DHCPv4 Options for Port-Set Assignment

draft-bajko-pripaddrassign-04

draft-wu-dhc-port-set-option-00
Background

• The possible IPv4 address exhaustion in the near future

• IPv4 address sharing between end users
  – Manner 1: Carrier-grade NAT
    • NAT444, NAT64, DS-Lite
  – Manner 2: Divide full address into port sets and assign them to end users
    • “A+P” style
    • Lightweight 4over6, MAP, 4RD
DHCPv4 for port-set assignment

• Use case: lightweight 4over6
  – Per-user stateful IPv4-over-IPv6 mechanism
    • Lightweight 4over6 [draft-cui-softwire-b4-translated-ds-lite-07]
  – DHCPv4-over-IPv6 for IPv4 assignment in IPv6 net
    • draft-ietf-dhc-dhcpv4-over-ipv6-03
  – Port-set assignment
Defined options/sub-options

• For different styles of port set
• draft-wu
  – Contiguous Port Set Option
  – GMA Port Set Option
• draft-bajko
  – Port Mask Sub-Option
  – Random Port Delegation Sub-Option
Contiguous Port Set Option

- Assign a contiguous port range
- Bounded by Min & Max port number
- Format:
GMA Port Set Option

- Following the GMA Port mapping algorithm
  - Proposed in draft-ietf-softwire-map
- Port-set format:
  - Preserve well-known ports
    - A(j) cannot be 0 => preserve first $2^{(k+m)}$ ports
  - Port-set consists of scattered port ranges
    - $(2^a-1)$ port ranges of size $2^m$
    - Could be contiguous: $a=0$

```
+-----------------+-----------------+-----------------+-----------------+-----------------
| OPTION_NCON_PORT_SET | option-length   |
| PSID Offset        | PSID length     |
| PSID               |                 |
```
Port Mask Sub-Option

- Port set determined by 16-bit mask and value
- Port-set Format
  - Port-set Mask: position of the significant bits of mask (set to “1”)
  - Port-set Value: value of the significant bits (port-set ID)
  - Significant bits can be scattered in the total 16 bits
- Compose a port set with scattered port ranges
  - Could be more scattered than GMA
  - Could be contiguous: mask=11...100...0
- Preserving well-known ports: not defined
- IPv4 address assigned in the sub-option as well
Random Port Delegation Sub-Option

• Encryption function to achieve randomness
  – Input: key K, integer x as the plaintext \( \in [1024, 65535] \)
  – Output: integer y as the ciphertext \( \in [1024, 65535] \), to be the assigned port number
  – Encryption function determined in advance between C/S

• Compose a port set with randomized, scattered ports
  – \( E(K, a), E(K,a+1), \ldots, E(K, a+2047) \)

• Preserve well-known ports (0~1024)

• IPv4 address assigned in the sub-option as well

• The sub-option is encryption-algorithm-specific
More about port randomization

• Prevent Blind attacks against TCP/UDP
• First step: making the port-set non-contiguous
• More sophisticated solutions
  – 1. User randomly selects source port from the port-set
    • RFC6056
    • Algorithms need to evolve for non-contiguous port-set
  – 2. Server pre-allocates random-style port-set
    • Random Port Delegation sub-option
    • the client is forced to use random ports
    • Decryption is needed for encapsulation destination lookup logic on tunnel concentrator
Discussion on DHCP-centric issues

- **Multiple options for multiple port-set type vs. One option with multiple sub-options**
  - With multiple options, client can indicate the expected port-set type and avoid mismatch, at the cost of more option code numbers

- **IPv4 address assigned in original DHCP message vs. in port-set option**
  - Both could work
  - Use options like IP address lease time option by default vs. clarify the usage of them in this context

- **WG guidance?**
Next steps

• Merged as one document, or separated document for different options?
• WG adoption?