This document defines YANG data models for the DS-Lite Address Family Transition Router (AFTR) and Basic Bridging BroadBand (B4) elements.

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1. Introduction

This document defines data models for DS-Lite [RFC6333], using the YANG data modeling language [RFC6020]. Both the Address Family Transition Router (AFTR) and Basic Bridging BroadBand (B4) elements are covered by this specification. As a reminder, Figure 1 illustrates an overview of the DS-Lite architecture that involves AFTR and B4 elements.
Figure 1: DS-Lite Base Architecture
DS-Lite deployment considerations are discussed in [RFC6908].

This document follows the guidelines of [RFC6087], uses the common YANG types defined in [RFC6991], and adopts Network Management Datastore Architecture (NMDA).

1.1. Terminology

This document makes use of the terms defined in [RFC6333].

The terminology for describing YANG data models is defined in [RFC6020].

1.2. Tree Diagrams

The meaning of the symbols in these diagrams is as follows:

- Brackets "[" and "]" enclose list keys.
- Curly braces "{" and "}" contain names of optional features that make the corresponding node conditional.
- Abbreviations before data node names: "rw" means configuration (read-write), "ro" state data (read-only).
- Symbols after data node names: "?" means an optional node, "!" a container with presence, and "*" denotes a "list" or "leaf-list".
- Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- Ellipsis ("...") stands for contents of subtrees that are not shown.

2. DS-Lite YANG Data Models

Figure 2 depicts the YANG data model for the AFTR element, while Figure 3 shows the YANG data model for the B4 element.

As shown in Figure 1:

- The AFTR element is a combination of an IPv4-in-IPv6 encapsulation/decapsulation function and a NAT function.
- The B4 element is an IPv4-in-IPv6 encapsulation function.

Therefore, the AFTR YANG module is designed to augment both the Interfaces YANG module [RFC7223] and the NAT YANG module.
This document assumes [RFC4787][RFC5382][RFC5508] are enabled by default. Also, the data model adheres to the recommendations in [RFC6888] and [RFC7857]. Furthermore, the data model supports state migration as per [RFC7785].

PCP-related considerations are out of scope of the document. A YANG data model for PCP is documented in [I-D.boucadair-pcp-yang].

module: ietf-dslite-afr
augment /if:interfaces/if:interface:
  +++-rw aftr-ipv6-address? inet:ipv6-address
  +++-rw aftr-ipv4-address? inet:ipv4-address
  +++-rw tunnel-mtu? uint16
  +++-rw max-softwire-per-subscriber? uint8
  +++-rw v6-v4-dscp-preservation? boolean
augment /nat:nat-module/nat:nat-instances/nat:nat-instance:
  +++-rw state-migrate? boolean
  +++-rw mss-clamping
    ----+---rw mss-clamping-enable? boolean
    ----+---rw mss-value? uint16
  +++-rw b4-ipv6-address? inet:ipv6-address
  +++-rw v6-dscp? uint8
  +++-rw internal-v4-dscp? uint8
  +++-rw external-v4-dscp? uint8

Figure 2: YANG Data Model for DS-Lite AFTR

A B4 instance is provided with the IPv6 address of the AFTR to use, an (optional) instruction whether DSCP marking is to preserved when encapsulating an IPv4 packet in an IPv6 packet, and other optional parameters shown in Figure 3.

module: ietf-dslite-b4
augment /if:interfaces/if:interface:
  +++-rw b4-ipv6-address? inet:ipv6-address
  +++-rw aftr-ipv6-address? inet:ipv6-address
  +++-rw b4-ipv4-address? inet:ipv4-address
  +++-rw tunnel-mtu? uint16
  +++-rw v6-v4-dscp-preservation? boolean

Figure 3: YANG Data Model for DS-Lite B4
3. DS-Lite AFTR YANG Module

<CODE BEGINS> file "ietf-dslite-aftr@2017-08-10.yang"

module ietf-dslite-aftr {
    prefix dslite-aftr;

    import ietf-inet-types { prefix inet; }
    import ietf-interfaces { prefix if; }
    import iana-if-type { prefix ianaift; }
    import ietf-nat {prefix nat;}

    organization "Softwire Working Group";
    contact
    "Mohamed Boucadair <mohamed.boucadair@orange.com>
    Christian Jacquenet <christian.jacquenet@orange.com>
    Senthil Sivakumar <ssenthil@cisco.com>";

    description
    "This module is a YANG module for DS-Lite AFTR
    implementations.

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    (http://trustee.ietf.org/license-info).

    This version of this YANG module is part of RFC XXXX; see
    the RFC itself for full legal notices.";

    revision 2017-08-10 {
        description "The module augments also the Interface module.";
        reference "-ietf-04";
    }

    revision 2017-07-27 {
        description "Redesign the module as an augment of the NAT YANG module.";
        reference "-ietf-04";
    }

    revision 2017-07-03 {
        description "Fix some minor points.";
    }

// Augment Interface module with DS-Lite Softwire
augment "/if:interfaces/if:interface" {
  when "if:type = 'ianaift:tunnel'";

description
  "Augments Interface module with AFTR parameters.  
  IANA interface types are maintained at this registry:  

tunnel (131),         -- Encapsulation interface";

leaf aftr-ipv6-address {
  type inet:ipv6-address;
  description
    "IPv6 address of the DS-Lite AFTR.";

    reference
      "RFC 6333.";

}

leaf aftr-ipv4-address {
  type inet:ipv4-address;
  default "192.0.0.1";

  description
    "IPv4 address of the DS-Lite AFTR.  
    192.0.0.1 is reserved for the AFTR element.  
    This address can be used to report ICMP  
    problems and will appear in traceroute  
    outputs.";

  reference
    "RFC 6333.";

}

leaf tunnel-mtu {
  type uint16;

  description
    "Configures a tunnel MTU.  
    [RFC6908] specifies that since  
    fragmentation and reassembly is not  
    optimal, the operator should do  
    everything possible to eliminate  
    the need for it.  If the operator uses  
    simple IPv4-in-IPv6 softwire, it is  
    recommended that the MTU size of the IPv6  
    network between the B4 and the AFTR  
    accounts for the additional overhead";
leaf max-softwire-per-subscriber {
  type uint8;
  default 1;

  description "Configures the maximum softwire per subscriber feature. A subscriber is uniquely identified by means of subscriber-mask.

  This policy aims to prevent a misbehaving subscriber from mounting several DS-Lite softwires that would consume additional AFTR resources (e.g., get more external ports if the quota were enforced on a per-softwire basis, consume extra processing due to a large number of active softwires).";

  reference "Section 4 of RFC 7785.";
}

leaf v6-v4-dscp-preservation {
  type boolean;

  description "Copies the DSCP value from the IPv6 header and vice versa.

  According to Section 2.10 of [RFC6908], operators should use this model by provisioning the network such that the AFTR copies the DSCP value in the IPv4 header to the Traffic Class field in the IPv6 header, after the encapsulation for the downstream traffic.";

  reference "Section 2.10 of RFC 6908.";
}
// Augment NAT module with AFTR parameters

    description "Augments NAT module with AFTR parameters."

    leaf state-migrate {
        type boolean;
        default true;

        description "State migration is enabled by default."

        In the event a new IPv6 address is assigned to the B4 element, the AFTR should migrate existing state to be bound to the new IPv6 address. This operation ensures that traffic destined to the previous B4’s IPv6 address will be redirected to the newer B4’s IPv6 address. The destination IPv6 address for tunneling return traffic from the AFTR should be the last seen as the B4’s IPv6 source address from the CPE.

        The AFTR uses the subscriber-mask to determine whether two IPv6 addresses belong to the same CPE (e.g., if the subscriber-mask is set to 56, the AFTR concludes that 2001:db8:100:100::1 and 2001:db8:100:100::2 belong to the same CPE assigned with 2001:db8:100::/56)."

        reference "RFC 7785.";
    }

    container mss-clamping {
        description "MSS rewriting configuration to avoid IPv6 fragmentation."

        leaf mss-clamping-enable {
            type boolean;

            description "Enable/disable MSS rewriting feature."
        }

        leaf mss-value {
            type uint16;

            units "octets";
        }
    }
}
Sets the MSS value to be used for MSS rewriting.

Augments the NAT mapping tables with DS-Lite specifics.

Corresponds to the IPv6 address used by the B4 element.

References

RFC 6333.
<CODE ENDS>

4. DS-Lite B4 YANG Module

<CODE BEGINS> file "ietf-dslite-b4@2017-08-10.yang"

module ietf-dslite-b4 {
    prefix dslite-b4;

    import ietf-inet-types { prefix inet; }
    import ietf-interfaces { prefix if; }
    import iana-if-type { prefix ianaift; }

    organization "Softwire Working Group";
    contact
        "Mohamed Boucadair <mohamed.boucadair@orange.com>
         Christian Jacquenet <christian.jacquenet@orange.com>
         Senthil Sivakumar <ssenthil@cisco.com>";

description
    "This module is a YANG module for DS-Lite B4 implementations.

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(http://trustee.ietf.org/license-info).

This version of this YANG module is part of RFC XXXX; see
the RFC itself for full legal notices.";

revision 2017-08-10 {
    description "Augment the interfaces YANG module.";
    reference "-ietf-05";
}

revision 2017-07-27 {
    description "Separate B4 from AFTR.";
    reference "-ietf-04";
}

// Augment Interface module with DS-Lite Softwire
augment "/if:interfaces/if:interface" {
  when "if:type = 'ianaift:tunnel'";

description
  "Augments Interface module with B4 parameters.
  IANA interface types are maintained at this registry:
  tunnel (131), -- Encapsulation interface"

leaf b4-ipv6-address {
  type inet:ipv6-address;

description
  "The IPv6 address used by the B4 element.";

reference
  "RFC 6333.";
}

leaf aftr-ipv6-addr {
  type inet:ipv6-address;

description
  "The AFTR's IPv6 address.";

reference
  "RFC 6333.";
}

leaf b4-ipv4-address {
  type inet:ipv4-address;
  default "192.0.0.2";

description
  "IPv4 address of the DS-Lite B4.
  192.0.0.0/29 is reserved for the B4 element
  [RFC6333].
  This address can be used to report ICMP problems and will appear in traceroute
  outputs.";

reference
  "RFC 6333.";
}

leaf tunnel-mtu {
  type uint16;
}
description
"Configures a tunnel MTU. [RFC6908] specifies that since fragmentation and reassembly is not optimal, the operator should do everything possible to eliminate the need for it. If the operator uses simple IPv4-in-IPv6 softwire, it is recommended that the MTU size of the IPv6 network between the B4 and the AFTR accounts for the additional overhead (40 bytes)."

reference
"RFC 6908."

leaf v6-v4-dscp-preservation {
  type boolean;

description
"Copies the DSCP value from the IPv6 header and vice versa. According to Section 2.10 of [RFC6908], operators should use this model by provisioning the network such that the AFTR copies the DSCP value in the IPv4 header to the Traffic Class field in the IPv6 header, after the encapsulation for the downstream traffic."

5. Security Considerations

The YANG module defined in this memo is designed to be accessed via the NETCONF protocol [RFC6241]. The lowest NETCONF layer is the secure transport layer and the support of SSH is mandatory to implement secure transport [RFC6242]. The NETCONF access control model [RFC6536] provides means to restrict access for particular NETCONF users to a pre-configured subset of all available NETCONF protocol operations and contents.
All data nodes defined in the YANG module which can be created, modified and deleted (i.e., config true, which is the default). These data nodes are considered sensitive. Write operations (e.g., edit-config) applied to these data nodes without proper protection can negatively affect network operations.

6. IANA Considerations

This document requests IANA to register the following URIs in the "IETF XML Registry" [RFC3688]:

  Registrant Contact: The IESG.
  XML: N/A; the requested URI is an XML namespace.

  Registrant Contact: The IESG.
  XML: N/A; the requested URI is an XML namespace.

This document requests IANA to register the following YANG modules in the "YANG Module Names" registry [RFC6020].

- name: ietf-dslite-aftr
  prefix: dslite-aftr
  reference: RFC XXXX

- name: ietf-dslite-b4
  prefix: dslite-b4
  reference: RFC XXXX

7. Acknowledgements

Thanks to Q. Wu for identifying a compiling error.

Many thanks to Ian Farrer for the review and comments.

8. References

8.1. Normative references

[I-D.sivakumar-yang-nat]
8.2. Informative references

[I-D.boucadair-pcp-yang]


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Authors’ Addresses

Mohamed Boucadair
Orange
Rennes 35000
France

EMail: mohamed.boucadair@orange.com