Stateless automatic IPv4 over IPv6 Tunneling (SA46T)

draft-matsuhira-sa46t-spec-01.txt

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Network Configuration

Backbone Network (IPv6 only)

Stub Network (IPv4 only)

Stub Network (Dual Stack)

Stub Network (IPv6 only)

SA46T: Stateless Automatic IPv4 over IPv6 Tunneling
Function of SA46T

1. Encapsulation / Decapsulation of IPv4 packet
   - IPv4
   - IPv4
   - IPv6
   - IPv4
   - IPv6

1-1. Return ICMP Packet too big message (if exceed MTU)

(2) Route Advertisement of Stub Network

Stub Network (IPv4 only)  SA46T  Backbone Network (IPv6 only)
# SA46T address architecture and routing

- IP address of inner IPv4 header

- IP address of outer IPv6 header (SA46T address)

<table>
<thead>
<tr>
<th>SA46T address prefix</th>
<th>IPv4 network plane ID</th>
<th>IPv4 address</th>
</tr>
</thead>
</table>

- Locator (IPv6)
- Locator (IPv4)
- Identifier

<table>
<thead>
<tr>
<th>Locator (IPv6)</th>
<th>Locator (IPv4)</th>
<th>Identifier</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>IPv4 address</th>
<th>/24</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>IPv4 address</th>
<th>/120</th>
</tr>
</thead>
</table>
Example of SA46T address format

IPv6 Global Unicast Address Format (RFC3587)

3  45bits  16bits  64bits

<table>
<thead>
<tr>
<th>001</th>
<th>global routing prefix</th>
<th>subnet ID</th>
<th>Interface ID</th>
</tr>
</thead>
</table>

allocated from ISP  Select by organization  EUI-64 address (64bit MAC)

SA46T address  Use part of global address space (e.g. one subnet)

<table>
<thead>
<tr>
<th>001</th>
<th>global routing prefix</th>
<th>subnet ID</th>
<th>IPv4 network plane ID</th>
<th>IPv4 address</th>
</tr>
</thead>
</table>

SA46T address prefix

$2^{32} = \text{about 4.3 billions IPv4 networks space}$
Route Advertisement

IPv4

Src: 10.1.1.1
Dst: 10.1.2.1

IPv6

Src: <prefix>:10.1.1.1
Dst: <prefix>:10.1.2.1

IPv4

Src: 10.1.1.1
Dst: 10.1.2.1

IPv4

Src: <prefix>:10.1.1.0/120

<prefix>: 001+global routing prefix + subnet ID + IPv4 network plane ID
Stacking Multiple IPv4 Networks
(Using same IPv4 Address, i.e. private address)

IPv4
Src: 10.1.1.1
Dst: 10.1.2.1
Stub Network (IPv4 only) 10.1.1.0/24
10.1.2.0/24

IPv6
<prefix#1>:10.1.1.0/120

IPv4
Src: 10.1.1.1
Dst: 10.1.2.1
Stub Network (IPv4 only) 10.1.1.0/24
10.1.2.0/24

IPv6
<prefix#2>:10.1.1.0/120

IPv4
Src: 10.1.1.1
Dst: 10.1.2.1
Stub Network (IPv4 only) 10.1.2.0/24
10.1.1.0/24

IPv6
<prefix#2>:10.1.2.0/120

IPv4
Src: 10.1.1.1
Dst: 10.1.2.1
Stub Network (IPv4 only) 10.1.2.0/24
10.1.1.0/24

IPv6
<prefix#1>:10.1.2.0/120

IPv4
Src: 10.1.1.1
Dst: 10.1.2.1
Stub Network (IPv4 only) 10.1.2.0/24
10.1.1.0/24

IPv6
<prefix#1>:10.1.1.0/120

IPv4
Src: 10.1.1.1
Dst: 10.1.2.1
Stub Network (IPv4 only) 10.1.2.0/24
10.1.1.0/24

IPv6
<prefix#2>:10.1.2.0/120
Configuration of SA46T

• Only one line per SA46T
  – Three information needed, can represent in one line
    • SA46T address prefix + IPv4 network plane ID /Prefix Length

• N numbers of SA46Ts in a Network
  – One line per SA46T x N = N lines in the network
    • static tunneling require N(N-1)

• Adding new SA46T
  – Configure one line to new SA46T
  – No change needed to existing SA46Ts
Host Configuration in Stub Network

SA46T Configuration Server

SA46T with DHCP Server

Response

Request (MAC Address)

SA46Tplefix+v4planeID/prefix Allocatable IPv4 address block

Protocol (TBD)

~

DHCP Request

DHCP Response

DHCP Protocol

Host in Stub Network
Applicability of SA46T
(draft-matsuhira-sa46t-applicability-00.txt)

- IPv6 only Campus / Enterprise / ISP Backbone Network
  - Possible transition scenario, edge based solution

- IPv4 VPNs over IPv6 backbone
  - Pure L3 solution, can mix different L2 (wire and wireless)
  - Over 4096 possible, 4.3 billion with 32bits plane ID
  - Inter AS VPN with SA46T Global address

- IPv4 address reuse (IPv4 address sharing)
  - Possible solution for IPv4 Global address running out
  - Can reuse Net10 in each IPv4 plane
  - 4.3 billion IPv4 plane with 32bits plane ID

- Possible Option of Tunneling technology for DS-Lite?
Access Network with IPv4 address reuse

The Internet

v4NAT + IPv6

SA46T

plane #1

v4NAT + IPv6

SA46T

plane #2

Access Network (IPv6 only)

v4NAT + IPv6

SA46T

plane #3

v4NAT + IPv6

SA46T

plane #n

SA46T as DS-Lite Tunneling Technologies

Home

Dual Stack (NAT less)

Dual Stack IPv6 Global IPv4 Private

The Internet

v4NAT + IPv6

SA46T

plane #1

v4NAT + IPv6

SA46T

plane #2

Access Network (IPv6 only)

v4NAT + IPv6

SA46T

plane #3

v4NAT + IPv6

SA46T

plane #n

SA46T as DS-Lite Tunneling Technologies

Home

Dual Stack (NAT less)

Dual Stack IPv6 Global IPv4 Private
Current Status and Next Step

• Current Status
  – Initial I-Ds (spec & gaddr) submitted in Feb 2010
  – Presentation at v6ops WG, 77th Anaheim meeting
    • Suggested continuing in softwire wg
  – update spec and gaddr I-Ds and applicability I-D submitted in July 2010

• Next Step
  – Implementation
  – Experiment in testbed network
  – Planning to report both implementation and experiment at next IETF meeting

• Interests ?
  – WG documents ?
Summary

(1) Reduce operation cost by IPv6 only

(2) Reallocate IPv4 addr from B.B. to Stub

(3) Less configuration

(4) No special protocol

(5) No dependence with L2

(6) Stacking IPv4 Private networks

(7) Easy stop IPv4 operation (just remove SA46T)

(8) Provide Redundancy

plane#1

Stub Network (IPv4 only)

Stub Network (IPv4 only)

Stub Network (IPv4 only)

Stub Network (IPv4 only)

SA46T

SA46T

SA46T

SA46T

plane#2

Stub Network (IPv4 only)

Stub Network (IPv4 only)

Stub Network (Dual Stack)

Stub Network (Dual Stack)

SA46T

SA46T

SA46T

SA46T

plane#n

Stub Network (Dual Stack)

Stub Network (Dual Stack)

Stub Network (Dual Stack)

Stub Network (Dual Stack)

SA46T

SA46T

SA46T

SA46T

Backbone Network (IPv6 only)
IPv4 Networks
as
IPv6 application
provided by SA46T
Prepare for questions
SA46T Route

• # of SA46T route is same as # of IPv4 route
  – Total # of route (both IPv6 and IPv4) is remain the same with Dual Stack operation

• Route aggregation may possible
  – same manner with IPv4 route aggregation

• Default route may used
  – SA46T prefix / 96 is example of default route
  – Can reduce # of SA46T route
Enterprise / Campus Network

Section Network (Dual Stack)
SA46T

Section Network (IPv4 only)
SA46T

Corporate IT Backbone Network (IPv6 only)
SA46T

Section Network (IPv4 only)
SA46T

Section Network (Dual Stack)
SA46T

Section Network (IPv4 only)
SA46T

Section Network (IPv6 only)
SA46T

78th IETF
ISP Backbone Network

- Customer Network (Dual Stack)
- Customer Network (IPv4 only)
- Customer Network (IPv6 only)
- Customer Network (IPv4 only)
- Customer Network (IPv6 only)
- Customer Network (IPv4 only)
- Customer Network (IPv4 only)
- Customer Network (IPv6 only)

SA46T

SA46T

SA46T

SA46T

SA46T

SA46T
VPN service by ISP

ISP Backbone Network (IPv6 only)

plane #A

A.com (IPv4 only)
SA46T
A.com (IPv4 only)
SA46T
A.com (Dual Stack)
SA46T

plane #B

B.com (IPv4 only)
SA46T
B.com (Dual Stack)
SA46T
B.com (IPv4 only)
SA46T

plane #C

C.com (IPv4 only)
SA46T
C.com (Dual Stack)
SA46T
Network Configuration without Global SA46T address

- Backbone Network (IPv6 only)
- Stub Network (IPv4 only)
- Stub Network (Dual Stack)
Network Configuration with SA46T
Global address

Backbone Network (IPv6 only)

SA46T

Stub Network (IPv4 only)

SA46T

Stub Network (Dual Stack)

Backbone Network (IPv6 only)

SA46T

Stub Network (IPv4 only)

SA46T

Stub Network (Dual Stack)