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MPLS-TP protection for interconnected rings
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Abstract

The requirements for MPLS Transport Profile include a requirement (R93) that requires MPLS-TP must support recovery mechanisms for a network constructed from interconnected rings that protect user data that traverses more than one ring. In particular, This includes protecting against cases of failure at the ring-interconnect nodes and links. This document presents different scenario of interconnected rings and special mechanism to address recovery of the failure of ring-interconnect nodes and links. .

This document is a product of a joint Internet Engineering Task Force(IETF) / International Telecommunications Union Telecommunications Standardization Sector (ITU-T) effort to include an MPLS Transport Profile within the IETF MPLS and PWE3 architectures to support the capabilities and functionalities of a packet transport network as defined by the ITU-T.

Status of This Memo

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

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1. Introduction

This document describes different interconnected ring scenario and a few special mechanisms to protect against the failure of the ring-interconnect nodes and links. There are three common interconnection scenarios that we will address in this document:

Dual-node interconnection - when the two rings are interconnected by two nodes from each ring (see Figure 1);

Single-node interconnection - when the connection between the two rings is through a single node (see Figure 2).As the interconnnection node(LSR-A) is a single-point of failure, this scenario should be avoided in real networks;

Chained interconnection - when a series of rings are connected through interconnection nodes that are part of both interconnected rings (see Figure 3)

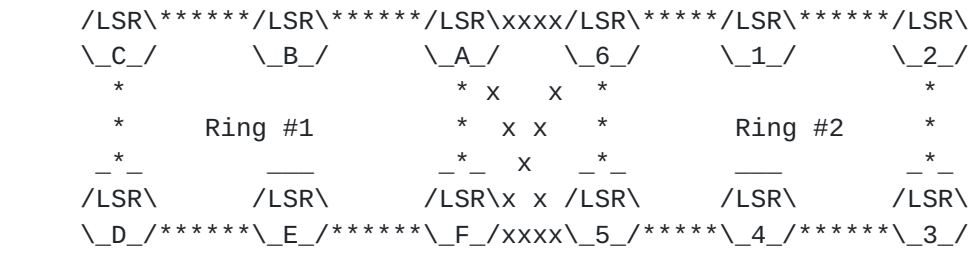


Figure 1: Dual-node interconnection scenario

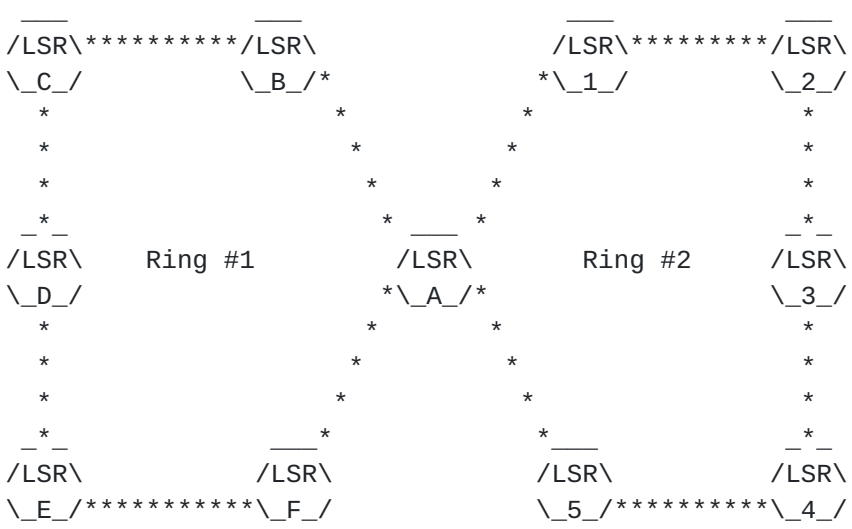


Figure 2: Single-node interconnection scenario

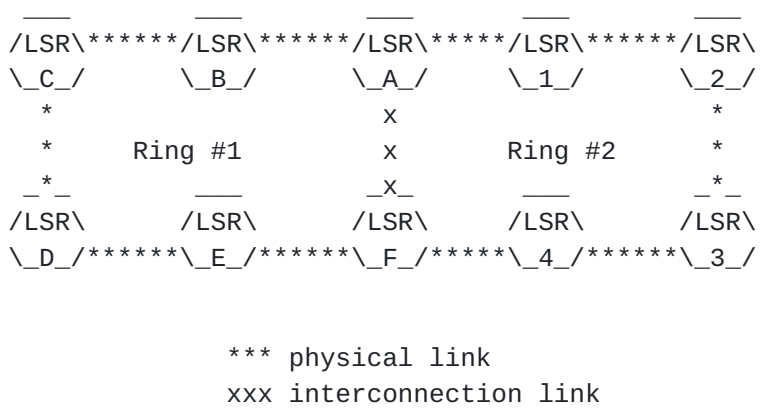


Figure 3: chained interconnected scenario

Considering a traffic that traveres more than two rings. Many interconnection scenarios could be existed in the same scenario, They will be mixed interconnection scenario;

Dual-node and single-node mixed interconnection- when there exists a multi-ring traffic which traveres more than two rings. two of these rings are dual-node interconnection. while another two are single-node interconnection (see figure 5);

Dual-node and chained mixed interconnection-when there exist both dual-node interconnection and chained interconnection in this scenario (see figure 4);

single-node and chained mixed interconnection-when there exist both single-node interconnection and chained interconnection in this scenario(see figure 6);

Dual-node, single-node and chained mixed interconnection-when there exist all three interconnection scenrios in this scenario including Dual-node interconnnection, single-node interconnection and chained interconnnection(see figure 7);

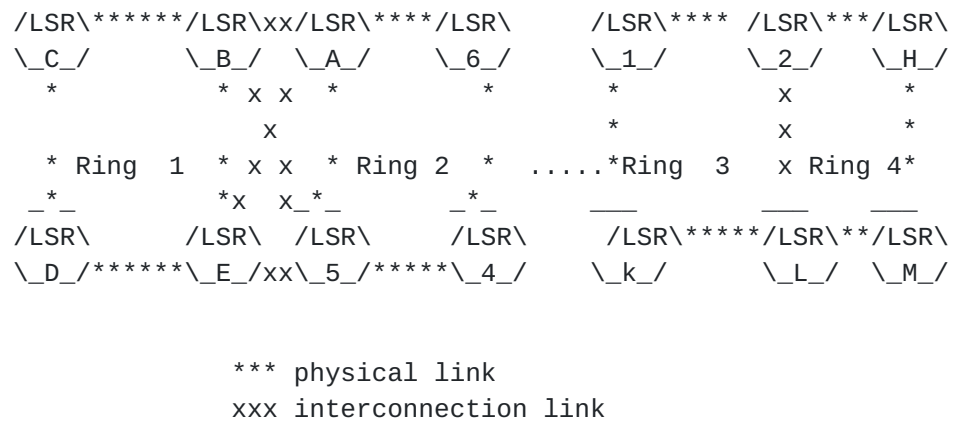


Figure 4: Dual-node and chained mixed interconnect scenario

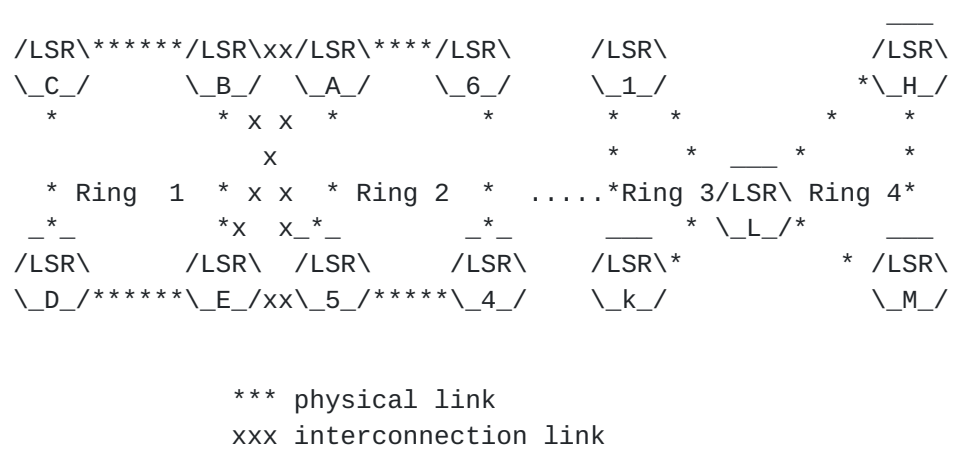
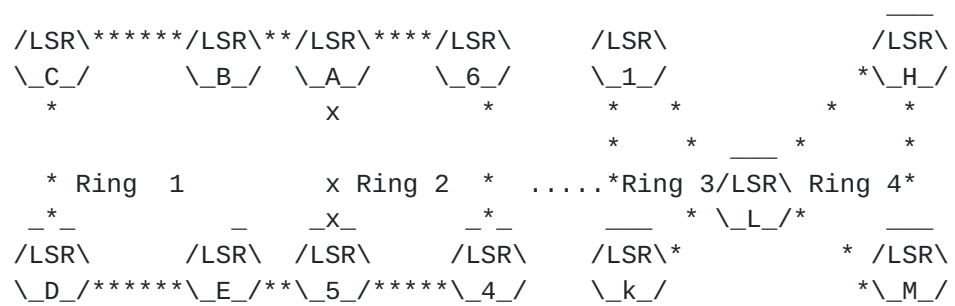


Figure 5: Dual-node and single-node mixed interconnect scenario



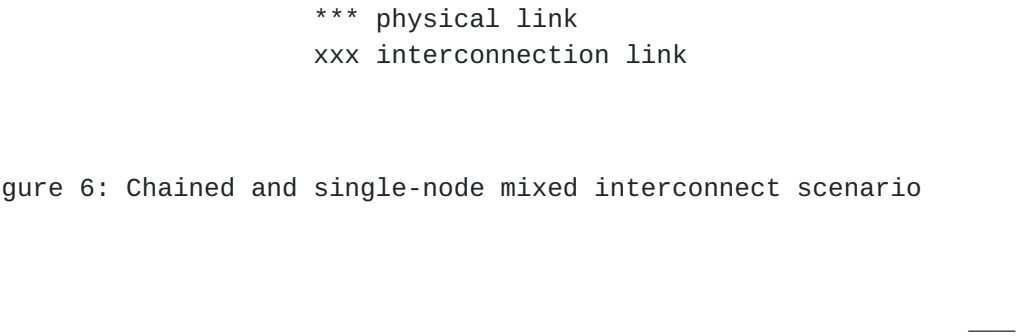


Figure 6: Chained and single-node mixed interconnect scenario

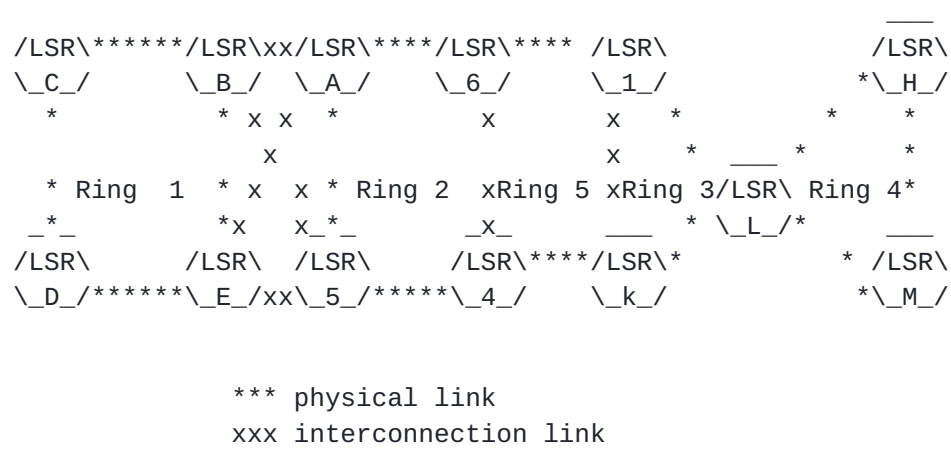


Figure 7: Dual-node,chained and single-node mixed interconnect scenario

For a multi-ring traffic, It will be across more than one ring just like above seven scenarios. If a failure happens on a multi-ring path, quick recovery is necessary requirement for multi-ring traffic.

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC-2119.

OAM: Operations, Administration, Maintenance

LSP: Label Switched Path.

TLV: Type Length Value

PSC:Protection Switching Coordination

SD:Signal Degrade

SF:Signal Fail

MPLS-TP:Multi-Protocol Label Switching Transport Profile

3. Recovery mechanism

In the following subsection, It proposes different mechanism that may be applied for traffic recovery for different interconnection scenario. In general, It may be possible to provide protection against the failure of a ring node/link by using a single-ring protection mechanism. These cases are out of scope for this document.At the same time, It is also possible to configure an end-to-end protection path to protect a multi-ring traffic which will across multi-ring. While this protection mechanism does not scale very well. We need to consider special mechanism to address recovery from failures of the interconnecting nodes and links

3.1. Recovery mechanism for Dual-node interconnection

Under this scenario , When interconnection link(LSRA-LSR6) has a failure as shown in figure 8. it is possible use 1:1 linear protection mechanism to protect the failure of segment(LSRA-LSR6) by using one of the protection tunnels (LSRA-LSRF-LSR5-LSR6 or LSRA-LSRF-LSR6 or LSRA-LSR5-LSR6) .

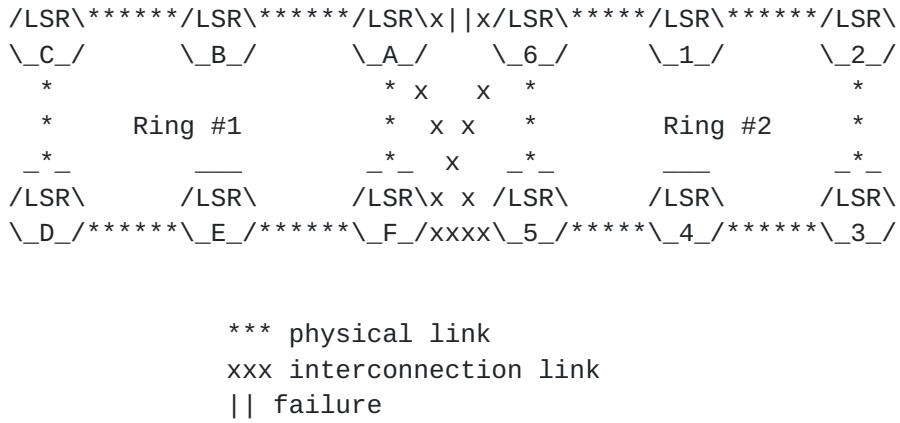


Figure 8: interconnection link failure for dual-node interconnection

When the interconnection node(LSRA or LSR6) detects a SF or SD on the interconnection link(LSRA-LSR6), LSRA or LSR6 will send SF or SD failure message to its peer node. Then they push the multi-ring traffic into its corresponding protection tunnel to another end

point(LSRA or LSR6) of the segment . When the peer node (LSR6 or LSRA) receives the traffic packet from its protection tunnel, it will POP the outer label of protection tunnel and return back to the original working tunnel(LSRA-LSRB-LSRC or LSR6-LSR1-LSR2) of another ring(ring 1 or ring 2) to transport the multi-ring traffic.

When the interconnection node(LSRA or LSR6) has a failure as shown in figure 9. The end node of the segment detects the failure of the interconnection node, It should send failure messge to the backup interconnection node(LSRF or LSR5) to active its corresponding protection path that goes to the backup interconnection node(LSRF or LSR5) to trasnport the multi-ring traffic. At the same time, the backup interconnection node should active its corresponding protection path that goes to another primary interconnection node(LSR6 or LSRA) of another ring.Then the multi-ring traffic should return back to the original working path to be transported in another ring.

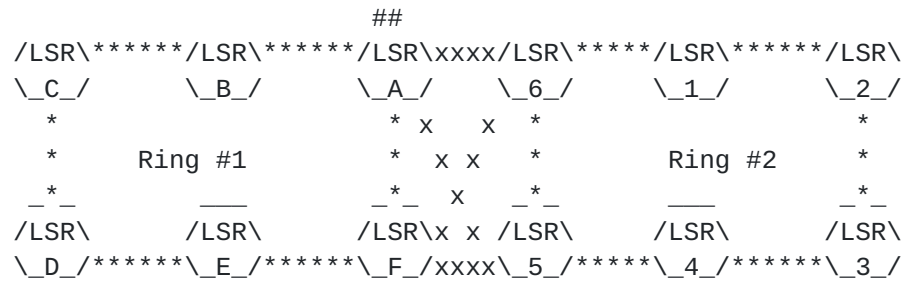


Figure 9: interconnection node failure for dual-node interconnection

For example , When LSRC directly detects or is informed of a failure on the interconnection node LSRA. it will send a failure message to notify the backup interconnection node LSRF to active its protection path(LSRC-LSRD-LSRE-LSRF) to transport the multi-ring traffic.At the same time, When LSRF receives the failure message from LSRC ,it should still active its corresponding protection path that goes to another primary interconnection node LSR6 to transport the multi-ring traffic.The corresponding protection path may be one of the two paths (LSRF-LSR5-LSR6 or LSRF-LSR6). Then the multi-ring traffic will be transported by its original working path(LSR6-LSR1-LSR2) to another peer node LSR2.

3.2. Recovery mechanism for chained interconnection

For this scenario , When only a failure is detected on the interconnection link by interconnection node. since the failure should not affect the multi-ring traffic. no action is need to be taken. When a failure happens on the segment of the multi-ring path and the interconnection link at the same time ,just as shown in figure 10. The end node of the multi-ring path directly detects or is informed of the two failures, Then it will active the protection path that goes to the backup interconnection node to transport the multi-ring traffic. After the backup interconnection node receives the failure message , it will active its corresponding protection path that goes to the end node of another ring

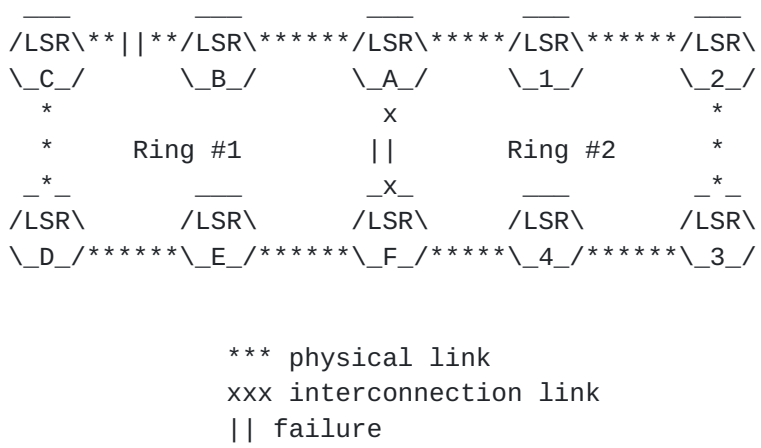


Figure 10: interconnection link failure for chained interconnected scenario

For example, there are a failure on both link(LSRC-LSRB) and (LSRA-LSRF) at the same time as shown in figure.10. When LSRC detects or is notified of the segment failure on both the segment of ring 1 and the interconnection link. It will send a failure message to the backup interconnection node LSRF, Then LSRF will active its corresponding protection path(LSRF-LSR4-LSR3-LSR2) of ring 2 to transport the multi-ring traffic.

When a interconnection node has a failure for the chained interconnection scenario, both peer node of the two rings will detect the failure by segment OAM. So they should switch into the multi-ring protection path to transport the multi-ring traffic.

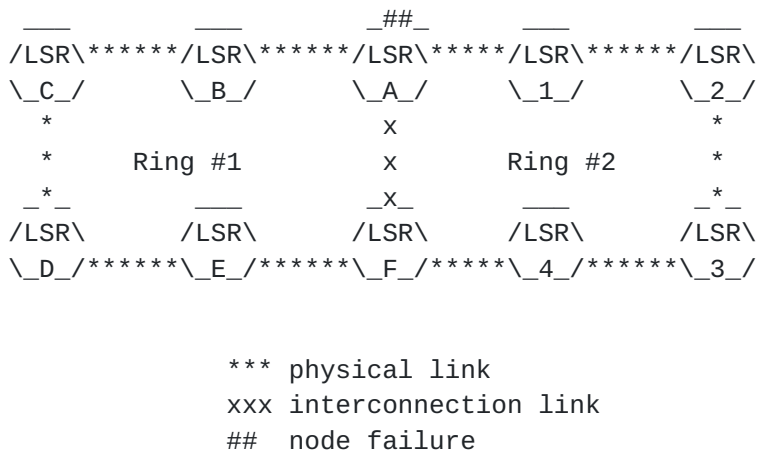


Figure 11: interconnection node failure for chained interconnected scenario

Just as the failure scenario in figure 11. When an interconnection node LSRA has a failure, the peer node(LSRC and LSR2) of ring 1 and ring 2 must detect the node failure by segment OAM , Then they will active protection switch and transport the protected multi-ring traffic by its corresponding protection path(LSRC-LSRD-LSRE-LSRF-LSR4-LSR3-LSR2) to LSR2. Then the protected traffic will return back to the original working path to be transported.

4. Security Considerations

TBD

5. IANA Considerations

TBD.

6. Acknowledgments

TBD .

7. References

7.1. Normative References

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7.3. URL References

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