# APNIC
# Internet Routing Registry

*An introduction to the IRR*

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# The Internet Routing Registry

- Global Internet Routing Registry database
  - 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
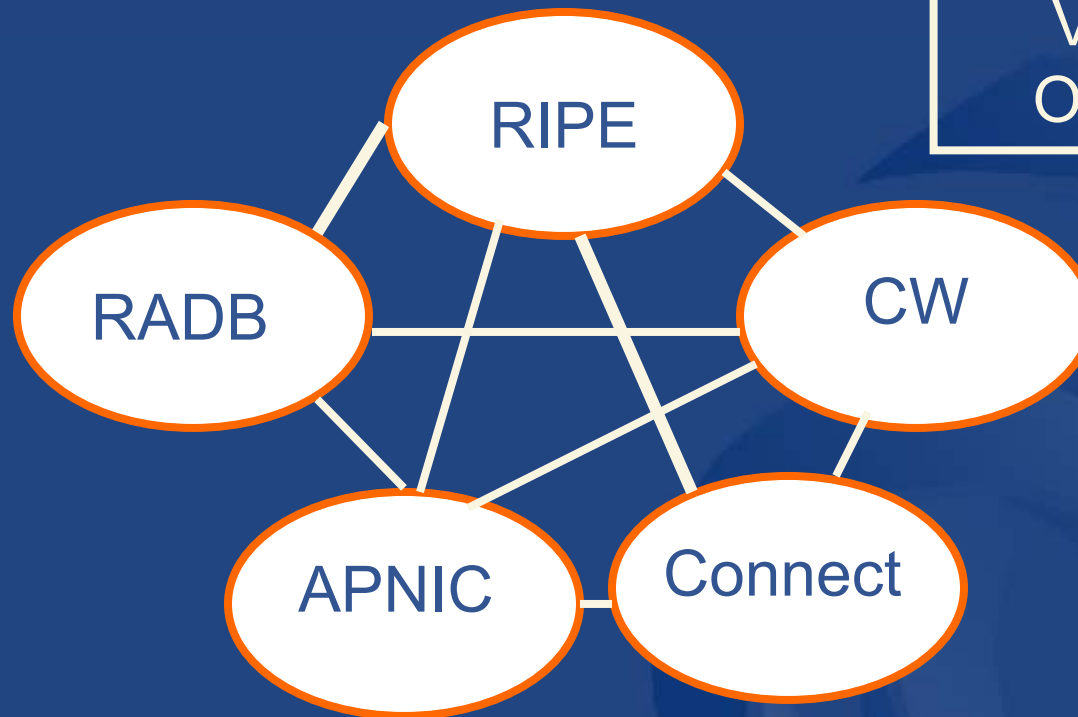
ARIN, ArcStar, FGC, Verio, Bconnex, Optus, Telstra, ...

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?)
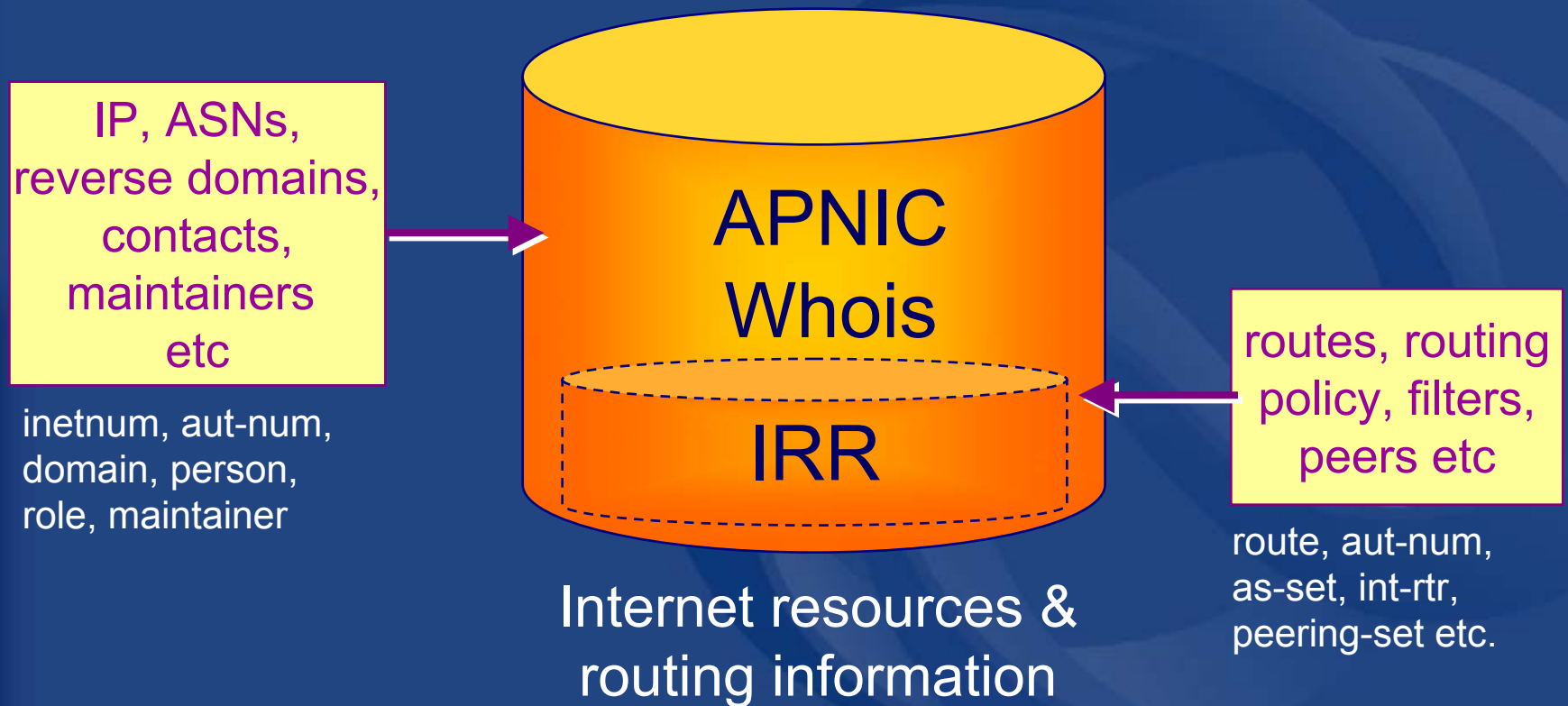- What to do if no route exists?

# 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

IP, ASNs,
reverse domains,
contacts,
maintainers
etc

inetnum, aut-num,
domain, person,
role, maintainer

APNIC
Whois

IRR

Internet resources &
routing information

routes, routing
policy, filters,
peers etc

route, aut-num,
as-set, int-rtr,
peering-set etc.

# 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

RFC 2622
RFC 2725
RFC 2650

# 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/
  - Download: ftp://ftp.ripe.net/tools/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          ← full BGP routing
export:   to AS3000 announce AS2000
import:   from AS4000 accept AS4000       ← local routes
export:   to AS4000 announce AS2000
[…]
```

```
route: 10.20.0.0/24
origin: AS2000
[…]
```

```
route: 10.187.65.0/24
origin: AS2000
[…]
```

# RtConfig output (import)

```
no route-map AS3000-IMPORT
!
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



**http://www.ripe.net/cgi-bin/RtConfig.cgi**

# Using the Routing Registry & RtConfig

Define your routing policy → Enter policy in IRR → Run rtconfig → Apply config to routers
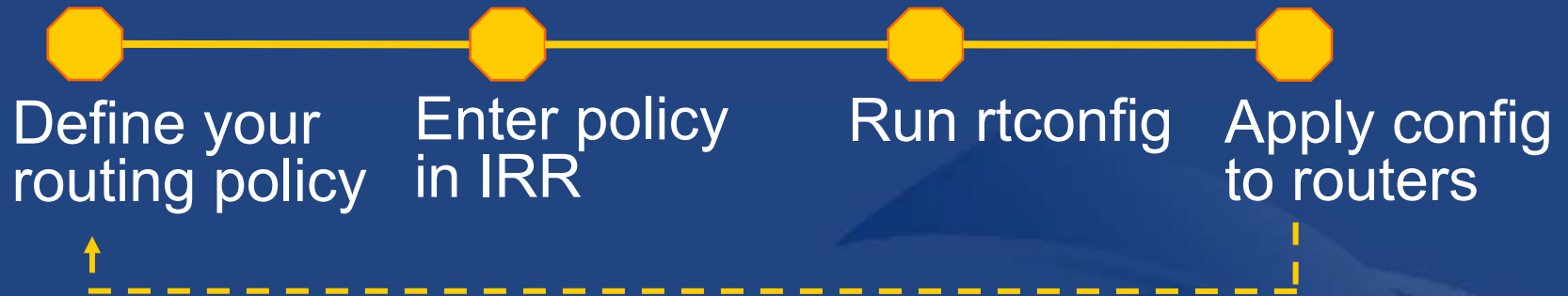
## Disadvantages

- 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*

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

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