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Representation of IP Routing Policies in the RIPE database

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Overview

- ❍ Motivation
- ❍ Basic Concept
  - ❍ Policies
  - ❍ Autonomous System (AS)
  - ❍ Community
  - ❍ Representation of AS
  - ❍ Some Examples
- ❍ What does it solve?
- ❍ What doesn’t it solve?
- ❍ Open Issues

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Routing Registry

- ❍ Neutral run European registry (RIPE NCC)
- ❍ Registration of routing policy information

Proposal for a format for documenting routing policy

“Representation of IP Routing Policies in the RIPE Database” (ripe-81)

Generic guidance document as well as having direct relevance to European Route Server work

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Motivation

- ❍ Clarity by using objects explainable/ understandable to network operators
- ❍ Provide an easy mapping to the way network operators think about routing policy
- ❍ To educate network operators by giving guidance
- ❍ Cut down on complexity where possible
- ❍ Provide the platform for building diagnostic tools, for example in terms of policy information
- ❍ Need configuration info for the route server

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Policies

- General Representation
  - Effort to clarify terms and be consistent
  - Networks
    - -- Layer 3 entities NOT organizations
  - Network Operators
    - -- Service Providers
    - -- Customers
  - Autonomous System (AS)
    - -- A group of networks having a single defined **routing policy**
    - -- An entity exchanging reachability information with neighboring ASes

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Policies

- Routing Policies
  - Interaction of routing exchanges between peering ASes
  - Set for various reasons
  - Need to be documented
  - All routing policies are based on network number
  - Defined in terms of groups of networks
- Access Policies
  - Rarely defined in terms of routing policy
  - Need to be documented
  - Several examples (AUP, Closed user groups, etc.)

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Autonomous System (AS)

- Paper gives guidance for creation, engineering and maintenance of an AS
- Key point is a network can only belong to one AS
- By having an AS object we can document clearly the routing policy of that AS when exchanging reachability information with any other AS
- The AS tag can only be created/updated by the “guardian” of the AS. This ensures control and consistency at the AS level
- Provides two basic key things:
  - A manageable group of networks
  - A description of admin detail and routing policy information

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Autonomous System (AS)

- Can be used to generate **network** based routing filters
- Can be used with newer protocols supporting AS path information
- **Doesn’t rely on using BGP**, however BGP is recommended wherever possible

Community

- A network can be part of more than one community
- Group of networks that cannot be represented by an AS
- Other uses...
  - Special/restricted access policies
  - Accountability -- Statistics, accounting, etc.
- Global relevance
- Should not be tied to any single AS
- The community tag can only be created/updated by the guardian of the community object

Representation of AS

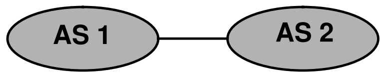
- Routing policies of an AS represented in the AS object
- Details of how routing exchanges take place between ASes
- Based on network number, NOT AS paths, purely on originating AS
- Detail incoming and outbound information for any AS peers an AS has
- Additional preference information

Representation

```
aut-num: AS1104
descr: NIKHEF-H
descr: Science Park Watergraafsmeer
descr: Amsterdam, The Netherlands
as-in: AS1213 100 AS1213
as-in: AS1930 200 AS1930
as-in: AS2107 200 AS2107
as-in: AS1755 150 AS-EBONE
as-in: AS2122 150 ANY
as-out: AS1213 ANY
as-out: AS1930 ANY
as-out: AS2107 ANY
as-out: AS1755 AS1104 AS1930 AS2107 AS1213
as-out: AS2122 ANY
as-out: AS2121 ANY
as-out: AS2121 150 ANY
default: AS1755 100
guardian: ripe-op@nikhef.nl
admin-c: Rob Blokzijl
tech-c: Marten Terpstra
changed: marten@ripe.net 930216
```


Representation of AS

Basic idea




```
as: AS1
<administrivia go here>
as-out: AS2 AS1      # announce all networks in AS1 to AS2
as-in:  AS2 100 AS2  # accept all AS2 networks from AS2

as: AS2
<administrivia go here>
as-out: AS1 AS2      # announce all networks in AS2 to AS1
as-in:  AS1 100 AS1  # accept all AS1 networks from AS1
```

The value of **100** is a measure of cost AND is always used in “as-in” tag

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Representation of AS

A simple example


```
as: AS1
<administrivia go here>
as-out: AS2 AS1             # announce all networks in AS1 to AS2
as-in:  AS2 100 AS2 AS3     # accept AS2 and AS3 networks from AS2

as: AS2
<administrivia go here>
as-out: AS1 AS2 AS3         # announce all networks in AS2 and AS3 to AS1
as-in:  AS1 100 AS1         # accept all AS1 networks from AS1
as-out: AS3 AS2 AS1
as-in:  AS3 100 AS3

as: AS3
<administrivia go here>
as-out: AS2 AS3             # announce all networks in AS3 to AS2
as-in:  AS2 100 AS1 AS2     # accept AS2 and AS1 networks from AS2
```


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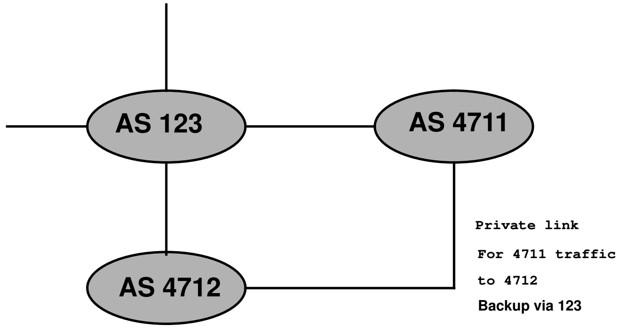
Representation of AS

More complex example



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Representation of AS

```
as: AS4711
as-in:   AS123 100 ALL       # accept all routes from AS123
as-out: AS123 AS4711
as-in:  AS4712 99 AS4712   # prefer AS4712 from AS4712
as-out:  AS4712 AS4711       # announce only own nets to AS4712

as: AS123
as-in:  AS4711 100 AS4711
as-out: AS4711 ALL
as-in:  AS4712 100 AS4712
as-out: AS4712 ALL

as: AS4712
as-in:  AS123 100 ALL
as-out: AS123 AS4712
as-in:  AS4711 99 AS4711
as-out: AS4711 AS4712
```

The cost is now used to show routing policy

The lower the cost value the **more preferred** the route is

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What does it solve?

- Concise way to express routing policy
- Easy to understand
- Easy to publish in existing database
- Suitable to compile into router configurations
- Suitable to be used by NOC tools

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What doesn’t it solve?

- Cannot deal with routing policies based on transit information
  - Whole concept is based on originating AS
- Cannot deal with routing policies for networks which are not published in the (RIPE) database
- Cannot deal with “half baked” routing policies
- limitations of destination based forwarding

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Open Issues

- CIDR (should be OK)
- configuration exchange between neighboring ASes (multiple links)
- does it scale to source based forwarding?
- consistency with routing registries using other representations
- others??