

Workgroup: BIER WG

Internet-Draft: draft-ietf-bier-te-yang-04

Published: 7 November 2021

Intended Status: Standards Track

Expires: 11 May 2022

Authors: Z. Zhang	C. Wang	R. Chen
ZTE Corporation	Individual	ZTE Corporation
F. Hu	M. Sivakumar	H. Chen
Individual	Juniper networks	Individual

A YANG data model for Tree Engineering for Bit Index Explicit Replication (BIER-TE)

Abstract

This document defines a YANG data model for Tree Engineering for Bit Index Explicit Replication (BIER-TE) configuration and operation.

Status of This Memo

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

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

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 11 May 2022.

Copyright Notice

Copyright (c) 2021 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

- [1. Introduction](#)
- [2. Conventions Used in This Document](#)
- [3. Design of the Data Model](#)
- [4. BIER-TE configuration](#)
- [5. Notifications](#)
- [6. RPCs](#)
- [7. BIER TE YANG model](#)
- [8. IANA Considerations](#)
- [9. Acknowledgement](#)
- [10. References](#)
 - [10.1. Normative References](#)
 - [10.2. Informative References](#)
- [Authors' Addresses](#)

1. Introduction

[[I-D.ietf-bier-te-arch](#)] introduces an architecture for BIER-TE: Tree Engineering for Bit Index Explicit Replication (BIER). This document defines a YANG data model for BIER TE. The content is in keeping with the TE architecture draft. In addition, this YANG data model contains BIER TE frr items of [[I-D.eckert-bier-te-frr](#)].

2. Conventions Used in This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

3. Design of the Data Model

The BIER TE YANG model includes BIER TE adjacency configuration and forwarding items configuration. Some features can also be used to enhance BIER TE function, like ECMP and FRR.

```

module: ietf-bier-te
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol:
    +--rw bier-te
    +--rw te-adj
    |   +--rw adj-if* [name]
    |   |   +--rw name          if:interface-ref
    |   |   +--rw subdomain* [subdomain-id]
    |   |   |   +--rw subdomain-id    uint16
    |   |   |   +--rw si* [si]
    |   |   |   |   +--rw si          uint16
    |   |   |   |   +--rw adj-id*    uint16
    |   |   +--rw adj-type?    enumeration
    +--rw te-fwd
    |   +--rw subdomain* [subdomain-id]
    |   +--rw subdomain-id    uint16
    |   +--rw bsl* [fwd-bsl]
    |   |   +--rw fwd-bsl    uint16
    |   |   +--rw si* [si]
    |   |   |   +--rw si          uint16
    |   |   +--rw te-bift-id
    |   |   |   +--rw encap-type?  encapsulation-type
    |   |   |   +--rw value        rt-types:mpls-label
    |   |   +--rw fwd-items* [te-bp]
    |   |   |   +--rw te-bp          uint16
    |   |   |   +--rw fwd-next-hop* [next-hop]
    |   |   |   |   +--rw next-hop    inet:ip-address
    |   |   |   |   +--rw dnr-flag?    boolean
    |   |   |   |   +--rw fwd-type
    |   |   |   |   |   +--rw (fwd-type)
    |   |   |   |   |   |   +--:(connected)
    |   |   |   |   |   |   +--:(routed)
    |   |   |   |   |   |   +--:(local-decap)
    |   |   |   |   |   |   +--:(other)
    |   |   |   |   +--rw te-out-bift-id
    |   |   |   |   |   +--rw te-out-bift-id* [encap-type]
    |   |   |   |   |   +--rw encap-type    encapsulation-type
    |   |   |   |   |   +--rw value
    |   |   |   |   |   |   rt-types:mpls-label
    |   |   |   |   +--rw out-if-list* [fwd-intf]
    |   |   |   |   |   +--rw fwd-intf    if:interface-ref
    |   |   +--rw te-frr {bier-te-frr}?
    |   |   |   +--rw frr-index?    leafref
    |   |   |   +--rw resetbitmask
    |   |   |   |   +--rw bit-string* [index]
    |   |   |   |   +--rw index      uint8
    |   |   |   |   +--rw bitmask?   uint32
    +--rw te-frr-items {bier-te-frr}?
    |   +--rw btaft* [frr-index]

```

```

+--rw frr-index      uint16
+--rw frr-si         uint16
+--rw frr-bsl        uint16
+--rw addbitmask
    +--rw bit-string* [index]
        +--rw index      uint8
        +--rw bitmask?   uint32

```

notifications:

```

+---n bier-te-notification
    +--ro bp-is-zero* [if-index]
        +--ro if-index    if:interface-ref
        +--ro adj-type?   enumeration

```

4. BIER-TE configuration

The BIER-TE forwarding item is indexed by the combination of sub-domain-id, BitStringLength and set identifier.

One interface can be used in different sub-domain, so the BIER TE adjacency information is managed by BIER TE function other than by interface itself.

Because the BIER-TE is controlled by controller now, the information about IGP is not defined. If in the future the IGP is used to carry the information about BIER-TE, the IGP extension will be added in this document.

5. Notifications

If the adjacency id of one adjacency is set to zero, the value is invalid. The notification should be sent to controller and network manager.

6. RPCs

TBD.

7. BIER TE YANG model

```

<CODE BEGINS> file "ietf-bier-te@2021-11-08.yang"

module ietf-bier-te {

    yang-version 1.1;

    namespace "urn:ietf:params:xml:ns:yang:ietf-bier-te";

    prefix bier-te;

    import ietf-inet-types {
        prefix "inet";
        reference
            "RFC 6991: Common YANG Data Types";
    }

    import ietf-routing {
        prefix "rt";
        reference
            "RFC 8349: A YANG Data Model for Routing Management
              (NMDA Version)";
    }

    import ietf-interfaces {
        prefix "if";
        reference
            "RFC 8343: A YANG Data Model for Interface Management";
    }

    import ietf-routing-types {
        prefix "rt-types";
        reference
            "RFC 8294: Common YANG Data Types for the Routing Area";
    }

    organization " IETF BIER (Bit Indexed Explicit Replication)
                  Working Group";

    contact
        "WG Web:  <http://tools.ietf.org/wg/bier/>
        WG List:  <mailto:bier@ietf.org>

        Editor:   Zheng Zhang
                  <mailto:zhang.zheng@zte.com.cn>
        Editor:   Cui Wang
                  <mailto:lindawangjoy@gmail.com>
        Editor:   Ran Chen
                  <mailto:chen.ran@zte.com.cn>
        Editor:   Fangwei Hu
                  <mailto:hufwei@gmail.com>
        Editor:   Mahesh Sivakumar

```

Editor: <mailto:sivakumar.mahesh@gmail.com>
Huanan Chen
<mailto:chenhuanan@189.cn>

";

description

"The module defines the YANG definitions for Traffic Engineering for Bit Index Explicit Replication (BIER-TE).

Copyright (c) 2020 IETF Trust and the persons identified as authors of the code. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, is permitted pursuant to, and subject to the license terms contained in, the Simplified BSD License set forth in Section 4.c of the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>).

This version of this YANG module is part of RFC XXXX (<https://www.rfc-editor.org/info/rfcXXXX>); see the RFC itself for full legal notices.

The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'NOT RECOMMENDED', 'MAY', and 'OPTIONAL' in this document are to be interpreted as described in BCP 14 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

revision 2021-11-08 {

description

"Initial revision.";

reference

"I-D.ietf-bier-te-arch: Tree Engineering for Bit Index Explicit Replication (BIER-TE)";

}

/*

* Features

*/

feature bier-te-frr {

description

"Support Fast Re-route feature in BIER TE.";

reference

"I-D.eckert-bier-te-frr: Protection Methods for BIER-TE";

}

/*

* Identities

```

*/

identity bier-te {
    base rt:control-plane-protocol;
    description
        "Identity for the Tree Engineering for Bit Index Explicit
        Replication (BIER-TE).";
    reference
        "I-D.ietf-bier-te-arch: Tree Engineering for Bit Index
        Explicit Replication (BIER-TE)";
}

typedef encapsulation-type {
    type enumeration {
        enum MPLS {
            description
                "The forwarding encapsulation is MPLS
                described in RFC8296 section 2.1.";
        }
        enum Ethernet {
            description
                "The forwarding encapsulation is Ethernet,
                which is belonging to non-mpls part
                described in RFC8296 section 2.2.";
        }
        enum IPv6 {
            description
                "The forwarding encapsulation is IPv6,
                which is belonging to non-mpls part
                described in RFC8296 section 2.2.";
        }
    }
    description
        "The encapsulation type of the BIER-TE packet.
        If this type is not set, MPLS is the default type.";
} // encapsulation-type

grouping bit-string {
    description
        "The bit string which each bit represents an adjacency.
        It is encapsulated in BIER header.";
    reference
        "I-D.ietf-bier-te-arch: Tree Engineering for Bit Index
        Explicit Replication (BIER-TE), section 3.3.
        RFC8279: Multicast Using Bit Index Explicit Replication
        (BIER).
        RFC8296: Encapsulation for Bit Index Explicit Replication
        (BIER) in MPLS and Non-MPLS Networks.";
}

```

```

list bit-string {
    key "index";
    description
        "As the definition in RFC 8279, the bit-string lengths are
        64, 128, 256, 512, 1024, 2048, 4096 bits. The according
        encapsulation is defined in RFC8296. BIER-TE uses the
        similar function for bit string.";

    leaf index {
        type uint8 {
            range "2..128";
        }
        description
            "The index of bit-mask. The minimum index value is 64 and
            the corresponding bit string length is 64 bits. The
            maximum index value is 128 and the corresponding
            bit-string length is 4096 bits.";
    }
    leaf bitmask {
        type uint32;
        description "The bit-string in 4-octet units.";
    }
}
} // bit-string

grouping adj-type {
    description "The collection of all possible adjacency type.";

    leaf adj-type {
        type enumeration {
            enum p2p {
                description "Describes p2p adjacency.";
            }
            enum bfer {
                description "Describes bfer adjacency.";
            }
            enum leaf-bfer {
                description
                    "Describes leaf-bfer adjacency. There is no next BFR that
                    the packet should be forwarded.";
            }
            enum lan {
                description "Describes lan adjacency.";
            }
            enum spoke {
                description "Describes spoke adjacency of hub-and-spoke.";
            }
            enum ring-clockwise {
                description "Describes clockwise adjacency in ring.";
            }
        }
    }
}

```

```

    }
    enum ring-counterclockwise {
        description "Describes counterclockwise adjacency in ring.";
    }
    enum ecmp {
        description
            "Describes ecmp adjacency. When the type is set to ecmp,
            the corresponding ecmp entry should be used to balance
            the load.";
    }
    enum virtual-link {
        description
            "Describes virtual adjacency between two indirect connect
            nodes.";
    }
    enum other {
        description "Describes other id type of adjacency.";
    }
}
description "The collection of all possible adjacency type.";
}
} // adj-type

grouping te-items {
    description "The BIER TE forwarding items collection.";

    list fwd-next-hop {
        key "next-hop";
        description
            "The next hop information for forwarding.
            If ECMP function defined in section 3.2.3 is used,
            multiple next hops may be existed.
            If ECMP function is not enabled,
            the next hop may be one only.";

        leaf next-hop {
            type inet:ip-address;
            mandatory true;
            description "Next hop address.";
        }
        leaf dnr-flag {
            type boolean;
            description
                "When the flag is set to 1, the BP of adjacency should not
                be reset when packet copies are created. The flag makes
                sense only when the forwarding type is 'connected'.";
        }
    }
    container fwd-type {
        description

```

```

    "The collection of all possible forwarding types.";
choice fwd-type {
    mandatory true;
    case connected {
        description
            "The forwarding type is connected. Mostly connected
            interfaces.";
    }
    case routed {
        description
            "The forwarding type is routed. Mostly not connected
            interfaces.";
    }
    case local-decap {
        description
            "Means that the packet should be decapsulated and
            forward out of BIER domain.";
    }
    case other {
        description
            "Means that the packet should be discarded.";
    }
    description
        "The collection of all possible forwarding types.";
}
} // fwd-type

container te-out-bift-id {
    description
        "The bift-id information corresponding to a specific
        outbound interface.";

    list te-out-bift-id {
        key "encap-type";
        leaf encap-type {
            type encapsulation-type;
            description
                "The encapsulation type of BIER-TE packet.";
        }
        leaf value {
            type rt-types:mpls-label;
            mandatory true;
            description
                "The bift-id value of the forwarding item.
                It can be a mpls label or an index for ethernet
                or IPv6 encapsulation, which is used to represent
                specific combination of [SD, BSL, SI].
                The ethernet or IPv6 index value is the same range
                (20bits) as mpls label.

```

```

        This value MUST NOT be set to 0.";
    }
    description
        "The bift-id value and the encapsulation type
        for the BIER-TE packet.";
    }
}

list out-if-list {
    key "fwd-intf";
    description
        "The outbound interface information for forwarding.";

    leaf fwd-intf {
        type if:interface-ref;
        mandatory true;
        description
            "The out interface of this forwarding item.";
    }
}
} // next-hop
} // te-items

/*
* data nodes
*/
augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol" {
    description "The BIER TE information.";
    container bier-te {
        description "The BIER TE information container.";

        container te-adj {
            description "The BIER TE adjacency information.";
            list adj-if {
                key "name";
                description "List of BIER-TE interfaces.";
                leaf name {
                    type if:interface-ref;
                    description "Interface name reference.";
                }
            }
            list subdomain {
                key "subdomain-id";
                description
                    "The sub-domain which the interface belongs to.
                    One interface can belong to many subdomains.";

                leaf subdomain-id {
                    type uint16;

```

```

        description "The sub-domain-id of this sub-domain.";
        reference
            "RFC 8279: Multicast Using Bit Index Explicit
            Replication (BIER)";
    }
    list si {
        key "si";
        description "The set identifier value.";

        leaf si{
            type uint16;
            mandatory true;
            description
                "The set identifier of this forwarding item.";
        }
        leaf-list adj-id {
            type uint16;
            description "The ID of an adjacency.";
        }
    }
}
uses adj-type;
}
} // te-adj

```

```

container te-fwd {
    description "The BIER TE forwarding information.";

    list subdomain {
        key "subdomain-id";
        description
            "The sub-domain which the interface belongs to.
            One interface can belong to many subdomains.";

        leaf subdomain-id {
            type uint16;
            description "The sub-domain-id of this sub-domain.";
            reference
                "RFC 8279: Multicast Using Bit Index Explicit
                Replication (BIER)";
        }
    }
    list bsl {
        key "fwd-bsl";
        description "The forwarding items in one BSL.";
        leaf fwd-bsl {
            type uint16;
            description "The value of bitstringlength.";
        }
        list si {

```

```

key "si";
description
    "The forwarding items in one combination of SD,
    BSL and SI.";
leaf si{
    type uint16;
    mandatory true;
    description
        "The set identifier of this forwarding item.";
}

    container te-bift-id {
description
    "The bift-id which is used to locate the specific
    forwarding item.";
leaf encap-type {
    type encapsulation-type;
    description
        "The encapsulation type for BIER-TE packet.";
}

leaf value {
    type rt-types:mpls-label;
    mandatory true;
    description
        "The bift-id value of the forwarding item.
        It can be a mpls label or an index for
        ethernet or IPv6 encapsulation,
        which is used to represent specific combination
        of [SD, BSL, SI].
        The ethernet or IPv6 index value is the same
        range (20bits) as mpls label.";
}
}

list fwd-items {
    key "te-bp";
    description
        "The forwarding information of one BIER TE item.";
    leaf te-bp {
        type uint16;
        mandatory true;
        description
            "The bit index of a BIER TE forwarding item.";
    }
    uses te-items;

    container te-frr {
        if-feature bier-te-frr;
        leaf frr-index {

```

```

        type leafref {
            path "../../../.." +
                "te-frr-items/btaft/frr-index";
        }
        description "The index of this frr path.";
    }
    container resetbitmask {
        description
            "The deleting bitmask of the forwarding item.";
        uses bit-string;
    }
    description
        "If this link is protected, frr items can be
        used to forward flows when this link is down.";
    } // te-frr
    } // fwd-items
    } // si
} // bsl

container te-frr-items {
    if-feature bier-te-frr;
    description "The TE fast re-route information.";
    list btaft {
        key "frr-index";
        description
            "The index of the frr paths. This item can be used
            for multiple links protection in different SI.";
    }
    leaf frr-index {
        type uint16;
        mandatory true;
        description "The frr item index.";
    }
    leaf frr-si{
        type uint16;
        mandatory true;
        description
            "The set identifier of this forwarding item.";
    }
    leaf frr-bsl {
        type uint16;
        mandatory true;
        description "The value of bitstringlength.";
    }
    container addbitmask {
        description
            "The adding bitmask of the forwarding item.
            This item should be merged into the packet's
            bit-string.";
        uses bit-string;
    }

```

```

        }
    } // btaft
} // te-frr-items
} // subdomain
} // te-fwd
} // bier-te
}

/*
 * Notifications
 */
notification bier-te-notification {
    description
        "The notification is sent when a condition changes.";
    list bp-is-zero {
        key "if-index";
        description "The adjacency id is zero. It is invalid.";
        leaf if-index {
            type if:interface-ref;
            description "The adjacency id is zero.";
        }
        uses adj-type;
    }
}
}
}

<CODE ENDS>

```

8. IANA Considerations

The IANA is requested to assign two new URIs from the IETF XML registry ([[RFC3688](#)]). Authors are suggesting the following URI:

URI: urn:ietf:params:xml:ns:yang:ietf-bier-te

Registrant Contact: BIER WG

XML: N/A, the requested URI is an XML namespace

This document also requests one new YANG module name in the YANG Module Names registry ([[RFC6020](#)]) with the following suggestion:

name: ietf-bier-te

namespace: urn:ietf:params:xml:ns:yang:ietf-bier-te

prefix: bier-te

reference: RFC XXXX

9. Acknowledgement

The authors would like to thank Min Gu (gumin20181129@163.com) for her testing, verification and valuable suggestion. And the authors would like to thank Benjamin R and Benchong Xu for their valuable comments.

10. References

10.1. Normative References

- [I-D.ietf-bier-te-arch] Eckert, T., Cauchie, G., and M. Menth, "Tree Engineering for Bit Index Explicit Replication (BIER-TE)", Work in Progress, Internet-Draft, draft-ietf-bier-te-arch-10, 9 July 2021, <<https://www.ietf.org/archive/id/draft-ietf-bier-te-arch-10.txt>>.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <<https://www.rfc-editor.org/info/rfc6020>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.
- [RFC8279] Wijnands, IJ., Ed., Rosen, E., Ed., Dolganow, A., Przygienda, T., and S. Aldrin, "Multicast Using Bit Index Explicit Replication (BIER)", RFC 8279, DOI 10.17487/RFC8279, November 2017, <<https://www.rfc-editor.org/info/rfc8279>>.
- [RFC8296] Wijnands, IJ., Ed., Rosen, E., Ed., Dolganow, A., Tantsura, J., Aldrin, S., and I. Meilik, "Encapsulation for Bit Index Explicit Replication (BIER) in MPLS and

Non-MPLS Networks", RFC 8296, DOI 10.17487/RFC8296,
January 2018, <<https://www.rfc-editor.org/info/rfc8296>>.

[RFC8343] Bjorklund, M., "A YANG Data Model for Interface Management", RFC 8343, DOI 10.17487/RFC8343, March 2018, <<https://www.rfc-editor.org/info/rfc8343>>.

[RFC8349] Lhotka, L., Lindem, A., and Y. Qu, "A YANG Data Model for Routing Management (NMDA Version)", RFC 8349, DOI 10.17487/RFC8349, March 2018, <<https://www.rfc-editor.org/info/rfc8349>>.

[RFC8407] Bierman, A., "Guidelines for Authors and Reviewers of Documents Containing YANG Data Models", BCP 216, RFC 8407, DOI 10.17487/RFC8407, October 2018, <<https://www.rfc-editor.org/info/rfc8407>>.

10.2. Informative References

[I-D.eckert-bier-te-frr] Eckert, T., Cauchie, G., Braun, W., and M. Menth, "Protection Methods for BIER-TE", Work in Progress, Internet-Draft, draft-eckert-bier-te-frr-03, 5 March 2018, <<https://www.ietf.org/archive/id/draft-eckert-bier-te-frr-03.txt>>.

[I-D.ietf-bier-bier-yang] Chen, R., Hu, F., Zhang, Z., Dai, X., and M. Sivakumar, "YANG Data Model for BIER Protocol", Work in Progress, Internet-Draft, draft-ietf-bier-bier-yang-07, 8 September 2020, <<https://www.ietf.org/archive/id/draft-ietf-bier-bier-yang-07.txt>>.

[RFC3688] Mealling, M., "The IETF XML Registry", BCP 81, RFC 3688, DOI 10.17487/RFC3688, January 2004, <<https://www.rfc-editor.org/info/rfc3688>>.

Authors' Addresses

Zheng(Sandy) Zhang
ZTE Corporation
Nanjing
China

Email: zhang.zheng@zte.com.cn

Cui(Linda) Wang
Individual

Email: lindawangjoy@gmail.com

Ran Chen

ZTE Corporation
Nanjing
China

Email: chen.ran@zte.com.cn

Fangwei Hu
Individual
Shanghai
China

Email: hufwei@gmail.com

Mahesh Sivakumar
Juniper networks
1133 Innovation Way
Sunnyvale, CALIFORNIA 94089 ,
United States

Email: sivakumar.mahesh@gmail.com

Huanan Chen
Individual
China

Email: chenhuanan@189.cn