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Operations, Administration and Maintenance (OAM) Requirements for Bit Index Explicit Replication (BIER) Layer
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Abstract

This document describes a list of functional requirements toward Operations, Administration and Maintenance (OAM) toolset in Bit Index Explicit Replication (BIER) layer of a network.

Status of This Memo

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1. Introduction

[RFC8279] introduces and explains Bit Index Explicit Replication (BIER) architecture and how it supports forwarding of multicast data packets.

This document lists the OAM requirements for the BIER layer (see Section 4.2 of [RFC8279]) of the multicast domain. The list can further be used for gap analysis of available OAM tools to identify possible enhancements of existing or whether new OAM tools are required to support proactive and on-demand path monitoring and service validation.

1.1. Conventions used in this document

1.1.1. Terminology

The term "BIER OAM" is used in this document interchangeably with a more extended version, "set of OAM protocols, methods, and tools for BIER layer".

* In-band OAM is an active OAM or hybrid OAM method [RFC7799] in which OAM packets traverse the same set of links and interfaces, and receive the same QoS treatment, as the monitored BIER flow.

* Out-of-band OAM refers to an active OAM method in which the path traversed through the BIER domain is not topologically identical to that of the monitored BIER flow, or in which the OAM test packets receive different QoS treatment, or both.

* OAM session is a communication established between network nodes to perform OAM functions like fault detection, performance monitoring, and localization [RFC7276]. These sessions can be proactive (continuous, persistent configuration) or on-demand (manual, temporary diagnostics).

1.1.2. 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.

The requirements language is used in Section 2 and applies to implementations of BIER OAM conformant to the listed requirements.

1.1.3. Acronyms

BFD: Bidirectional Forwarding Detection [RFC8562]

BFR: Bit-Forwarding Router [RFC8279]

BFER: Bit-Forwarding Egress Router [RFC8279]

BIER: Bit Index Explicit Replication [RFC8279]

OAM: Operations, Administration, and Maintenance [RFC6291]

p2mp: Point-to-Multipoint [RFC8562]

STAMP: Simple Two-way Active Measurement Protocol [RFC8762]

2. Requirements

This section lists the requirements for OAM of the BIER layer:

1. The listed requirements MUST be supported with any transport layer over which the BIER layer can be realized.

2. It MUST be possible to initialize a BIER OAM session from any Bit-Forwarding Router (BFR) of the given BIER domain.

3. It SHOULD be possible to initialize a BIER OAM session from a centralized controller.

4. BIER OAM MUST support proactive and on-demand OAM monitoring and measurement methods.

5. BIER OAM MUST support unidirectional OAM methods, both continuity check (e.g., Bidirectional Forwarding Detection (BFD) [RFC8562]) and performance measurement (e.g., Simple Two-way Active Measurement Protocol (STAMP) [RFC8762]).

6. BIER OAM packets in the forward direction (i.e., from the ingress toward the egress endpoint(s) of the OAM test session) MUST be transmitted in-band, as defined in Section 1.1.1.

7. BIER OAM MUST support bi-directional OAM methods. Such methods MAY combine in-band monitoring or measurement in the forward direction with out-of-band notification, as defined in Section 1.1.1, in the reverse direction (i.e., from the egress toward the ingress endpoint of the OAM test session, as in Point-to-Multipoint (p2mp) BFD with active tail [RFC9780]).

8. BIER OAM MUST support proactive monitoring of BFER availability by a BFR in the given BIER domain, e.g., p2mp BFD active tail support [RFC9780].

9. BIER OAM MUST support Path Maximum Transmission Unit discovery [RFC1191].

10. BIER OAM MUST support Remote Defect Indication [RFC6428] notification of the source of continuity checking BFR by Bit-Forwarding Egress Routers (BFERs), e.g., by using the Diagnostic field in p2mp BFD with active tail support, as described in Section 5 of [RFC9780].

11. BIER OAM MUST support active and passive performance measurement methods [RFC7799].

12. BIER OAM MUST support unidirectional performance measurement methods to calculate throughput, loss, delay, and delay variation metrics [RFC6374]. STAMP ([RFC8762] and [RFC8972]) is an example of an active performance measurement method and performance metrics that may be applied in a BIER domain. The Alternate Marking Method, described in [RFC9341] and [RFC9342], is an example of a hybrid measurement method ([RFC7799]) that may be applied in a BIER domain.

13. BIER OAM MUST support defect notification mechanism, like Alarm Indication Signal [RFC6427]. Any BFR in the given BIER domain MAY originate a fault management message [RFC6427] addressed to any subset of BFRs within the domain.

14. BIER OAM MUST support methods to enable the survivability of a BIER layer. These recovery methods MAY use protection switching and restoration.

3. IANA Considerations

This document does not propose any IANA consideration. This section may be removed.

4. Security Considerations

This document lists the OAM requirement for a BIER-enabled domain and thus inherits security considerations discussed in [RFC8279] and [RFC8296]. Another general security aspect results from using active OAM protocols, according to the [RFC7799], in a multicast network. Active OAM protocols inject specially constructed test packets, and some active OAM protocols are based on the echo request/reply principle. In the multicast network, test packets are replicated as data packets, thus creating a possible amplification effect of multiple echo responses being transmitted to the sender of the echo request. Thus, an implementation of BIER OAM MUST protect the control plane from spoofed replies. Also, an implementation of BIER OAM MUST provide control of the number of BIER OAM messages sent to the control plane.

5. Acknowledgements

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