APNIC
Internet Routing Registry

An introduction to the IRR

TWNIC Meeting, 3 December 2003
Nurani Nimpuno, APNIC
The Internet Routing Registry

- Global Internet Routing Registry database
  - [http://www.irr.net/](http://www.irr.net/)
  - Established in 1995 by Merit
    - Community driven
  - Originally only 5 databases
  - Now more than 50 worldwide
What is an IRR?

- Both public and private databases
  - These databases are independent
    - but some exchange data
    - only register your data in one database
- Network operators share information
  - Provides stability and consistency of routing
  - Data may be used by anyone worldwide to help debug, configure, and engineer Internet routing and addressing
Internet Routing Registries

RIPE

RADB

CW

APNIC

Connect

IRR = APNIC RR + RIPE DB + RADB + C&W + ARIN + ...
Overview of IRR functions

• Route filtering
  – Peering networks
  – A provider and its customer

• Network troubleshooting
  – Easier to locate routing problems outside your network

• Router configuration
  – By using IRRToolSet

• Global view of routing
  – A global view of routing policy improves the integrity of Internet’s routing as a whole.
Why define a Routing Policy?

• Documentation
• Provides routing security
  – Can peer originate the route?
  – Can peer act as transit for the route?
• Allows automatic generation of router configurations
• Provides a debugging aid
  – Compare reality versus policy
Determining Routing Policy

- Who are my BGP neighbours?
  - (customers/ peers/ upstreams)
- What routes are:
  - Originated by each neighbour?
  - Imported from each neighbour?
  - Exported to each neighbour?
  - Preferred when multiple routes exist?
  - How are they treated (modified routing parameters?)
- What to do if no route exists?
APNIC Database & the IRR

• 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 IRR

- Integrated APNIC Whois Database & Internet Routing Registry

**APNIC Whois**
- IP, ASNs, reverse domains, contacts, maintainers etc
- inetnum, aut-num, domain, person, role, maintainer

**IRR**
- routes, routing policy, filters, peers etc
- route, aut-num, as-set, int-rtr, peering-set etc.

Internet resources & routing information
RPSL

• Routing Policy Specification Language
  – Object oriented language
    • Based on RIPE-181
  – Structured whois objects
  – Higher level of abstraction than access lists

• Relevant RFCs
  – Routing Policy Specification Language
  – Routing Policy System Security
  – Using RPSL in Practice
APNIC IRR objects

- **route**
  - Specifies interAS routes

- **aut-num**
  - Represents an AS. Used to describe external routing policy

- **inet-rtr**
  - Represents a router

- **peering-set**
  - Defines a set of peerings

- **route-set**
  - Defines a set of routes

- **as-set**
  - Defines a set of `aut-num` objects

- **rtr-set**
  - Defines a set of routers

- **filter-set**
  - Defines a set of routes that are matched by its filter

www.apnic.net/db/ref/db-objects.html
Using the Routing Registry

Routing policy, the IRRToolSet & APNIC RR Benefits
IRRToolSet

• Set of tools developed for using the Internet Routing Registry
  – Started as RAToolSet

• Now maintained by RIPE NCC:
  – [http://www.ripe.net/db/irrtoolset/](http://www.ripe.net/db/irrtoolset/)
  • Installation needs: lex, yacc and C++ compiler
Use of RPSL - RtConfig

- RtConfig v4
  - 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
    - (documentation says Cisco only)
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)

– Engineers don't need to understand filter rules
  • it just works :-(
Using RtConfig – IRR objects

aut-num: AS2000
import: from AS3000 accept ANY
export: to AS3000 announce AS2000
import: from AS4000 accept AS4000
export: to AS4000 announce AS2000

route: 10.20.0.0/24
origin: AS2000

route: 10.187.65.0/24
origin: AS2000

full BGP routing
local routes
RtConfig output (import)

```conf
go to
route-map AS3000-IMPORT permit 10
! router bgp 2000
neighbor 10.0.1.3 route-map AS3000-IMPORT in
! no route-map AS4000-IMPORT
!
route-map AS4000-IMPORT permit 10
! router bgp 2000
neighbor 10.4.192.4 route-map AS4000-IMPORT in
```
RtConfig – web prototype

RtConfig generates router configurations from policies specified in RPSL or RIPE-181. Several vendor and public domain router languages are supported, including Cisco routers, Gated, Rsd and Nortel Bay routers. It can generate configurations that may use both the address prefix based filters, and the AS path based filters.

Source AS & Router
Peer AS & Router
Export / Import
Config format
Cisco prefix-lists
Using the Routing Registry & RtConfig

- Define your routing policy
- Enter policy in IRR
- Run rtconfig
- Apply config to routers

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

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

• Goals of the IRR
  – consistency and stability of routing
  – enable development of tools to use information

• Member responsibilities
  – maintain policy information in RR

• APNIC responsibilities
  – assigning Autonomous System Numbers
  – consistency checking of data
  – maintenance of RR support tools
Thank you

nurani@apnic.net

More info at:
http://www.apnic.net/services/apnic-rr-guide.html

This presentation will be available at:
http://www.apnic.net/community/presentations/