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BIER Underlay Path Calculation Algorithm and Constraints
draft-ietf-bier-bar-ipa-09

Abstract

This document specifies general rules for the interaction between the BIER Algorithm (BAR) and the IGP Algorithm (IPA) used for underlay path calculation. The semantics defined in this document update [RFC8401](#), [RFC8444](#), and [draft-ietf-bier-ospfv3-extensions](#).

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.

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[1.](#) Introduction

In the 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. The paths are calculated in the underlay topology for each sub-domain following a calculation algorithm specific to the sub-domain. The topology or algorithm may be congruent with unicast. The algorithm could be a generic IGP algorithm (e.g. SPF) or could be a BIER specific one defined in the future.

This document specifies general rules for the interaction between the BIER Algorithm (BAR) and the IGP Algorithm (IPA) used for underlay path calculation. The semantics defined in this document update [[RFC8401](#)], [[RFC8444](#)], and [[I-D.ietf-bier-ospfv3-extensions](#)].

2. General Rules for the BAR and IPA fields

For a particular sub-domain, all BIER Forwarding Routers (BFRs) MUST be provisioned with and signal the same BAR and IPA values. If a BFR discovers another BFR advertising different BAR or IPA value, it MUST treat the advertising router as incapable of supporting BIER (one way of handling incapable routers is documented in [Section 6.9 of \[RFC8279\]](#) and additional methods may be defined in the future).

Both BAR and IPA 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 an IPA value corresponds to an 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 specified.

For a particular topology X that a sub-domain is associated with, a router MUST calculate the underlay paths according to its BCBA and RCRA in 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)).

It's possible that the resulting AG is not applicable to BIER. In that case, no BIER paths will be calculated and it is a network design issue that an operator needs to avoid when choosing BAR/IPA.

2.1. When BAR Is Not Used

BAR value 0 is defined as "No BIER-specific algorithm is used" [[rfc8401](#)]. This value indicates NULL BA and BC. Following the rules defined above, the IPA value alone identifies the calculation algorithm and constraints to be used for a particular sub-domain.

2.2. Compatibility

Currently only value 0 is used for both BAR and IPA in [[RFC8401](#)], [[RFC8444](#)] and [[I-D.ietf-bier-ospfv3-extensions](#)], which means no constraints, so there are no compatibility issues.

2.3. 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 a new BAR with the constraint of "excluding BIER incapable routers". That BIER specific constraint can go with any IPA: whatever RCRA defined by the IPA is augmented with "excluding BIER incapable routers", i.e., routers that do not support BIER are not considered when applying the IGP Algorithm.

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

4. IANA Considerations

No IANA Consideration is requested in this document.

5. Security Considerations

This document specifies general rules for the interaction between the BIER Algorithm (BAR) and the IGP Algorithm (IPA) used for underlay path calculation. It does not change the security aspects as discussed in [[RFC8279](#)], [[RFC8401](#)], [[RFC8444](#)] and [[I-D.ietf-bier-ospfv3-extensions](#)].

6. Acknowledgements

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