KHALED ROUTING PROTOCOL (KRP)

https://www.ietf.org/archive/id/draft-omar-krp-06.txt

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- KRP is a new Exterior Gateway Protocol (KRP) that is used to route IP packets from the source host to the destination host through various Autonomous Systems (ASs) over the global Internet.

- The enhancements that KRP adds are:
  a) Decreases the BGP routing table by 80%.
  b) Enhancing the routing function.
  c) Enhancing the QoS.
The globe will be subdivided into 5 logical Regions.

Region Number (RN) ➔ A unique number that identifies a Region.
KRP REGIONS

• The 1\textsuperscript{st} hexadecimal digit of the 2\textsuperscript{nd} group of an IPv6 address determines on which Region Number this IPv6 address is located.

2001:2D51:8A51:4D24::/64 $\rightarrow$ Region Number 3

• The 1\textsuperscript{st} octet of an IPv4 address determines on which Region Number this IPv4 address is located.

80.144.15.22 $\rightarrow$ Region Number 4
# REGION NUMBER TABLE (RNT)

<table>
<thead>
<tr>
<th>Region Number (RN)</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Hexadecimal Digit Of the 2&lt;sup&gt;nd&lt;/sup&gt; group of an IPv6 address</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Octet Of an IPv4 address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(0 - 5 - A - F)</td>
<td>ARIN Pool</td>
</tr>
<tr>
<td>2</td>
<td>(1 - 6 - B)</td>
<td>LACNIC Pool</td>
</tr>
<tr>
<td>3</td>
<td>(2 - 7 - C)</td>
<td>RIPE NCC/APNIC Pool</td>
</tr>
<tr>
<td>4</td>
<td>(3 - 8 - D)</td>
<td>AFRINIC Pool</td>
</tr>
<tr>
<td>5</td>
<td>(4 - 9 - E)</td>
<td>APNIC Pool</td>
</tr>
</tbody>
</table>
KRP ROUTERS

• Regional Boarder Router (RBR).
• Regional Router (RR).
• Local KRP AS Router (LKAR).
REGIONAL BOARDER ROUTER (RBR)
REGIONAL BOARDER ROUTER (RBR)

A router in a Region (with an Assigned RN) that has at least one interface connected to a router’s interface in another different region (with another assigned RN).
REGIONAL ROUTER (RR)

RN 3

ASN 20

ASN 10
A router in a local AS that has at least one interface connected to a router's interface in another different AS in the same region.
LOCAL KRP AS ROUTER (LKAR)

RN 3
LOCAL KRP AS ROUTER (LKAR)

A router in an AS that has all interfaces connected to other routers in the same AS in the same region.
KRP ROUTERS

• Each KRP router is configured with a Region Number (RN) that identifies in which region that router is located.

• All KRP routers’ interfaces will be assigned by default to the configured Region Number (RN).

• First, the two connected KRP routers’ interfaces exchange their RNs:
  If they are the same, the two KRP routers are RRs.
  If they are different, the two KRP routers are RBRs.

• Second, the two connected KRP routers’ interfaces exchange their KRP ASNs:
  If they are the same, the two KRP routers are LKARs.
  If they are different, the two KRP routers are RRs.
Note:-

• For ISPs and Enterprises, the RN and KRP ASN are configured **manually** on every KRP router.

• For Enterprises, the RN and KRP ASN must be stored on every assigned GUA (in case of IPv6) and on every public IP address (in case of IPv4).
KRP FORWARDING MECHANISM

KRP requires the IPv6 and IPv4 assignment for enterprises must follow these requirements:

a) The 2nd two groups of an IPv6 address are represented as follows:

```
xxxx|yyyy|yyyy|yyyy:yyyy|yyyy|yyyy|yyyy (Binary digits)
```

```
XYYY:YYYY (Hexa-decimal digits)
```

where X hex-digit is associated with a specific Region Number (RN) and XYYY:YYYY hex digits represents the KRP ASN.
b) The 4 octets of an IPv4 address are represented as follows:

```
xxxxxxxx.xxx.yyyyyyyyy.yyyyyyyyy (Binary digits)
```

```
XXYY.YYYY (Hexa-decimal digits)
```

where XX hex-digits are associated with a specific Region Number (RN).
and XXYY.YYYY Hex digits represents the KRP ASN.
Note:-

• The Region Number (RN) is unique for every region.

• The KRP ASN must be unique for every AS.

• For IPv4, the 4 octets are represented in decimal in the IPv4 address itself, but the KRP ASN is represented in 8 hexa-decimal digits.

• For IPv4, Enterprises can be assigned more than one KRP ASN.
There are 3 types of tables, 2 RBR messages and 1 RR message that KRP uses:
KRP ROUTER REGIONAL TABLE (RT)

- Each RBR and RR creates its own Regional Table (RT).

- The Regional Table (RT) is as follows:

<table>
<thead>
<tr>
<th>Local RN</th>
<th>Remote RN</th>
<th>Traffic Class</th>
<th>Local KRP ASN</th>
<th>RBR KRP ASN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Forwarding Table (FT) is as follows:

<table>
<thead>
<tr>
<th>Local KRP ASN</th>
<th>Remote KRP ASN</th>
<th>RBR KRP ASN</th>
<th>Best AS Path</th>
<th>Output Interface</th>
<th>Next-hop IP Address</th>
</tr>
</thead>
</table>
KRP ROUTER IGP ROUTING TABLE (IRT)

- The IGP Routing Table is as follows:

<table>
<thead>
<tr>
<th>Prefix (Subnet)</th>
<th>Metric</th>
<th>Output Interface</th>
<th>Next-hop IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RBR MESSAGES

- RBR Advertised Message Information for the local region's RRs is as follows:

<table>
<thead>
<tr>
<th>Remote RN</th>
<th>RBR KRP ASN</th>
<th>Traffic Class</th>
<th>No. of Hops</th>
<th>RBR IP Address</th>
</tr>
</thead>
</table>

- RBR Advertised Message Information for the remote region's RBR is as follows:

<table>
<thead>
<tr>
<th>Local RN</th>
<th>Remote RN</th>
<th>Traffic Class</th>
<th>No. of Hops</th>
<th>Timeout Value</th>
<th>RBR KRP ASN</th>
</tr>
</thead>
</table>
**RR MESSAGE**

- RR Advertised Message Information for the local AS is as follows:

<table>
<thead>
<tr>
<th>Local KRP ASN</th>
<th>Remote KRP ASN</th>
<th>Traffic Class</th>
<th>RR IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
EXAMPLE
AS WEIGHT

```
R1#traceroute 10.1.1.50
Type escape sequence to abort.
Tracing the route to 10.1.1.50
VRF info: (vrf in name/id, vrf out name/id)
1 20.1.1.1.2 [AS 300] 80 msec 60 msec 80 msec 64 msec
2 40.1.1.1.2 [AS 300] 60 msec 90 msec 64 msec
3 60.1.1.2 [AS 300] 100 msec 132 msec 76 msec
4 100.1.1.2 [AS 300] 100 msec 196 msec 184 msec
5 90.1.1.2 [AS 300] 252 msec 256 msec 184 msec
```