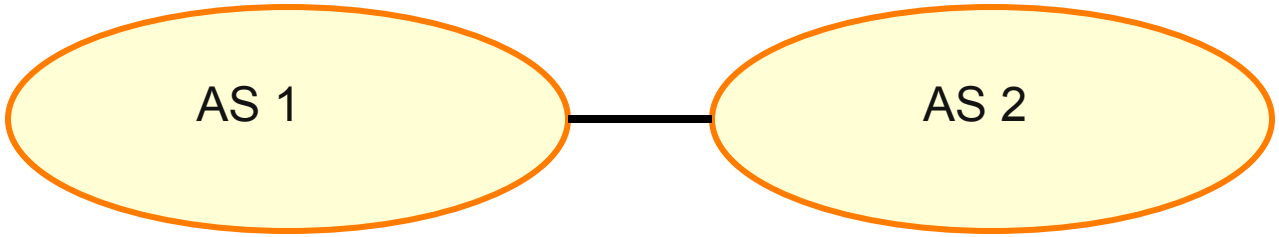
- Higher level of abstraction than access lists

- Describes things interesting to routing policy:
  - Routes, AS Numbers …
  - Relationships between BGP peers
  - Management responsibility



Routing Policy – Examples

Basic concept



"action pref" – the lower the value, the preferred the route

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

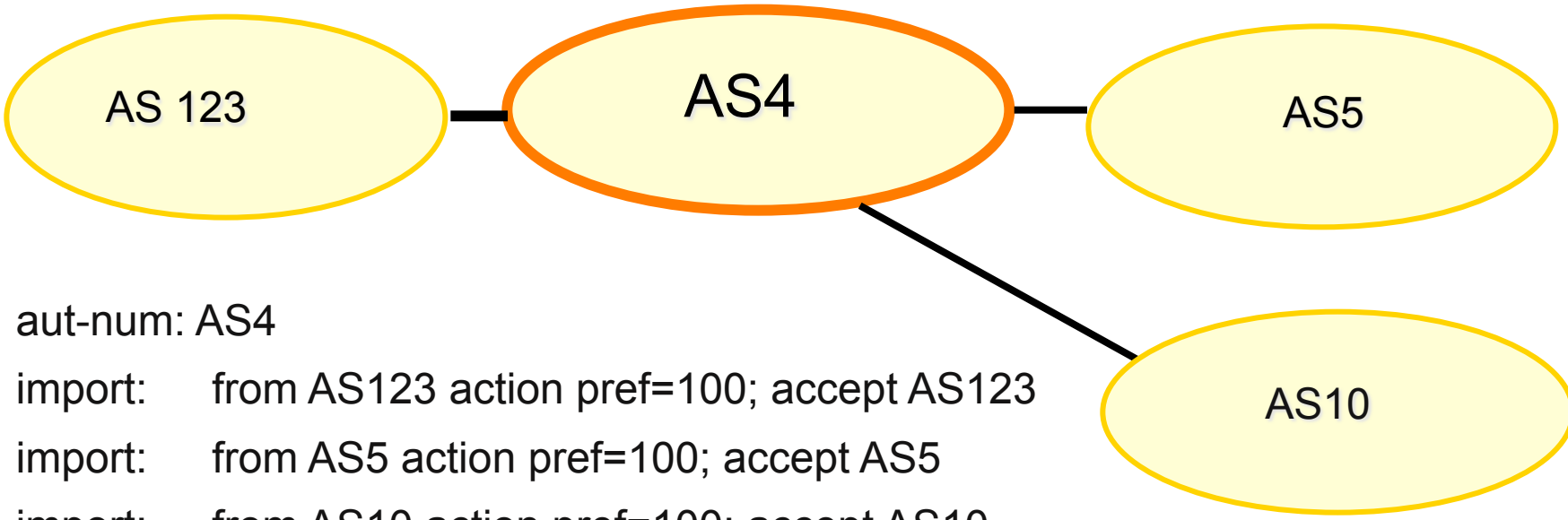
```
aut-num: AS2
…
import:   from AS1
          action pref=100;
          accept AS1
export:   to AS1 announce AS2
```

Routing Policy – Examples

More complex example:

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

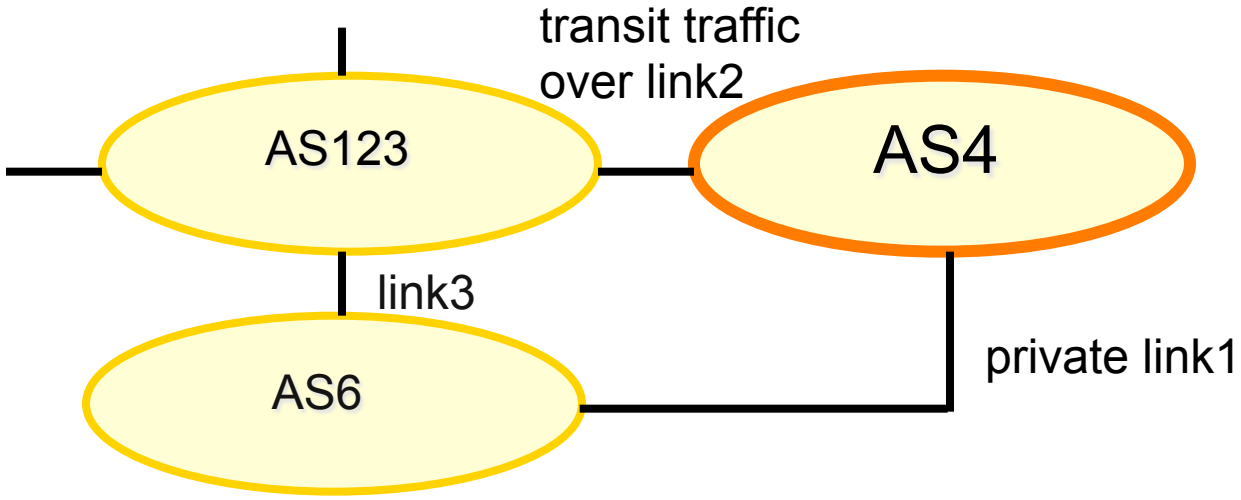
Routing Policy – Examples



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

Not a path

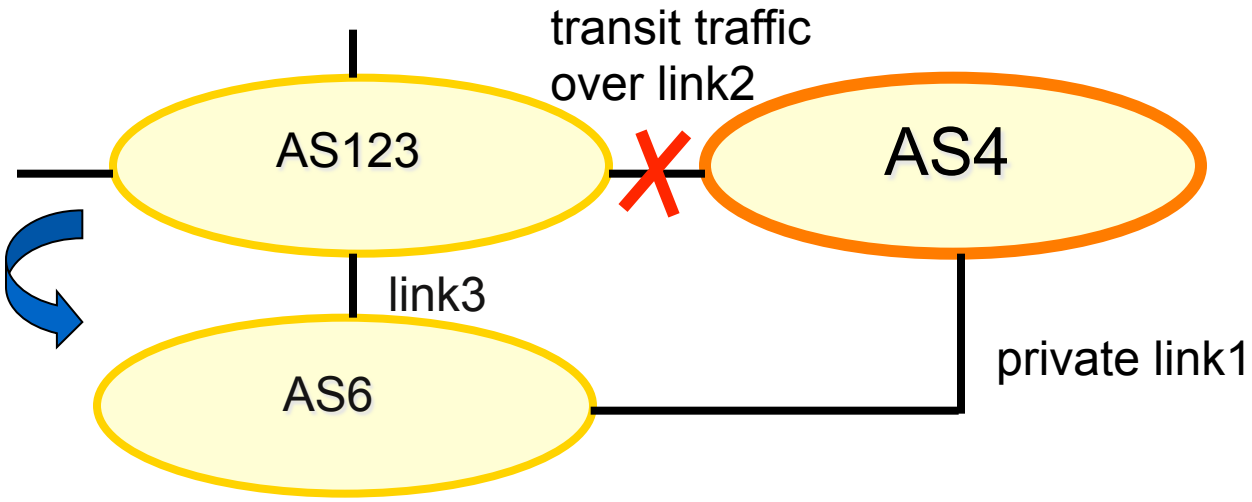
Routing Policy – Examples



More complex example

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

Routing Policy – Examples



AS representation

aut-num: AS4

import: from AS123 action pref=100; accept ANY ← *Full routing received*

import: from AS6 action pref=50; accept AS6 ← *High preference for AS6*

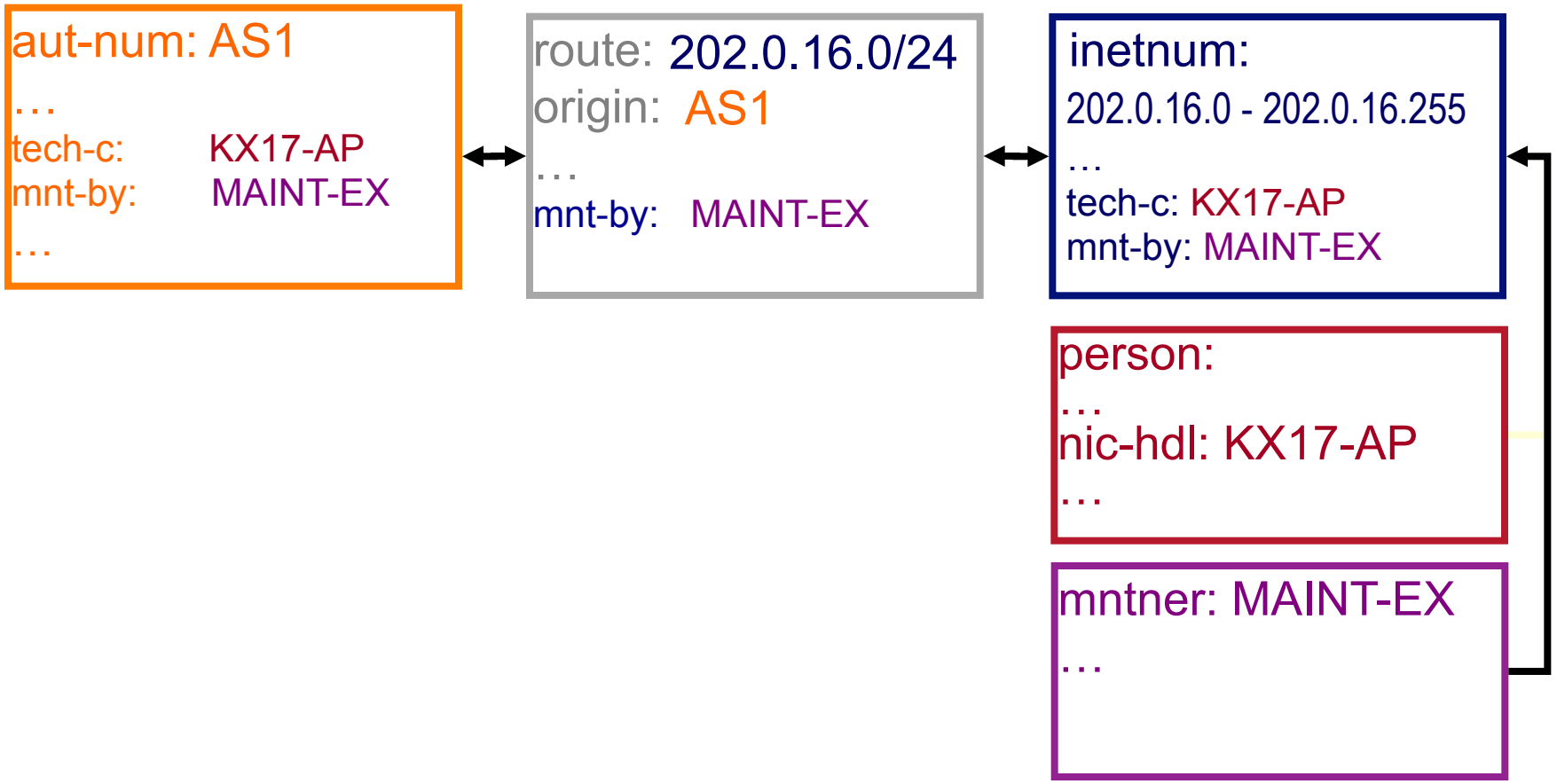
import: from AS6 action pref=200; accept ANY

export: to AS6 announce AS4

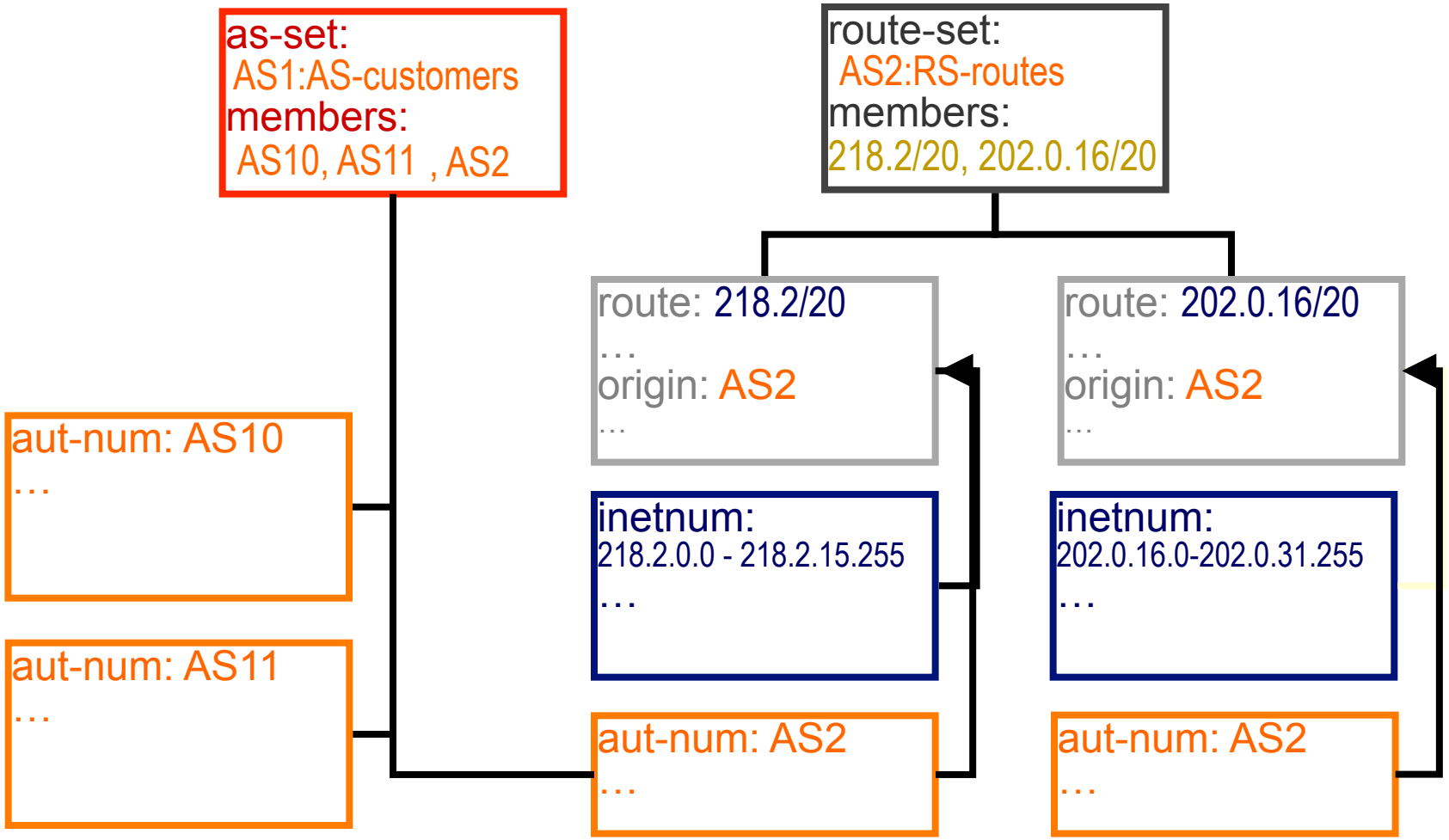
export: to AS123 announce AS4

Lower preference for backup route

Inter-related IRR Objects



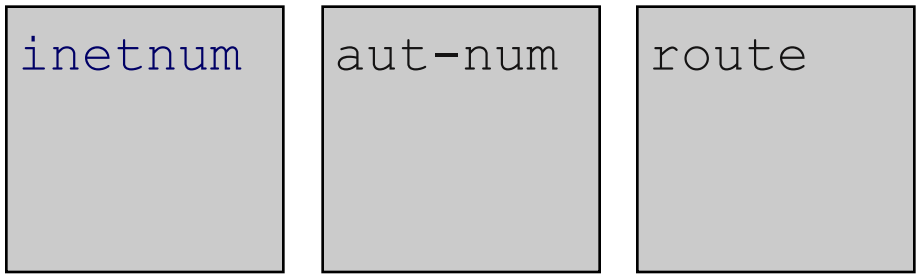
Inter-related IRR Objects



Hierarchical Authorisation

- mnt-routes
  - authenticates creation of route objects
    - creation of route objects must pass authentication of mntner referenced in the mnt-routes attribute
  - Format:
    - mnt-routes: <mntner>

In:



Authorisation Mechanism

```
inetnum:     202.137.181.0 - 202.137.196.255
netname:     SPARKYNET-TC
descr:       SparkyNet Service Provider
…
mnt-by:      APNIC-HM
mnt-lower:   MAINT-SPARKYNET1-TC
mnt-routes:  MAINT-SPARKYNET2-TC
```

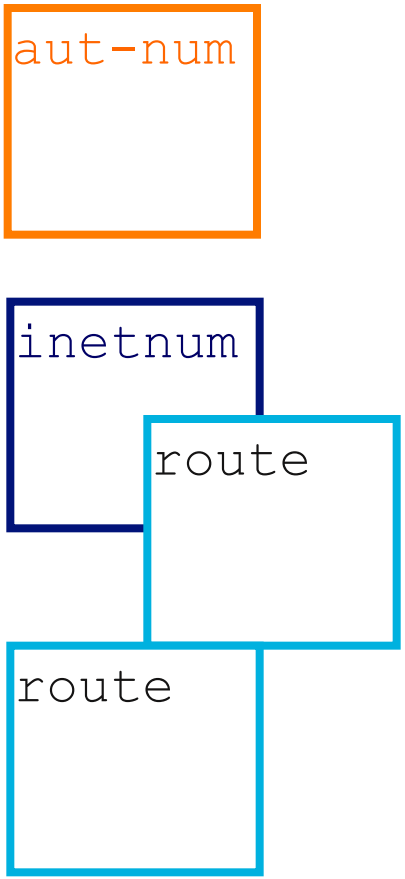
This object can only be modified by APNIC

Creation of more specific objects (assignments) within this range has to pass the authentication of MAINT-SPARKYNET

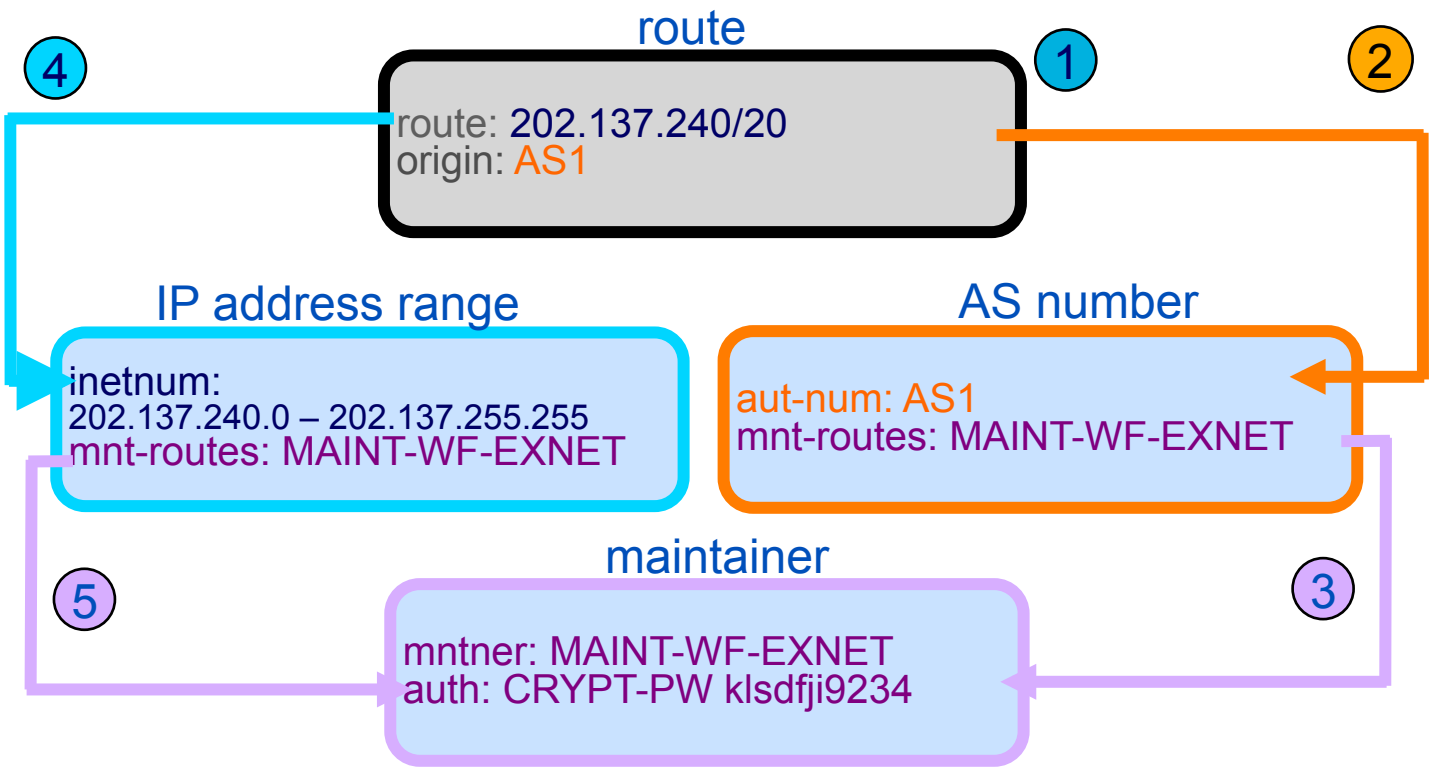
Creation of route objects matching/within this range has to pass the authentication of MAINT-SPARKYNET-WF

Creating Route Objects

- Multiple authentication checks:
  - Originating ASN
    - mntner in the mnt-routes is checked
    - If no mnt-routes, mnt-lower is checked
    - If no mnt-lower, mnt-by is checked
  - AND the address space
    - Exact match & less specific route
      - mnt-routes etc
    - Exact match & less specific inetnum
      - mnt-routes etc
  - AND the route object mntner itself
    - The mntner in the mnt-by attribute



Creating Route Objects



1. Create route object and submit to APNIC RR database
2. DB checks aut-num obj corresponding to the ASN in route obj
3. Route obj creation must pass auth of mntner specified in aut-num *mnt-routes* attribute.
4. DB checks inetnum obj matching/encompassing IP range in route obj
5. Route obj creation must pass auth of mntner specified in inetnum *mnt-routes* attribute.

Using Routing Registry

APNIC

IRRToolSet

- Set of tools developed for using the Internet Routing Registry (IRR)
- Work with Internet routing policies
  - These policies are stored in IRR in the Routing Policy Specification Language (RPSL)
- The goal of the IRRToolSet is to make routing information more convenient and useful for network engineers
  - Tools for automated router configuration,
  - Routing policy analysis
  - On-going maintenance etc.

Use of RPSL – RtConfig

- RtConfig
  - part of IRRToolSet

- Reads policy from IRR (aut-num, route & -set objects) and generates router configuration
  - vendor specific:
    - Cisco, Bay's BCC, Juniper's Junos and Gated/RSd
  - Creates route-map and AS path filters
  - Can also create ingress / egress filters

Why use IRR and RtConfig?

- Benefits of RtConfig
  - Avoid filter errors (typos)
  - Expertise encoded in the tools that generate the policy rather than engineer configuring peering session
  - Filters consistent with documented policy
    - (need to get policy correct though)

Benefits Using the IRR

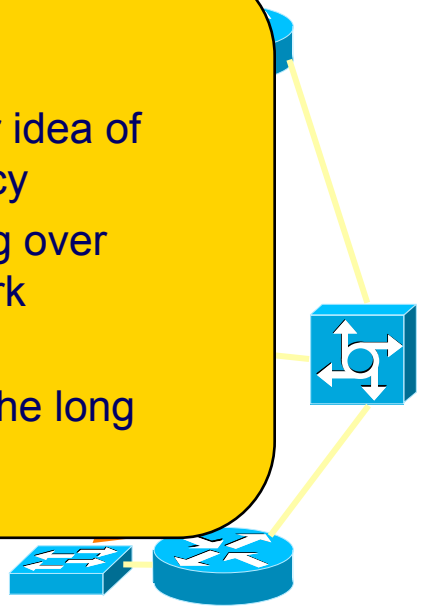
Using the Routing Registry

<u>Costs</u>

- Requires some initial planning
- Takes some time to define & register policy
- Need to maintain data in RR

<u>Benefits</u>

- You have a clear idea of your routing policy
- Consistent config over the whole network
- Less manual maintenance in the long run



APNIC RR integrated in Whois DB

- Facilitates network troubleshooting
- Registration of routing policies
- Generation of router configurations
- Provides global view of routing

Summary

- APNIC RR integrated in APNIC Whois DB
  - Facilitates network troubleshooting
  - Generation of router configuration
  - Provides global view of routing
- APNIC RR benefits
  - Single maintainer (& person obj) for all objects
  - APNIC asserts resources for a registered route
  - Part of the APNIC member service!

Questions?

Need any help?

APNIC Helpdesk

helpdesk@apnic.net

APNIC