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Contributors:	**Gabriella Paolini**
Reviewers:	**Carlos Friaças**

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Abstract: This document describes the final standardization for the Routing Policy Specification Language, RPSLng. This deliverable updates foregoing versions with reports from the standardization process and some news about RPSLng tools.

Keywords: Routing Policy, Routing Registry, RIPE DataBase, RPSL, RPSLng, RAToolSet, IRRToolSet, Autonomous System

Executive Summary

In this document we explain how the Routing Policy Specification Language next generation (RPSLng) is used to document routing policies for the Multiprotocol Border Gateway Protocol (MBGP) in Routing Registries, and how to generate equipment network configuration from that data.

RPSLng is a revision of RPSL and it supports unicast and multicast address families for both IPv4 and IPv6.

RPSLng is formalized in the RFC 4012 and the completion of standardization process is an important step towards the implementation of IPv6 routing in the Global Internet.

While the previous versions of this deliverable (D3.3.1v1 and D3.3.1v2) explored the standardization process and analysed prototype environments with some realistic tests, now RPSLng registries are supposed to be a production service. We also describe RIPE registry status and the possibility to implement the new language.

Table of Contents

1. Introduction

The Internet is the interconnection of many independently managed networks. Each network is a domain with its own policies about internal and external relationships. The protocol used to exchange routing information between domains, also known as «Autonomous Systems» (AS), is the Border Gateway Protocol, version 4 [BGP4] .

The Multiprotocol Extensions to BGP (MP-BGP) [RFC2858] are widely implemented and deployed today, mainly for IPv4 multicast, IPv6 unicast, and BGP/MPLS VPNs [RFC2547]. Deployments for IPv6 multicast are also starting to show up, mainly in the Research & Education Networks' environment.

The exchange of BGP routes between ASes is constrained by policies. These policies are defined by each operator for its own network and permit to manage, above all, incoming routes and consequently the outgoing flow of traffic. A relationship between two ASes is called peering. All the peerings are bidirectional, and are only possible between two parties. A network operator can maintain different policies for each peering. Peering policies permit to keep peering cost to a minimum and provide an excellent way to achieve network connectivity between domains. The positive side of peerings is that they tend to reduce the latency between two nodes of different domains, hence improving the overall connectivity quality between them.

Operators have the possibility to document their routing policies in their regional routing registry. In Europe the Regional Internet Registry is RIPE, but alternative routing data repositories also exist (RADB is an example). The language, that standardizes entries format in routing registries, has been defined in RFC2622 - Routing Policy Specification Language and, then, in RFC4012 - RPSLng .

The information in the Routing Registries can be used, above all, for automatic generation of BGP router configuration. Policy information can be documented in the registry at various levels of detail. The operators decide its own policies and their level of publicity. Most upstream providers ask their customers to maintain routing registry data continuously up to date and consistent. Conditions can be relaxed in some Internet Exchange Points [IXP], especially for small organizations.

2. Relationship to other deliverables

The present document does not replace previous versions of this deliverable (D3.3.1v1 - D3.3.1v2), but complements them. D3.3.1v1 includes an introduction to inter-domain routing on the Internet and the routing registry in general, as well as historic background on the development of the routing registry language. D3.3.1v2 highlights developments related to the standardization of RPSLng and its testing process.

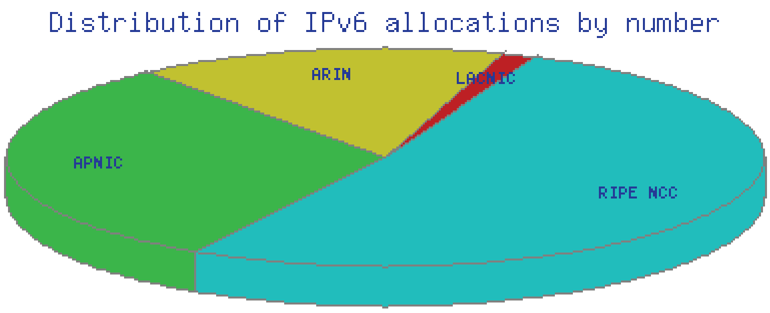
This activity is closely related to activities in other Work Packages, in particular in WP1 (*configuration, documentation and operation of 6NET*) describing the external routing policies for the 6NET with several different types of interconnected networks: National Research and Education Networks (NRENs), the GÉANT backbone, the Euro6IX IST project network, other international research networks, and also networks of industry 6NET partners, and in WP6 (*IPv6 network management architecture and tools*) about network management tools that access and interpret the routing registry data.

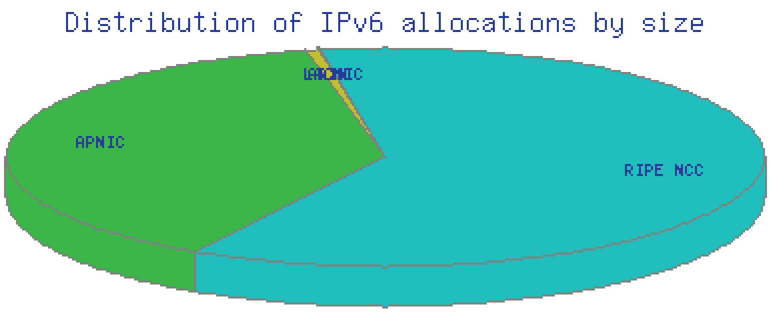
3. Background

3.1. Routing Technology for the Internet

There is only one working inter-domain routing protocol: BGP4. A large number of researchers is involved in a new concept for an external routing protocol that may solve all BGP4 problems, and mostly its scalability. Full IPv4 routing table is continuously growing and the same problem could be recreated with the "real" use of IPv6 in the Global Public Internet. The number of IPv6 allocated networks is becoming very interesting, above all in the European region. RIPE can be seen as the top RIR in terms of allocating IPv6 networks to operators.

Total number of allocated IPv6 prefixes per RIR on 06/2005





At the moment, BGP4 with its extensions remains the unique protocol that can be used in the Internet.

The high distribution of AS numbers and networks advertised in each peering relationship and the continuous changes forced network administrators to consider the use of peering policies repositories, where that kind of information is publicly available.

Analyzing data retrieved from "the CIDR report", by Geoff Huston:

IPv4

Recent Table History

Date	Prefixes	CIDR Aggregated
30-05-05	159668	108869
31-05-05	159796	108546
01-06-05	159846	108487
02-06-05	159978	108483
03-06-05	159823	108535
04-06-05	160012	108563
05-06-05	160023	108637
06-06-05	160064	108747

AS Summary

19684	Number of ASes in routing system
8070	Number of ASes announcing only one prefix
1480	Largest number of prefixes announced by an AS

We can see how IPv4 network's announcements are unstable and complex.

IPv6 routing table is starting now, but it seems to follow IPv4 tendency.

IPv6

Table History

Date	Prefixes	CIDR Aggregated
31-05-05	736	678
01-06-05	734	678
02-06-05	735	683
03-06-05	741	691
04-06-05	749	690
05-06-05	748	686
06-06-05	744	680
07-06-05	752	693

AS Summary

545 Number of ASes in routing system

420	Number of ASes announcing only one prefix
57	Largest number of prefixes announced by an AS

In real-world operations, some ASes are not showing their policies, or forgetting to update them in the registry, generating out-of-date inconsistent data. However, many others are relying on the published available data to find the best route (for economical and technical reasons) for their packets.

The hierarchy paradigm described in D3.3.1v1 and repeated D3.3.1v2 is still applied:

Managing one domain in today's Internet is directly tied to the way other domains are managed by third party entities.

3.2. RFC 4012

For the history of the Routing Registry and its Routing Policy Specification Language, see the previous version of this deliverable, D3.3.1v1 - D3.3.1v2.

The common rules used in the Internet Routing Registry are specified in a set of IETF RFCs:

- RFC2622: Routing Policy Specifiaction Language (RPSL)
- RFC2725: Routing Policy System Security
- RFC2650: Using RPSL in Practice

Since March 2005, RFC4012 finally introduces a new set of simple extensions to the Routing Policy Specification Language (RPSL), enabling the language to document routing policies for the IPv6 and multicast address families currently used in the Internet.

This RFC, written by Larry Blunk (Merit Network), João Luís Silva Damas (Internet Systems Consortium), Florent Parent (Hexago) and Andrei Robachevsky (RIPE/NCC), provide RPSL the extensibility to allow users to document routing policies for IPv6 and multicast without creating a backward incompatible new language. This choice makes more confident user transition to new extensions, maintaining existing tools and processes, with simple upgrades. RPLSng is clear, easy to use and helps network administrators that need to maintain routing policies for different address families, often the same.

There are in the RPSLng four distinct routing policies: IPv4 unicast, IPv4 multicast, IPv6 unicast and IPv6 multicast.

The changes introduced in the new version of this language are the following:

- New dictionary attribute

  Address Family Identifier, “afi”, is an RPSLng list of address families for which a given routing policy expression should be evaluated.

  The possible values for afi attribute are:

  - ipv4.unicast

- ipv4.multicast
- ipv4 (equivalent to ipv4.unicast, ipv4.multicast)
- ipv6.unicast
- ipv6.multicast
- ipv6 (equivalent to ipv6.unicast, ipv6.multicast)
- any (equivalent to ipv4, ipv6)
- any.unicast (equivalent to ipv4.unicast, ipv6.unicast)
- any.multicast (equivalent to ipv4.multicast, ipv6.multicast)

These values must be preceded by the keyword "afi". It's possible to specify a list of values, in this case the attribute is separated by a comma.

- New predefined dictionary type

In order to support IPv6 addresses specified with the next-hop rp-attribute, a new predefined dictionary type entitled "ipv6_address" is added to the RPSL dictionary.

- New protocol dictionary specification

MPBGP is a new protocol dictionary specification. MPBGP means Multi-Protocol BGP.

- New policy attributes

The aut-num Class has three new policy attributes:

- mp-import:
- mp-export:
- mp-default:

These attributes incorporate the "afi" (address-family) specification. The afi specification is optional. If no afi specification is present, the policy expression is applied to ipv4.unicast, ipv4.multicast, ipv6.unicast, and ipv6.multicast. It's the same when we are using "afi any". The mp-import and mp-export attributes have both a basic policy specification and a more powerful structured policy specification.

- New route6 Class

The route6 class is the IPv6 equivalent of the route class and shares the same attribute names with the route class. The attribute names remain identical, but the values in 'route6', 'inject', 'components exports-comps', 'holes', and 'mnt-routes' attributes must specify IPv6 prefixes and addresses.

- New attribute in route-set Class

The route-set class is used to specify a set of route prefixes. A new attribute "mp-members:" allows to use IPv4 or IPv6 address-prefix-ranges as a set of route prefixes.

- New attribute in filter-set Class

The new "mp-filter:" attribute defines the policy filter set. A policy filter is a logical expression that when applied to a set of routes returns a subset of these routes. The "filter:" and "mp-filter:" attributes are optional, but a filter-set must contain one of the two . Implementations should reject instances where both attributes are defined in an object.

- New attribute in peering-set Class

The peering-set class is used to simplify peering statements in the import and export attributes of aut-num objects. The class has its new "mp-peering:" attribute. The "peering:" and "mp-peering:" attributes are optional, but a peering-set must contain at least one of these two attributes.

- New attributes in inet-rtr Class

The inet-rtr class can be used to determine which AS a router belongs. It can also be used to register information about peering relationships. It allows to keep track of internal routing configurations. Two new attributes are introduced to the inet-rtr class: "interface:" and "mp-peer:". The first one allows the definition of generic interfaces, including the information previously contained in the "ifaddr:" attribute, as well as support for tunnel definitions. The second includes and extends the functionality of the existing "peer:" attribute with the support for IPv6 addresses.

- New attribute in rtr-set Class

The rtr-set class allows you to groups routers (inet-rtr) with similar properties. The new attribute in this class is "mp-members:" and it extends the original "members:" attribute by allowing the specification of IPv6 addresses.

4. RPSLng Tools Available

4.1. RIPE RPSLng Registry

Since Wednesday 29 December 2004, the RIPE Database (whois.ripe.net) supports RPSLng, allowing description of IPv6 and multicast routing policies. It includes a new object type, ROUTE6, and new attributes, such as "mp-import:" and "mp-export:". This addition doesn't affect the old contents of the database and it is optional for any objects.

The main differences for users' queries are as follows:

- A query for an IPv4 address or network could return INETNUM, ROUTE, and INET-RTR objects. IPv6 queries returns INET6NUM, ROUTE6 and INET-RTR objects, if they are in the database.
- An inverse query (using the "-i" flag) for AUT-NUM objects could return both ROUTE and ROUTE6 objects.

It is possible to limit query using the "-T" flag. For example, to obtain only a ROUTE objects from an inverse query, by typing : whois -h whois.ripe.net -T route -i origin AS3333

Since May 2003, the RIPE NCC has operated an experimental registry with RPSLng syntax. They did not move the contents of the RPSLng prototype Whois server to the RIPE Whois Database. All the RPLSng objects in the production RIPE Whois Database are new objects, that describe production routing policies.

4.2. State of Implementation in RIPE Registry

In order to assess the amount of next generation routing policies that are present in RIPE registry, we used a script by Simon Leinen (SWITCH), that counts the `aut-num` objects with `mp-import` and `mp-export` attributes in them. The Perl source was described in D3.3.1v2 .

Here are the results of an execution of this script performed on 1 June 2005:

```
113 route6 objects found.
AS#     mp-i mp-e    i    e  changed origin-routes
AS137      3    3    4    4        0 2001:0760::/32
AS174      -    - 1039 1039        0 2001:0978::/32
AS250      -    -   11   11        0 2001:41e0::/32
AS513      -    -   23   24        0 2001:1458::/32
AS517      -    -    1    1        0 2001:0680::/32
AS559     14   13   47   46        0 2001:620::/32, 3FFE:2000::/24, 2002::/16
AS786      -    -  206  206        0 2001:630::/32
AS1103     -    -  168  168        0 2001:610::/32
AS1273     3    3  362  359        0 2001:5000::/21
AS1853    17   17  103  102        0 2001:628::/30
AS1887     -    -    7    5        0 2001:A10::/32
AS1930     -    -   22   22        0 2001:690::/32, 2002::/16, 2001:7F8:A::/48
AS2116     -    -   67   67        0 2001:8c0::/32
AS2200     -    -    7    8        0 2001:0660::/32
AS2594     -    -   10   11        0 2001:1a60::/32
AS2595     -    -    3    2        0 2001:0848::/32
AS2607     -    -   10    7        0 2001:4118::/32
AS2611     -    -  160  164        0 2001:6A8::/32
AS2847     -    -   11   11        0 2001:0778::/32
AS3212     1    1  235  234        0 2001:1688::/32
```

```
AS3246      5    5   21   25         0 2001:6E8::/32
AS3248      5    5   63   63         0 2001:858::/32
AS3292      -    -  625  625         0 2001:06C8::/32
AS3303      -    -  587   87         0 2001:0918::/32, 2001:1428::/32
AS3320      1    2    1    2         0 2003:0000::/19, 2003:0000::/20,
2001:07A0::/32
AS3323      -    -    3    3         0 2001:648:2000::/48
AS3327     10    9   54   54         0 2001:ad0::/32
AS3344      -    -   33   33         0 2001:4BD0::/32
AS3557      -    4    -    2         0 2001:500::/48, 2001:4f8::/48, 2001:4f8::/32
AS4589      -    - 1462 1450         0 2001:6f8::/32
AS5385      5    5   53   53         0 2001:AF8::/32
AS5408      -    -    7    7         0 2001:648:F000::/40, 2001:648:2320::/48,
2001:648:2E00::/48, 2001:648::/32
AS5430      -    -  244  244         0 2001:748::/32
AS5470      -    -    1    1         0 2001:648:2800::/48
AS5539     38   38  103  103         0 2001:608::/32
AS5602      -    -    2    2         0 2001:1450::/32
AS6762      -    -  123  123         0 2001:41a8::/32
AS6772      -    -   46   46         0 2001:4060::/32
AS6802      -    -    6    6         0 2001:4b58::/32
AS8214      -    -    1    1         0 2001:648:F000::/43
AS8220      -    -  976  972         0 2001:920::/32
AS8248      -    -    2    2         0 2001:648:2F00::/48, 2001:648:2E80::/48,
2001:648:2E10::/48, 2001:648:2D80::/48, 2001:648:2D00::/48, 2001:648:2C20::/48,
2001:648:2900::/48, 2001:648:2070::/48, 2001:648:2060::/48
AS8365      -    -  131  130         0 2001:41b8::/32
AS8447     14   14  233  234         0 2001:890::/32
AS8472      -    -  101  101         0 2001:0740::/32
AS8503      -    -    1    1         0 2001:4b48::/32
AS8591      4    4   46   47         0 2001:15c0::/32
AS8665      -    -   82   82         0 2001:1B20::/32
AS8708      -    -  473  474         0 2001:1518::/32
AS8758      -    -   79   79         0 2001:8E0::/32
AS8762      -    -    2    2         0 2001:648:2C10::/48
AS8763      -    -  120  118         0 2001:608:6::/48
AS8767      -    -   54   51         0 2001:a60::/32
AS8925      -    -    3    3         0 2001:ae0::/32
AS9009      -    -    3    3         0 2001:1598::/32
AS12046     -    -    8    8         0 2001:1a70::/32
AS12337     -    -  135  136         0 2001:780::/32
AS12355     2    2    3    3         0 2001:14f0::/32
AS12371     1    1    3    3         0 2001:14d8::/32
AS12399     -    -  135  135         0 2001:A78::/32
AS12504     -    -    2    2         0 2001:41f0::/32
AS12600     -    -   16   16         0 2001:1668::/32
AS12634     -    -  192  192         0 2001:960::/32
AS12637     -    -    3    3         0 2001:4b78::/32
AS12638     3    3    2    2         0 2001:1A28::/32
AS12657     1    2    2    2         0 2001:1578::/32
AS12702     -    -    -    -         0 2001:600::/32
AS12779     -    -   83   83         0 2001:1418::/32, 2002::/16
AS12793     -    -  226  227         0 2001:0870::/32
AS12816     2    1    2    2         0 2001:4CA0::/32
AS12817     4    4    4    4         0 2001:1578:0200::/40
AS12931     -    -    5    5         0 2001:14e0::/32
AS12964     -    -    5    5         0 2001:4CA8::/32
AS13041     -    -   22   22         0 2001:40B0::/32
AS13046     2    2   70   70         0 2001:1AF0::/32
```

```
AS13129    -    -  264  262        0 2001:0978::/32
AS15444   43   43  275  275        0 2001:1a90::/32
AS15501    -    -    1    1        0 2001:4078::/32
AS15589    -    -   41   42        0 2001:750::/32
AS15725    -    -    3    3        0 2001:4bd8::/32
AS16004    -    -   52   52        0 2001:1ac0::/32
AS16086    -    -    6    6        0 2001:14b8::/32, 2001:1a58::/32
AS16131    -    -    8    8        0 2001:1BE8::/32
AS20569    -    -    3    3        0 2001:8b8::/32
AS20621    -    -    3    3        0 2001:aa8::/32
AS20640    -    -  221  222        0 2001:4b88::/32
AS20745    -    -    2    2        0 2001:1678::/32
AS20912    -    -    2    2        0 2001:40d0::/32
AS20965    -    -   42   43        0 2001:0798::/32
AS21385    -    -  133  133        0 2001:1b18::/32
AS21501    -    -    8    8        0 2001:0830::/32
AS25137    -    -   15   15        0 2001:b18::/32
AS25152   24   24  245  245        0 2001:07FD::/32
AS25220    5    5  106  106        0 2001:4b38::/32
AS25336    -    -   19   19        0 3ffe:80e0::/28
AS25560   34   34  145  145        0 2001:1a50::/32
AS28716    -    -    2   33        0 2001:1bd0::/32
AS28725    -    -   39   39        0 2001:41d8::/32
AS29208    -    -   48   48        0 2001:1ba0::/32
AS29259    8    9    6    3        0 2001:1B10::/32, 2002::/16, 2001:16C0::/32
AS29317    3    3    3    3        0 2001:1578:0100::/40
AS29449    2    2    -    -        0 2001:15a8::/32
AS29670   12   12   35   35        0 2001:bf0:c000::/35
AS31383    -    -  190  191        0 2001:4038::/32
AS31479    -    -    3    3        0 2001:4030::/32
AS34138    -    -    3    3        0 2001:940:100::/40
AS34288    -    -    2    2        0 2001:4b20::/32
AS34465    -    -    7    7        0 2001:4c40::/32
AS34623    -    -    3    3        0 2001:4bf0::/48
AS34631    -    -    3    3        0 2001:4bb0::/32
AS34695    -    -    2    2        0 2001:4c00::/32
AS34771    -    -    5    4        0 2001:648:FFFF::/48
AS35062    -    -    2    2        0 2001:4c98::/32
```

Considering the six months of life that the RIPE RPLSng Whois server only has, we noted that there are 113 Route6 objects, and only 28 aut-num objects have multi-protocol policy in them. We can confirm on these grounds that few operators have practical experience with the proposed RPSLng specification. Though, we are observing a growing number of RPLSng policies , as well as IPv6 addresses assignments by the LIRs to their end-users.

4.3. Software

4.3.1. IRRToolSet

The "Internet Routing Registry ToolSet" (IRRToolSet) is a suite of policy analysis tools to operate with routing policies registered in Routing Registry. The main goal of the project is to make routing information useful for network administrators, by providing tools for up-to-date BGP router configuration and for routing policies analysis.

IRRToolSet project is now maintained by the Internet Systems Consortium (ISC).

The new homepage of the project is: http://www.isc.org/sw/IRRToolSet/

In the last version of the IRRToolSet 4.8.2 (03/08/2004) RPSLng is integrated in the standard version. It can be downloaded from ftp://ftp.isc.org/isc/IRRToolSet/ .

Only peval, rpslcheck and RtConfig tools work with the new dictionary.

In the IRRToolSet mailing list Damir Pobric (CANARIE) and Tim Streater (DANTE) reported problems with version 4.8.2 and RPLSng. Their reports did not receive any reply yet.

4.3.2. RIPE database server

The new version of RIPE database server WhoisServer 3.3.0 (25/05/2004) is RPSLng compliant.

It can be retrieved from: ftp://ftp.ripe.net/ripe/dbase/software/whoisserver-3.3.0.tar.gz

RIPE NCC offers now a web interface with CVS System to browse the source codes at: http://www.ripe.net/cgi-bin/cvsweb.cgi/whoisserver/

4.3.3. IRRd

IRRd is a freely available, stand-alone Internet Routing Registry database server maintained by MERIT. IRRd supports RPSLng. Last version of IRRd is 2.2.6 (06/04/2005) and it can be downloaded from: http://www.irrd.net/irrd2.2.6.tgz

5. Examples

Here are some examples of actual multi-protocol policies expressed in RPSLng.

5.1. route6 object:

```
route6:       2001:0760::/32
descr:        GARR-IPv6
origin:       AS137
mnt-by:       GARR-LIR
...
```

5.2. aut-num object:

```
aut-num:        AS1853
as-name:        ACOnet
descr:          ACOnet Backbone
descr:          AT
remarks:        ============================================================
remarks:      #upstream: Sprint.net
import:         from AS1239 action pref=100; accept ANY
export:         to   AS1239 announce AS-ACONET AND AS-SANET
mp-import:      afi ipv6.unicast   from AS6175  accept   ANY
mp-export:      afi ipv6.unicast   to   AS6175  announce AS-ACONET-V6
remarks:      #upstream: GEANT.net
import:         from AS20965 action pref=100; accept ANY
export:         to   AS20965 announce AS-ACONET AND AS-UNREN AND AS-ACOSERV
mp-import:      afi ipv6.unicast   from AS20965 accept   ANY
mp-export:      afi ipv6.unicast   to   AS20965 announce AS-ACONET-V6
remarks:        =============================================================
...
remarks:      #customer: SANET
import:         from AS2607 action pref=100; accept AS-SANET AS-SANETSIXPEERS
export:         to   AS2607 announce ANY
mp-import:      afi ipv6.unicast   from AS2607  accept   AS2607
mp-export:      afi ipv6.unicast   to   AS2607  announce AS-ACONET-V6
...
remarks:      #peering: SIL.at
import:         from AS3248 action pref=100; accept AS-SILAT
export:         to   AS3248 announce AS-ACONETTOVIX
mp-import:      afi ipv6.unicast   from AS3248  accept   AS3248
mp-export:      afi ipv6.unicast   to   AS3248  announce AS-ACONETTOVIX-V6
...
```

5.3. peering-set object:

```
peering-set:    prng-ebgp-peers
descr:          TopneT IPv6 ebgp peers
...
mp-peering:  AS12533 2001:15A8:A:1:FFFF:FFFF:FFFF:2 at
2001:15A8:A:1:FFFF:FFFF:FFFF:3
...
mp-peering:     AS5609 3FFE:1001:1:F036::1 at 3FFE:1001:1:F036::2
...
mp-peering:     AS5602 2001:15A8:A:1:FFFF:FFFF:FFFF:5 at
2001:15A8:A:1:FFFF:FFFF:FFFF:4
...
mp-peering:     AS6939 2001:470:1F01:FFFF::224 at 2001:470:1F01:FFFF::225
...
```

5.4. route-set object:

```
route-set:    AS29670:RS-IN-BERLIN
descr:        Individual Network Berlin e.V.
org:          ORG-INBE1-RIPE
mp-members:   192.109.21.0/24
mp-members:   192.109.42.0/24
mp-members:   217.197.80.0/20
mp-members:   193.96.24.0/24
mp-members:   2001:bf0:c000::/35
...
```

5.5. filter-set object:

```
filter-set:   AS12817:fltr-BOGONS
descr:        Generic IPv4/IPv6 Prefix & AS filter
mp-filter:    { 10.0.0.0/8^+,
                127.0.0.0/8^+,
                169.254.0.0/16^+,
                172.16.0.0/12^+,
                192.0.2.0/24^+,
                192.88.99.0/24^+,
                192.168.0.0/16^+,
                198.18.0.0/15^+,
                0.0.0.0/0^25-32 }
              AND
              { 2001:db8::/32^+,
                2002::/16^-,
                0000::/8^+,
                fe00::/9^+,
                ff00::/8^+,
                0::/0^49-128 }
              AND
              <[AS64512-AS65534]>
...
```

5.6. inet-rtr object:

```
inet-rtr:     BR1.mucI.baycix.net
descr:        BayCIX GmbH
descr:        Landshut, Germany
local-as:     AS12657
ifaddr:       212.72.95.1          masklen 32
ifaddr:       212.72.72.198        masklen 30
interface:    2001:1578:0:FFFF::1  masklen 128
interface:    2001:1578:0:FF::1    masklen 112
interface:    2001:1578:0:F0::1    masklen 64
peer:         BGP4 212.72.95.3           asno(AS12657)
peer:         BGP4 212.72.72.197         asno(AS29317)
mp-peer:      MPBGP 2001:1578:0:FFFF::2  asno(AS12657)
mp-peer:      MPBGP 2001:1578:0:FF::2    asno(AS29317)
...
```

6. Conclusions

RPSLng has became a standard and it is active in the RIPE database. This is a good starting point.

As well as IPv4 Routing Policies, IPv6 routing policies need to be documented. Maintaining up-to-date routing policy information data should be a daily practice, but often network administrators do not give it high priority, or decide that is better for them not to completely show their policy.

The continuous maintenance of RPSLng tools projects should be a substantial contribution to the future implementation that we hope for the new version of routing policy language.

7. Appendix A. Acronyms

AFI	Address Family Identifier
AS	Autonomous System
ASN or AS number	Autonomous System number
BGP	Border Gateway Protocol
Euro6IX	an IST project
IETF	Internet Engineering Task Force
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IRRToolSet	Internet Routing Registry Tool Set
I/IS-IS	Integrated Intermediate System to Intermediate System (routing protocol)
MP-BGP	BGP-4 with Multi-Protocol extensions according to RFC 2858
NREN	National Research and Education Network
RAToolSet	Routing Arbiter Tool Set
RFC	Request for Comment (IETF document)
ripe-999	RIPE Document number 999
RPSL	Routing Policy Specification Language
RPSLng	Routing Policy Specification Language (next generation)
WP	Work Package in a project

8. Appendix C. References

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