Using PCP To Coordinate Between the CGN and Home Gateway Via Port Allocation

draft-tsou-pcp-natcoord-07
IETF 84-Vancouver, August 2012

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Motivation

• The requirement on CGN processing capability grows with increasing subscribers;

• Delegating NAT function to the Home Gateway will offload the burden on CGN.

• It is motivated for lightweight 4over6
  – Given, PCP is already used to instruct individual mappings and PCP provides a flexible means for port set management, we need to extend PCP with the ability to reserve port sets instead of individual mappings
Overview of Lightweight 4over6

- NAT44 within restricted port set
- Tunnel encapsulation/de-capsulation.

So, we need to extend PCP with the ability to reserve port set instead of individual mapping.
Why do we need PCP extension?

• Lightweight 4over6 has mandatory port-set allocation mechanism using DHCPv4-over-v6 port-set extension.
• However, PCP based extension is more suitable for the following situation:
  – Operators who do not have existing DHCPv4 server.
  – PPP extension can only be used when TC is deployed in BRAS, but not for higher layer.
  – Dynamic port-set allocation when one subscriber needs multiple port-sets when necessary.
  – Operators planning to migrate the DS-Lite AFTR to behave as a port range router
    • PCP is likely to be deployed to manage individual mapping
    • Extending PCP to delegate port range would help in that migration path
Changes since -05

- MAP_PORT_SET OpCode format is updated according to MAP format.
- Explain the corner cases for MAP_PORT_SET
  - How to determine error codes
  - How to deal with the case when one subscriber needs multiple port-sets
  - How to deal with the situation when there is an existing mapping, or there is no existing mapping
Our basic idea

• It is inherent from MAP OpCode, with limited functionalities.
• The reason that we define a new OpCode to request a range of ports: MAP_PORT_SET
  – avoid overloading MAP
  – ease separating the port-range function from the handling of individual mappings.

• Define two options to assign port sets:
  – Port-Set option: convey contiguous, non-contiguous port-set
  – Cryptographically Random Port Range Option: convey pseudo-random port sets.
MAP_PORT_SET OpCode

- MAP_PORT_SET OpCode format is quite similar to MAP.
- The only difference is that the PCP server needs to remember \(N\) Mapping Nonces in case one client can ask for \(N\) port-set.
  - Each port-set binding will keep ONE Mapping Nonce Value.

Port-Set Options
- In Port Range Value/Port Range Mask format
- In Cryptographically Random Port Range format: function/starting point/ number of delegated ports/k
Procedure Overview

• Two port-set PCP Options MUST be supported

• Several policies can be enforced in the PCP Server’s side
  – Size of the port-set to allocate
  – Maximum number of port-sets for a subscriber
  – Enable random port sets
  – Allow multiple port sets
  – Port Quota
  – Assign Well-Known Ports

• The PCP Server MUST maintain a binding for each port set allocation
  – {PCP Client IP Address, (External IP Address, Port Set)}
Procedure Overview

• Generating a MAP_PORT_SET Request
  – Contains at least one of the port-set Options
  – PREFERE_FAILURE can be used if required
  – Generate Mapping Nonce randomly, independent of different requests
  – In retransmission case, Mapping Nonce should be copied from the previous MAP_PORT_SET request

• Renewing a MAP_PORT_SET Mapping
  – Renew each port-set mapping independently, update Mapping Nonce

• Processing a MAP_PORT_SET Request
  – One port-set should be treated consistently
  – Deal with the cases when there is a mapping already exists, or no mapping exists yet.
Next Steps

• Comments?

• Adopt the document as WG item?