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Stateless Automatic IPv4 over IPv6 Encapsulation / Decapsulation Technology: Global SA46T Address Format
draft-matsuhira-sa46t-gaddr-11

Abstract

This document proposes Stateless Automatic IPv4 over IPv6 Encapsulation / Decapsulation Technology (SA46T) Global Address Format.

SA46T can apply to organization's network individually, but if coordination between the organizations made, the total number of times of encapsulations and decapusulations can be reduced. That coordination is achieved by using same SA46T address format, that is Global address. This document proposes SA46T Global address format.

SA46T is a gateway technology, not protocol. But SA46T Global Address needs IANA assignment, so this document should be categorized standard track or experimental.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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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 January 24, 2016.

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1. Introduction

This document proposes Stateless Automatic IPv4 over IPv6 Encapsulation / Decapsulation Technology (SA46T) Global Address Format.

SA46T [I-D.draft-matsuhira-sa46t-spec]can apply to organization's network individually. Figure 1 shows such example. Organization A applies SA46T and makes backbone network to IPv6 only, and this operation has no effect to Organization B and others.

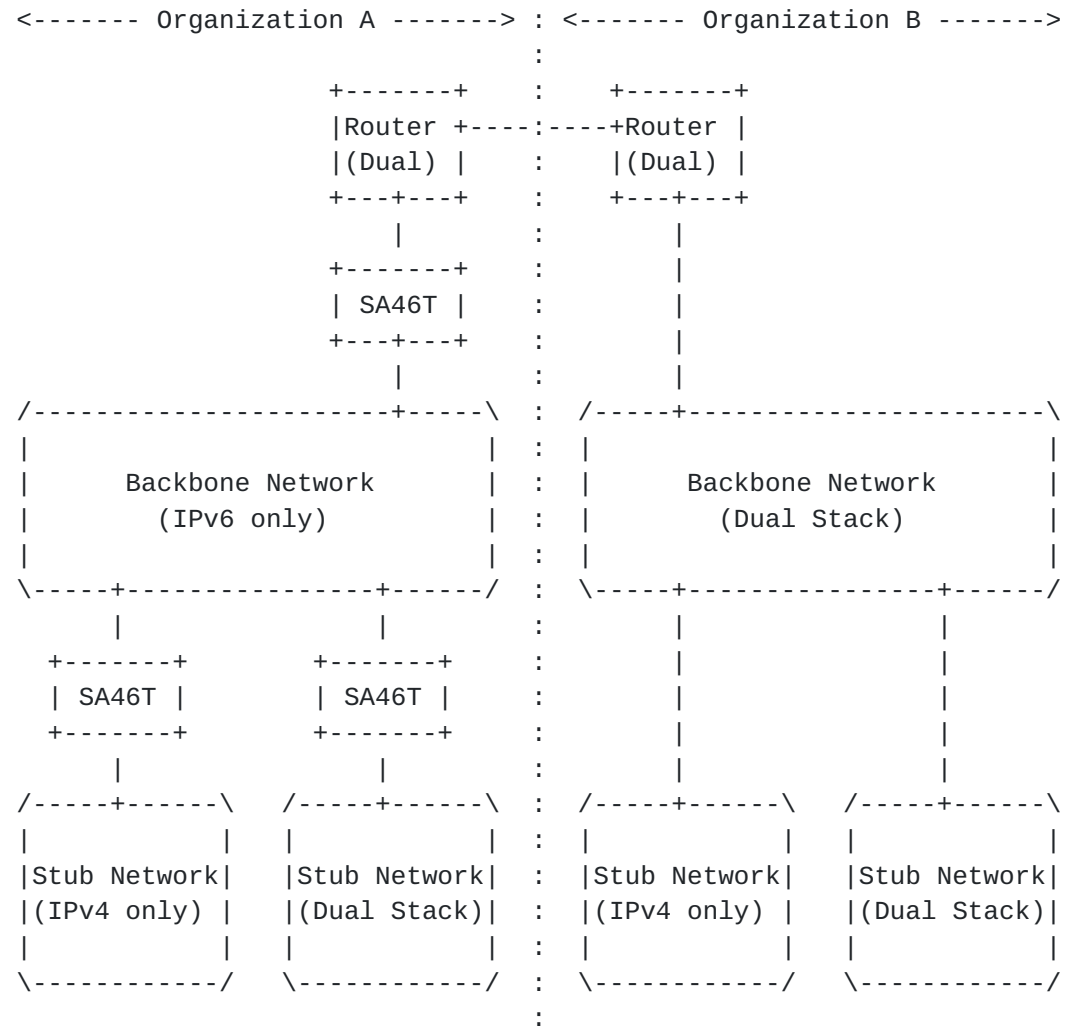

Figure 1

If organization B applies SA46T, network is just like Figure 2. In this network configuration, communication between IPv4 host in organization A and IPv4 host in organization B, IPv4 packet is encapsulated to IPv6 Packet, and decapsulated to IPv4, and

encapsulated to IPv6, and decapsulated to IPv4. There are two times encapsulations, and two times decapusulations. If number of organization which applies SA46T increase, number of encapsulations and decapusulation will increase.

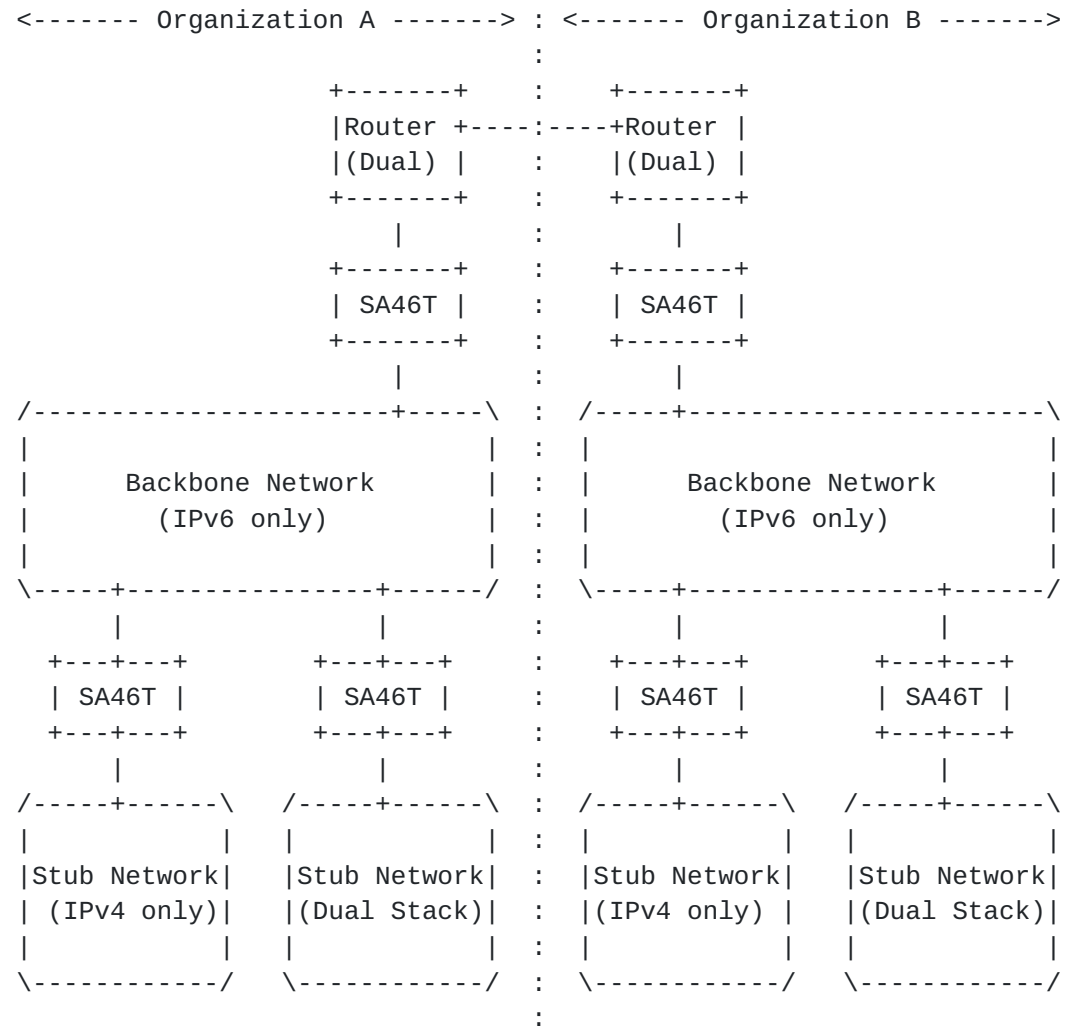

Figure 2

But if coordination between the organizations are made, the total number of times of encapsulations and decapusulations can be reduced. Figure 3 shows such example. That coordination is achieved by using same SA46T address format. This is the reason for the proposal of SA46T Global address. When most of IPv4 node moves to IPv6 and few IPv6 node exists, such coodination in the Internet scale is useful and efficient to co-existing IPv6 and IPv4.

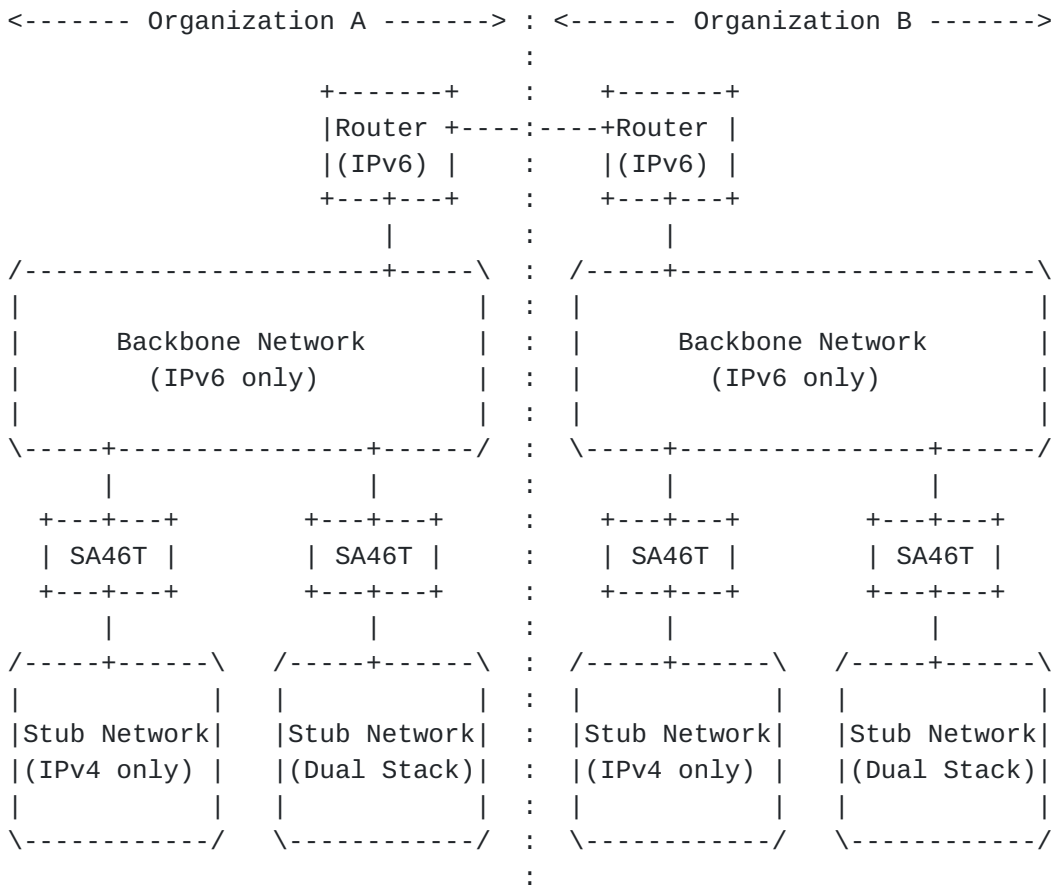

Figure 3

2. SA46T Global Address

Figure 4 shows SA46T address architecture[I-D.draft-matsuhira-sa46t-spec].

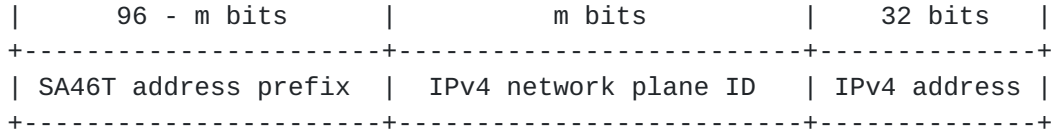

Figure 4

2.1. Option 1: Allocate new SA46T address prefix

This option requests special IPv6 address prefix for SA46T. Figure 5 shows SA46T Global Address Format.

Figure 5

Table 1 shows SA46T IPv4 network plane ID length (m) and SA46T prefix length and number of plane.

m	prefix length	number of plane
16	80	65536
32	64	4294967296

Table 1

Table 2 is an example of SA46T IPv4 network plane ID management table. Value 0 should be assigned to IPv4 Global Internet, and the other are reserved for IPv4 private networks.

plane ID value	assign to
0	Global IPv4 Internet (IPv4 Global address)
1	Reserved
2	Reserved
....	....

Table 2

These value except zero are reserved for stacking IPv4 private network over IPv6 Internet with SA46T. In future, if there are much demand for stacking IPv4 private network, These usage of reserved ID value may be defined. At that time, central coordination or assignment should be discussed too.

2.2. Option 2: Adjustment with IPv6 address with Embedded IPv4 addresses

RFC4291 [RFC4291] define IPv6 addresses with Embedded IPv4 addresses. SA46T address is such addresses. Therefore merging SA46T global address into IPv6 addresses with Embedded IPv4 addresses may be possible.

Figure 6 shows IPv4 Compatible IPv6 address, and Figure 7 shows IPv4-Mapped IPv6 address.

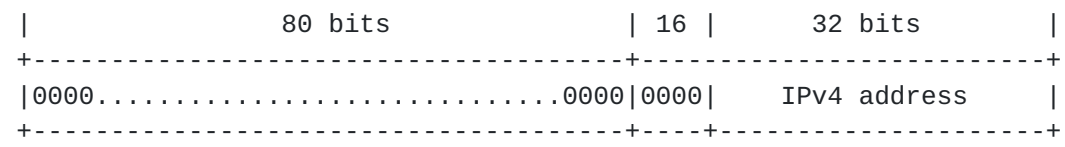

Figure 6

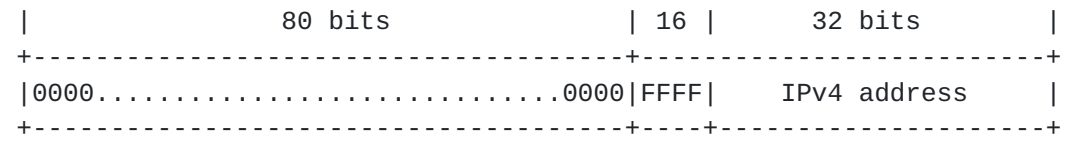

Figure 7

It seem that 80bits prefix (all zero) shows IPv6 addresses with Embedded IPv6 addresses, and continued 16bits shows more detail, 0x0000 means IPv4-Compatible addresses and 0xFFFF means IPv4-Mapped addresses.

Adjustment with such format, IPv6 addresses with Embedded IPv4 addresses may redefine such format. Figure 8 shows such format.

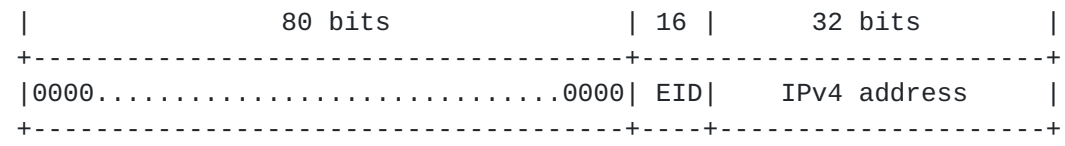

Figure 8

Where

IPv4 Embedded address prefix

IPv4 Embedded prefix. 80 bits long, value is zero.

EID

Embedded ID. Indicates Type of IPv6 addresses with Embedded IPv4 address. This value MUST be globally unique. See below for more detail.

IPv4 address

IPv4 address

Table 3 shows EID value of proposed IPv6 addresses with Embedded IPv4 addresses and the detail usage. EID = 0x0000 shows this IPv6 addresses with Embedded IPv4 address is the IPv4-Compatible IPv6 address, and EID=0xFFFF shows this IPv6 addresses with Embedded IPv4 address is the IPv4-Mapped address.

In this proposal, EID value except 0x0000 and 0xFFFF is for SA46T usage, and EID=0x0001 shows this IPv6 addresses is used for SA46T for IPv4 Internet, that mean, IPv4 address is limited for global and inhibit for private address.

In this proposal, EID value except 0x0000, 0x0001 and 0xFFFF are reserved for SA46T. These value are reserved for stacking IPv4 private network over IPv6 Internet with SA46T. In future, if there is much demand for stacking IPv4 private network, these usage of reserved EID value may be defined. At that time, central coordination or assignment should be discussed too.

EID	detail
0x0000	IPv4 Compatible IPv6 address
0x0001	SA46T address for IPv4 Internet (IPv4 Global Addresses)
0x0002	Reserved for SA46T
....	....
0xFFFE	Reserved for SA46T
0xFFFF	IPv4-Mapped IPv6 address

Table 3

3. IANA Considerations

This document may requests IANA to assign IPv6 prefix for SA46T Global address.

This document proposes two option. One is New IPv6 address prefix for SA46T. Another is adjustment with IPv6 address with Embedded IPv4 addresses.

The Well-known preifx 0000::/8 is reserved by IETF [RFC4291]. If new IPv6 address prefix for SA46T is allocated from 0000::/8 space by IETF, this document request no actions for IANA. And also, if

adjustment with IPv6 adddress with Embedded IPv4 addresses is approved by IETF, this document request no actions for IANA.

Note to RFC Editor: this section may be removed on publication as an RFC.

4. Security Considerations

SA46T uses automatic Encapsulation / Decapsulation technologies. Security consideration related tunneling technologies are discussed in RFC2893 [RFC2893], RFC2267 [RFC2267], etc.

5. Acknowledgements

This document is based on Naoki Matsuhira's original ideas and an individual effort of the author.

Review and encouragement have been provided by many others. Particulary Akira Kato at WIDE Project / Keio University and Masanobu Katoh at Fujitsu.

Originally, SA46T is an abbreviation for "Stateless Automatic IPv4 over IPv6 Tunneling". Now, SA46T is an abbreviation for "Stateless Automatic IPv4 over IPv6 Encapsulation / Decapsulation Technology". This change was made in response to the indication from the softwire WG chair at 4th softwire interim meeting in September 2011.

6. References

6.1. Normative References

[I-D.draft-matsuhira-sa46t-spec]
Matsuhira, N., "Stateless Automatic IPv4 over IPv6 Encapsulation / Decapsulation Technology: Specification", January 2014.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", RFC 4291, February 2006.

6.2. Informative References

[RFC2267] Ferguson, P. and D. Senie, "Network Ingress Filtering: Defeating Denial of Service Attacks which employ IP Source Address Spoofing", RFC 2267, January 1998.

[RFC2893] Gilligan, R. and E. Nordmark, "Transition Mechanisms for IPv6 Hosts and Routers", RFC 2893, August 2000.

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