

draft-omar-nep-03
Internet-Draft
Intended status: Standard Track
Expires: June 20, 2018

Khaled Omar
The Road

December 20, 2017

**Numbering Exchange Protocol (NEP)
Specification
draft-omar-nep-03**

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on June 20, 2018.

Copyright Notice

Copyright (c) 2017 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in [Section 4.e](#) of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Abstract

This document specifies Numbering Exchange Protocol (NEP).

Table of Contents

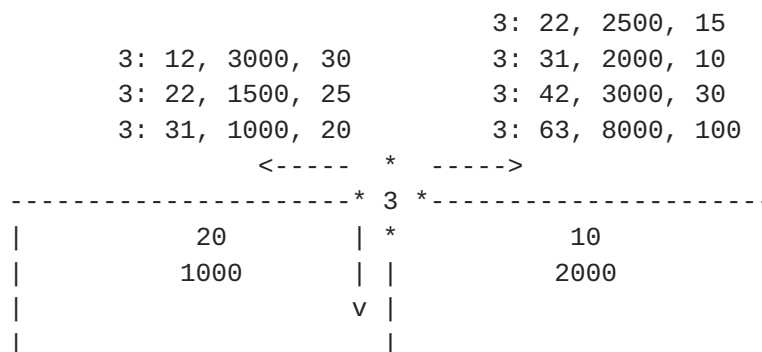
1. Introduction.....	1
2. Numbering Exchange Protocol (NEP).....	1
3. NEP Loop Prevention.....	3
4. Subnet Advertisement.....	4
5. Security Considerations.....	5
6. Acknowledgments.....	5
7. Author Address.....	5
8. References.....	5
9. Full Copyright Statement.....	5

1. Introduction

- Numbering Exchange Protocol (NEP) is an Interior Gateway Protocol (IGP) that delivers IP packets between routers in the same Autonomous System (AS).
- The problem that NEP is trying to solve is related to the IGP metric where:
 - a) RIP uses only the number of hops.
 - b) OSPF uses only the cost (bandwidth).
 - c) IS-IS uses only a default metric of 10 for all links.
 - d) EIGRP uses the least bandwidth and delay.
- NEP differs from other IGPs as it chooses its best path based on a composite metric of:
 - a. Highest total bandwidth (for faster transmission).
 - b. Number of hops (for less processing).
 - c. Lowest total delay (for faster delivery).
- NEP builds a short IP routing table less than other IGPs.
- NEP uses a numbering method between routers that provides a fast topology exchange and learning process.

2. Numbering Exchange Protocol (NEP)

- The following figure shows 6 interconnected routers within an AS as follows:



```

4: 22, 4000, 60      |           | 5           |
4: 41, 1000, 20      |           ^ | 500        |
4: 52, 1100, 220 ^   |           | |           | ^ 1:
11, 2000, 10
4: 62, 6000, 90     |           | |           | | 1:
22, 3000, 20
           | | 32,41,52,62 12,21,32 | 31,41,51 31,51 | | 1:
52, 5000, 20
*           <----- * ----->           <----- * ----->           <----- *
* 6 *-----* 4 *-----* 2 *-----* 1 *
*           70           40           | *           10           * | 1:
11, 3000, 10
           5000           |           3000           | |           1000           | | 1:
22, 4000, 20
           | |           v |           | v 1:
32, 5000, 20
4: 22, 3100, 240 | |           | 40           | 1:
43, 6000, 40
4: 32, 1100, 220 v |           ^ | 2000           | 1:
64, 11000, 110
4: 41, 100, 200     |           | |           |
4: 62, 5100, 270     |           | |           |
           |           200           |           10           |
           |           100           *           3000           |
           -----* 5 *-----
                   <----- * ----->
5: 12, 3100, 210     5: 22, 5000, 50
5: 22, 2100, 240     5: 42, 3100, 210
5: 51, 100, 200      5: 51, 3000, 10
                    5: 63, 8100, 280

```

- Each link has two numeric values:

Upper value represents the link delay.
Lower value represents the link bandwidth.

- Each NEP router advertises the topology information as follows:

a: rh, b, d

Where a represents the advertising router RID.
r represents the destination router RID.
h represents the number of hops.
b represents the total bandwidth.
d represents the total delay.

- Each router within an Autonomous System (AS) must be configured with a unique number called Router ID (RID).

* RID: 32-bit decimal number that uniquely identifies a router within an AS.

The RID has the following format: Y.Y.Y.Y

- Each router advertises its RID first to its neighboring routers using Hello messages.

- Each router advertises all the interconnected RIDs, total bandwidth, number of hops, and total delay to the neighboring router.

- Each router calculates the best path to each router using the following values:

- Total bandwidth.
- Number of hops.
- Total delay.

- The best NEP path from the local router to every other router from the collected advertised information has the following:

- Highest total bandwidth.
- Lowest number of hops that corresponds to the highest total bandwidth.
- Lowest total delay.

- The NEP metric is calculated using the following formula:

$$\text{Metric} = \left[\frac{(\text{No. of Hops} * \text{Total-Delay})}{\text{Total-BW}} \right] \times 10^7$$

- The best metric has the lowest value.

- Each NEP router sends an Echo message of each of its interface to the neighboring router, the time taken by the message to be sent and received over the link

divided by 2 determines the link delay.

- The Echo message is sent by every router every 10 seconds (by default).

- The link delay value is updated every 10 seconds on every advertised message that contains the 3 values that can be used to determine the best path from the NEP router to other routers.

3. NEP Loop Prevention:

- NEP uses a loop free mechanism by discarding the advertised topology information that has a higher metric than the existing stored entry for the same RID to prevent looping.

- When an NEP router receives an advertised topology information to a specific router, it checks its own topology table, if there is no entry listed for that RID contained in the advertised message, it adds it to its own topology table.

- If more than one message received to the same RID, the NEP router calculates the metric for each one of them and store the one with the lowest metric for that router.

For example:

a) Router 1 will have 3 messages to the destination router 4 as follows:

```
2: 42, 4000, 50 ==> Metric = 250,000    (discarded)
3: 42, 3000, 30 ==> Metric = 200,000    (added)
5: 42, 3100, 210 ==> Metric = 1,354,839 (discarded)
```

The message from router 3 has the lowest metric to the destination router 4 so this route through router 3 will be added to the routing table and other routes will be discarded.

b) Router 1 will have 3 messages to the destination router 6 as follows:

```
2: 63, 9000, 120 ==> Metric = 400,000    (discarded)
3: 63, 8000, 100 ==> Metric = 375,000    (added)
5: 63, 8100, 280 ==> Metric = 1,037,037 (discarded)
```

The message from router 2 has the lowest metric to the destination router 6 so this route through router 2 will be added to the routing table and other routes will be discarded.

Router 1 Routing Table:


```

*****
* Destination Router      *      Metric      *      Next-hop Router *
*****
*           2             *      100,000      *           2           *
*****
*           3             *      50,000       *           3           *
*****
*           4             *      200,000      *           3           *
*****
*           5             *      33,333.33    *           5           *
*****
*           6             *      375,000      *           3           *
*****

```

Note:- - In case of two or more equal metrics for the same destination, the routes are added to the routing table and traffic is balanced between these routes.

```

      |
      |
      |
      |
      V
      |
      |
      |
      |
      |
      |
      |
      |
      ^
11, 1000, 20
   3: 31, 3000, 10 | | 3: 31, 500, 50
32, 1500, 70       | | 1: 11, 500, 50 | | 1:
   3: 12, 3500, 60 | | 3: 22, 3500, 60       1: 22, 1500,70 | |
                  * ---->                      <----- *
                * 3 * -----* 1 *
1: 10.1.1.0/24^    *                               50          *
^ 3: 10.1.3.0/24  |                               500         |
|                 |                                     |
|                 | -----                             -----
|                 |                                     |
|                 |
---              --- 3: 10.1.3.0/24 ----->           <----- 1: 10.1.1.0/24
---
                        2: 10.1.2.0/24                    2: 10.1.2.0/24

```

- For router number 1, the following topology information are received:

```

2: 21, 1000, 20 ==> Metric = 200,000    (Added)
2: 32, 4000, 30 ==> Metric = 150,000    (Added)
3: 31, 500, 50  ==> Metric = 1,000,000  (Discarded)
3: 22, 3500, 60 ==> Metric = 342,857.1  (Discarded)

```

- Once every router learns the best route to every other router, each router learns the advertised subnets.

- The subnet information is advertised as follows:

```

a: subnet-number/mask  (for IPv4)
a: prefix/length       (for IPv6)

```

Where: a represents the advertised router RID that has the directly connected subnet or prefix.

- Then, each router builds its own IP routing table:

- For router number 1, the IP routing table will be as follows:

```

*****
*   Destination Router   *   Destination Subnet   *   Metric   *   Next-hop
Router  *
*****
*           2           *   10.1.2.0/24         * 200,000   *
2       *
*****
*           3           *   10.1.3.0/24         * 150,000   *
2       *
*****

```

- If more than one subnet is directly connected to a router, another entry will be added to the IP routing table for that subnet with the same destination router, metric and next-hop router.

- For loop prevention, each received subnet information through a specific interface is not advertised again through this interface, but out of other interfaces.

Security Considerations

Acknowledgments

Author Address

Khaled Omar Ibrahim Omar
The Road
6th of October City, Giza
Egypt

Phone: +2 01003620284
E-mail: eng.khaled.omar@hotmail.com
National ID No.: 28611262102992

References

Full Copyright Statement

Copyright (C) IETF (2017). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked.

This document and the information contained herein is provided on THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT

THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR
ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR
PURPOSE.