Membership test for Mapping Information optimization

draft-flinck-lisp-membertest-00

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The problem we are addressing

If an Ingress Tunnel Router acting as a gateway between two namespaces doesn't have a mapping for the destination EID, it needs to resolve the EID-to-RLOC mapping from a mapping system possibly using a map resolver.

EIDs are allocated in blocks; ALT assumes aggregatable EID-prefixes. EIDs are stated to be Provider Independent (= portable across provider boundaries)

However (as has happened with IPv4 allocations) prefix based allocations change over the time: new enterprises born, old ones merge and some disappear obsoleting the earlier allocations.

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The problem we are addressing (cont.)

More over:

1) Some sites maybe too small to be worth of a prefix allocation and related administration,

2) Some sites will be composition of devices (with PI EIDs) from earlier different EID-prefix allocations,

3) Server, terminal and network migration (and mobility) will break the EID-prefix based allocation

Individual EID-to-RLOC mappings needs to be supported.
Prefix based EID mappings do not cover all cases

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Map resolution is costly

- The first packet without a EID-to-RLOC mapping is:

  - Dropped

  - Buffered or

  - Relayed over the mapping system

- All of the above approaches contribute to delay and jitter. Therefore mappings are reused (= cached) when possible.

- To improve cache hit rate more information than the requested mapping should be returned.

- Possibly all entries that a queried ETR is servicing

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Membership test

The authoritative ETR provides to ITR a *membership test* that represents all or a subset of the EID it can route to.

Membership test is an efficient compressed data structure to represent the members that belong to the same set (= ETR).

An ETR can express with it:

- e.g. the most frequently requested mappings,
- any other subset or all of the mappings.

Membership test doesn't require that the EIDs aggregate into prefixes. *This makes it ideal for cases where an ETR is serving EIDs from different EID blocks.*

- *Small enterprises of size 100 and 1000 of hosts, larger ones are likely to have well managed EID-prefixes*

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Message handling with Membership test

Packet arrives from a host to an ITR

1. EID-to-RLOC mapping cache look up
2. If the look up doesn't result into a RLOC then a membership test cache is checked
3. If any of the membership tests results into a match then the corresponding RLOC is used
4. `Map-Request` message is "piggybacked" with the user packet to the RLOC
5. If no matching membership tests, use the map resolution
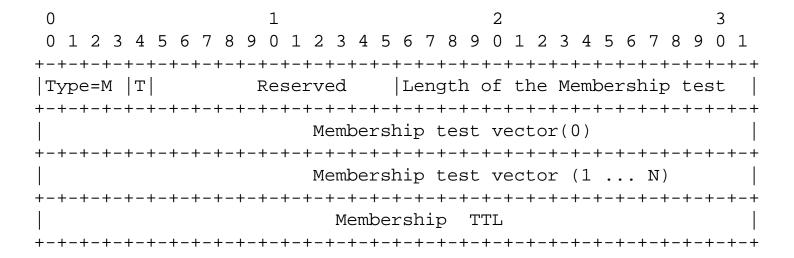
`Map-Request` Message arrives to the authoritative ETR

1. Generate a `Map-Reply` message with the mapping information complemented with *one or more optional membership test information elements*
2. If EID unknown send `Negative Map-Reply`

Note: The ETR SHOULD calculate the membership tests beforehand and just add the membership test option to the Map-Reply message.

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Message Format

- extends the LISP Map-Reply Message Format by defining a new Mapping Protocol Data option

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Type=M |T|          Reserved      |Length of the Membership test |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Membership test vector(0)                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Membership test vector (1 ... N)           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Membership  TTL                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

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Calculation of the membership test

- Standard Bloom filter are defined by the follow three parameters $<P_{err}, k, m>$:
  - P_{err} = error probability
  - k = number of hashes
  - m = test vector size

- We fix the membership test for **two** types of small sites/enterprises: a) those with 100 + hosts and those b) with 1000+ hosts
- The length of the vector tells the ITR which set of the parameters to use
  - P_{err}= 10exp-6
  - k= 20
  - m= 4096 or 32768 bits
- Hash functions are MD5 functions
- EID-prefixes should not be added to membership test as this adds to the processing complexity

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Error handling and security

- The false positive error case degenerates into stale mapping information case of baseline LISP

- ITR can trust an EID-to-RLOC mapping from an ETR, it can trust the Membership test as well, no new security issues

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Thank you

Future doesn't need to be a repetition of the past