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PBB-TE
Protection Switching

Unidirectional switching scenarios
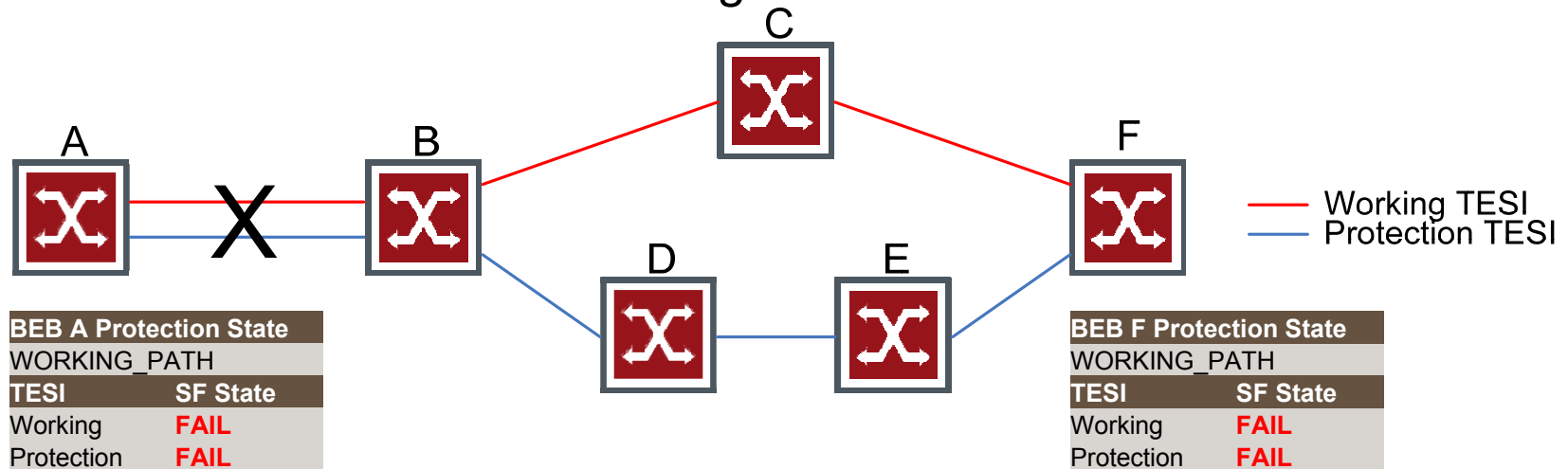
Oliver Thorp

Overview

- This contribution details scenarios where, following a unidirectional switch, the PBB-TE protection mechanism will forward a Backbone Service Instance on a different TESI in each direction

- 802.1Qay/D4.0 does not provide a mechanism that prevents or automatically corrects this state in all cases

- This issue was raised as ballot comment #196 against 802.1Qay/D3.5

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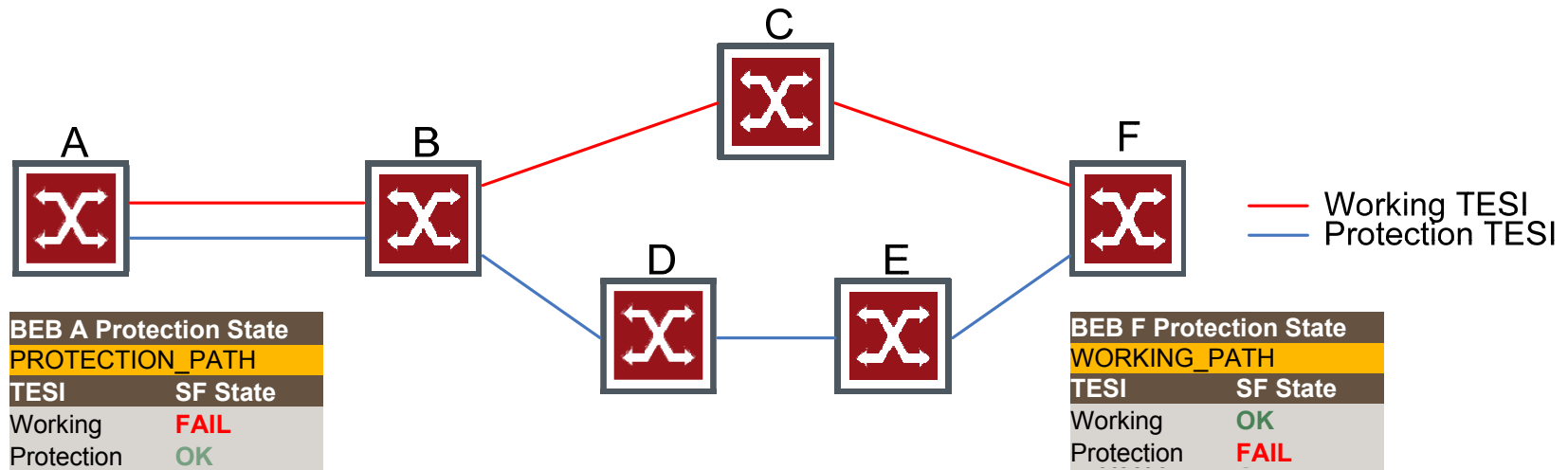# Race condition on signal-fail for co-routed TESIs

1) Initial state

- Assume there are two TESIs configured in a protection group between BEBs A and F
  - Working TESI is ABCF
  - Protection TESI is ABDEF
- A single physical link (AB) is shared by both TESIs
  - This link has failed
- The hold-off timer is disabled
- Both BEBs select the working TESI

BEB A Protection State	
WORKING_PATH	
TESI	SF State
Working	FAIL
Protection	FAIL

BEB F Protection State	
WORKING_PATH	
TESI	SF State
Working	FAIL
Protection	FAIL

Working TESI
Protection TESI

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Race condition on signal-fail for co-routed TESIs
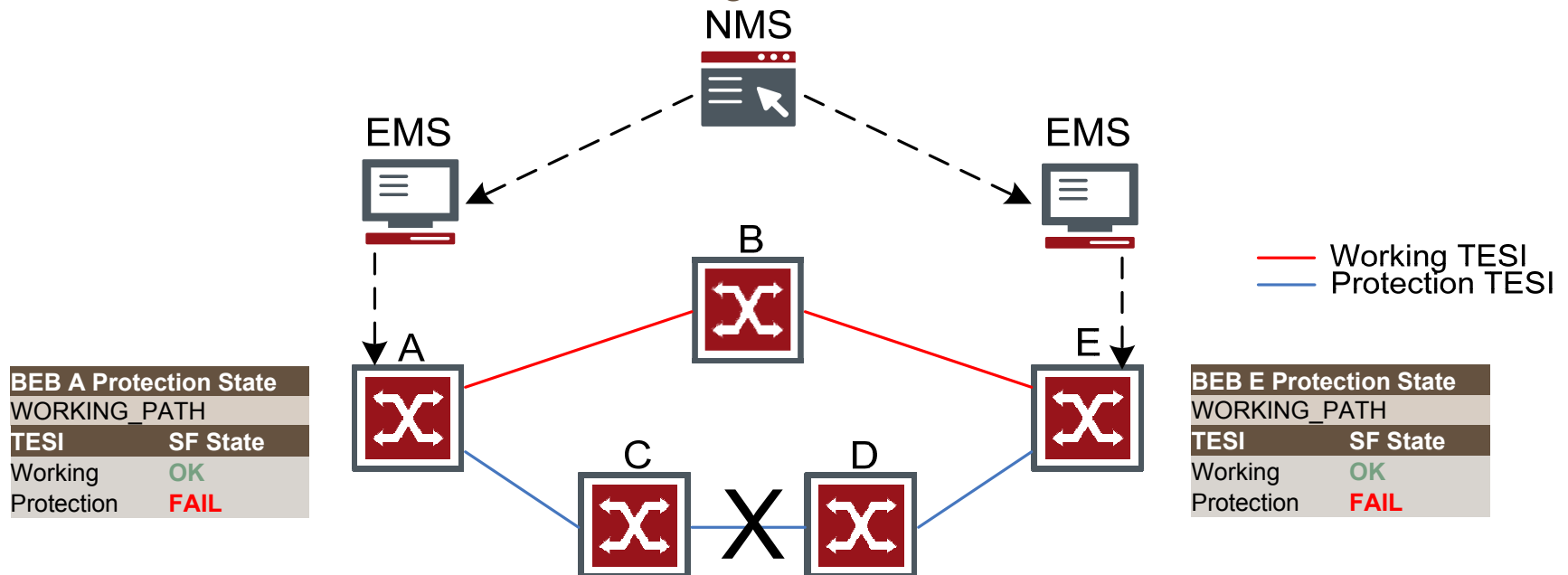
2) The link (AB) now recovers

- The protection switching state machines on the BEBs at each end of the protection group will now independently switch to whichever TESI clears the SF condition first…

- In the case shown, there is 50% chance of the two BEBs picking different paths

BEB A Protection State	
PROTECTION_PATH	
TESI	SF State
Working	FAIL
Protection	OK

BEB F Protection State	
WORKING_PATH	
TESI	SF State
Working	OK
Protection	FAIL

Working TESI
Protection TESI

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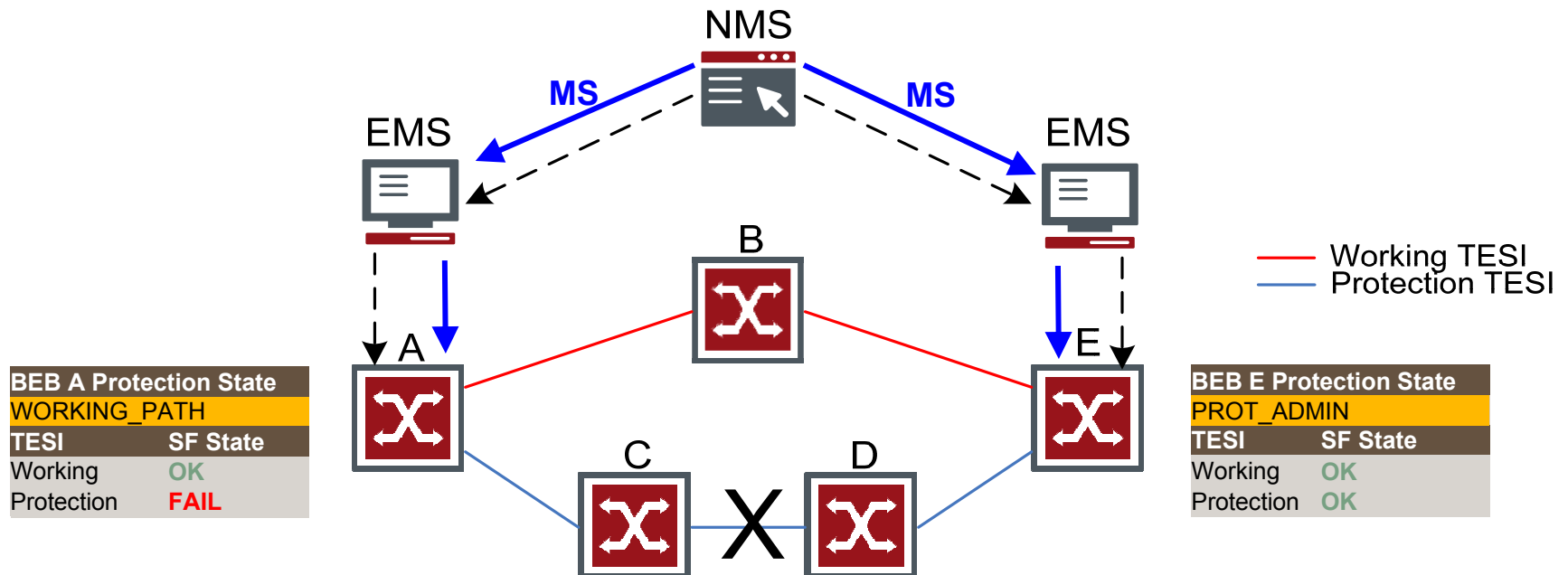
Race condition between MS & SF

1) Initial state

- Assume there are two TESIs configured in a protection group between BEBs A and E
  - Working TESI is ABE
  - Protection TESI is ACDE
- The protection TESI has failed
  - Both BEBs select the working TESI

BEB A Protection State	
WORKING_PATH	
TESI	**SF State**
Working	OK
Protection	FAIL

BEB E Protection State	
WORKING_PATH	
TESI	**SF State**
Working	OK
Protection	FAIL

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Race condition between MS & SF
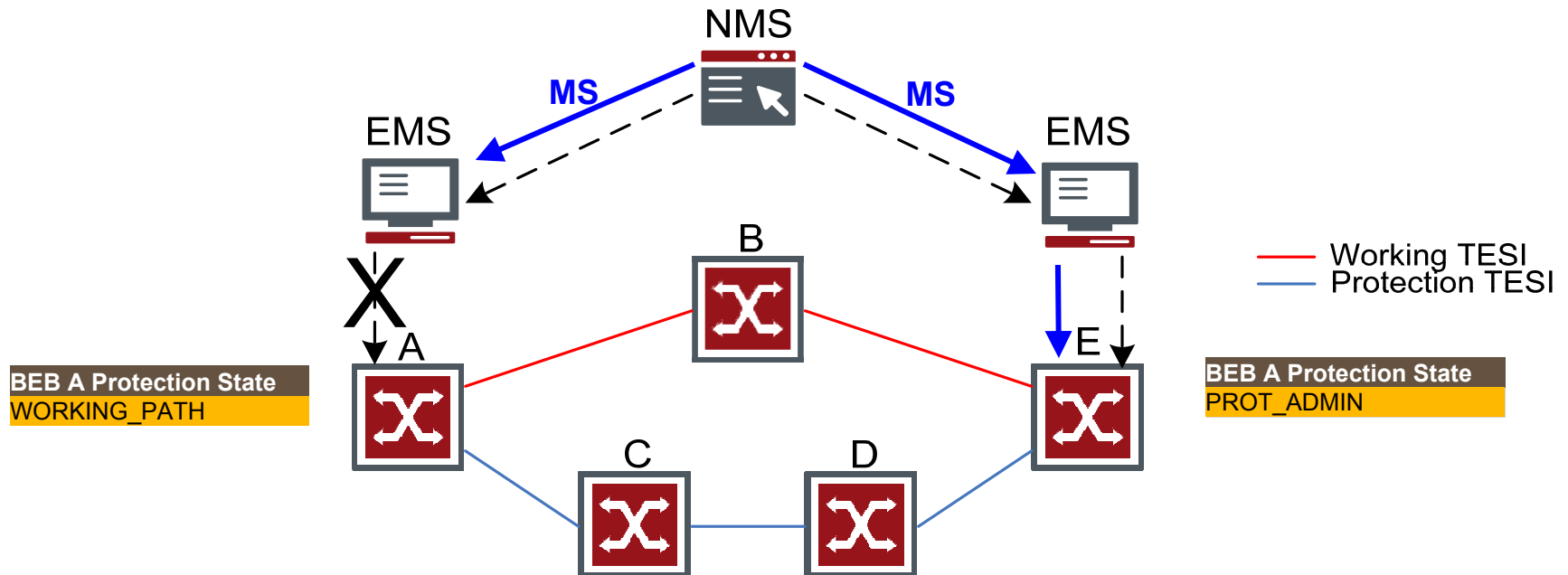
2) Operator initiates a manual switch to protection

- At the same time the protection TESI recovers
- The order in which each BEB sees the two events will determine the resulting protection state

BEB A Protection State

WORKING_PATH

TESI	SF State
Working	OK
Protection	FAIL

BEB E Protection State

PROT_ADMIN

TESI	SF State
Working	OK
Protection	OK

Working TESI
Protection TESI

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Loss of management path to BEB

- Scenario
  - Assume there are two TESIs configured in a protection group between BEBs A and E
  - The operator initiates a manual switch to protection
  - The EMS is unable to send the command to BEB A
  - BEB E performs a protection switch but BEB A does not

Mitigations

- Configure the hold-off timer to a period greater than the CCM detection time
  - Prevents signal fail race condition in the case shown
- Enable revertive protection switching mode
  - Any divergence will (eventually) clear itself
- Using mechanisms outside the scope of the 802.1Qay standard, verify that a operator request was performed at either both ends of a protection group or none
  - If necessary, apply a second command to one end of the protection group to fix any divergence in protection switching state.

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Proposal

- Section 26.10.1 last paragraph, replace first sentence as follows:

  "The description herein, defines and provides a scalable end-to-end resiliency mechanism that offers end-to-end 1:1 linear protection switching capable of load sharing for point-to-point TE service instances in a PBB-TE Region. This standard does not enforce bidirectional PBB-TE protection switching, however:

  - the someRDIdefect is used as a protection switching trigger which will normally cause a bidirectional switch; and

  - the Mismatch defect allows the network operator to check the remote mapping of traffic the working or protection TESI and if necessary request a manual switch before performing a maintenance action on one of the TESIs in a protection group."

- Annex Z.1: Add an additional bullet

  "x) Bidirectional Switching

  1) [McGuire]: item 4)"

  to the list of requirements 'Not currently planning to address'

Backup: How does G.8031 deal with this?

- ITU-T G.8031 does not have an issue with these race conditions since it co-ordinates the protection switching state using an APS protocol
  - G.8031 will select the working transport entity if the two endpoints disagree on the active transport entity and both transport entities are available
    - Eliminates divergence when endpoints of the protection group detect signal fail at different times
  - G.8031 implements operator requests by applying a command to one end of the protection group
    - Avoids race conditions in 802.1Qay where operator requests have only been applied to one end of the protection group

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