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BIER Underlay Path Calculation Algorithm and Constraints
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Abstract

   This document specifies general rules for interaction between the BAR
   (BIER Algorithm) and IPA (IGP Algorithm) fields defined in ISIS/
   OSPFv2 Extensions for BIER. The semantics for the BAR and IPA fields
   (when both or any of them is non-zero) defined in this document
   updates the semantics defined in RFC8444/RFC8401.

Requirements Language

   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.

   This Internet-Draft will expire on May 7, 2020.

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1. Introduction

   In Bit Index Explicit Replication (BIER) architecture [RFC8279],
   packets with a BIER encapsulation header are forwarded to the
   neighbors on the underlay paths towards the BFERs. For each sub-
   domain, the paths are calculated in the underlay topology for the
   sub-domain, following a calculation algorithm specific to the sub-
   domain. The <topology, algorithm> could be congruent or incongruent
   with unicast. The topology could be a default or non-default
   topology [RFC5120]. The algorithm could be a generic IGP algorithm
   (e.g. SPF) or could be a BIER specific one defined in the future.

   In [RFC8401] and [RFC8444], an 8-bit BAR (BIER Algorithm) field and
   8-bit IPA (IGP Algorithm) field are defined to signal the BIER
   specific algorithm and generic IGP Algorithm respectively and only
   value 0 is allowed for both fields in those two documents. This

document specifies the general rules for the two fields and their
interaction when either or both fields are not 0, and updates their
semantics defined in [RFC8444] and [RFC8401].

2. General Rules for the BAR and IPA fields

For a particular sub-domain, all routers SHOULD be provisioned with
and signal the same BAR and IPA values. When a BFR discovers another
BFR advertising different BAR or IPA value from its own provisioned,
it MUST treat the advertising BFR as incapable of supporting BIER for
the sub-domain. How incapable routers are handled is outside the
scope of this document.

It is expected that both the BAR and IPA values could have both
algorithm and constraints semantics. To generalize, we introduce the
following terms:

o   BC: BIER-specific Constraints

o   BA: BIER-specific Algorithm

o   RC: Generic Routing Constraints

o   RA: Generic Routing Algorithm

o   BCBA: BC + BA

o   RCRA: RC + RA

A BAR value corresponds to a BCBA, and a IPA value corresponds to a
RCRA. Any of the RC/BC/BA could be "NULL", which means there are no
corresponding constraints or algorithm.

When a new BAR value is defined, its corresponding BC/BA semantics
MUST be specified. For a new IGP Algorithm to be used as a BIER IPA,
its RC/RA semantics MUST also be clear.

For a particular topology X (which could be a default topology or
non-default topology) that a sub-domain is associated with, a router
calculates the underlay paths according to its provisioned BCBA and
RCRA the following way:

1. Apply the BIER constraints, resulting in BC(X).

2. Apply the routing constraints, resulting in RC(BC(X)).

3. Select the algorithm AG as following:

   A. If BA is NULL, AG is set to RA.

   B. If BA is not NULL, AG is set to BA.

4. Run AG on RC(BC(X)).

2.1. When BAR Is Not Used

   The BIER Algorithm registry established by [RFC8401] and also used in
   [RFC8444] has value 0 for "No BIER specific algorithm is used". That
   translates to NULL BA and NULL BC. Following the rules defined
   above, the IPA value alone identifies the calculation algorithm and
   constraints to be used for a particular sub-domain when BAR is 0.

2.2. Exceptions/Extensions to the General Rules

   Exceptions or extensions to the above general rules may be specified
   in the future for specific BAR and/or IPA values. When that happens,
   compatibility with defined BAR and/or IPA values and semantics need
   to be specified.

3. Examples

   As an example, one may define BAR=x with semantics of "excluding BIER
   incapable routers". That BIER specific constraint can go with any
   IPA: whatever RCRA defined by the IPA are augmented with "excluding
   BIER incapable routers", i.e., BIER incapable routers are not put
   onto the candidate list during SPF calculation.

   Note that if the BC and RC happen to conflict and lead to an empty
   topology, then no native BIER forwarding path will be found. That is
   a network design issue that an operator need to avoid when choosing
   BAR/IPA.

4. IANA Considerations

   No IANA Consideration is requested in this document.

5. Security Considerations

   This document does not change the secuity aspects as discussed in
   [RFC8279].

6. Acknowledgements

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   others for their suggestions and comments. In particular, the BCBA/

RCRA representation for the interaction rules is based on Alia's
write-up.

7. References

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