



## RFL eXmux® 3501 Hitless Switching

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### Purpose

This document details the mode of operation of the eXmux 3501 hitless switching function used in version 7.1 system software. Key differences are discussed between the current and preceding version, including improvements that were made.

This document also shows examples of how the technology can be applied on a closed ring topology or when spurred nodes are present.

### Overview

The current and latest iteration of the eXmux 3501 Hitless Switching protocol improves upon shortcomings from previous versions. The most significant improvement is that packet flooding, which was observable on earlier versions of the protocol, has now been addressed.

Packet flooding on previous versions of the Hitless Switching protocol occurs due to the nature of how each copy of the TDM over IP traffic is handled. Specifically, each copy of the traffic is sent encapsulated with a VLAN going to a destination node. The returning two copies of the traffic from the destination node going back to the source is yet encapsulated with another two VLANs different from what the source node is using. The TDM Engine MAC address of the source node is learned by the destination Node on VLANs where it doesn't transmit back. With respect to each node's perspective and since the MAC address of the TDM engines of the two communicating nodes are learned on different VLANs than the ones their traffic are transmitted, packet flooding of the TDM over IP traffic occurs across the network where the two nodes are connected.

In Version 7.1 of the eXmux system software, Hitless Switching has been slightly revamped to take care of the packet flooding occurrence found on previous versions. This is done by ensuring that TDM over IP traffic between two nodes are now transmitting and receiving using the same two VLANs. With this nature, each node learns their TDM Engine MAC Address appropriately on the same broadcast domains and therefore no longer needing to flood the TDM over IP traffic to reach its destination.

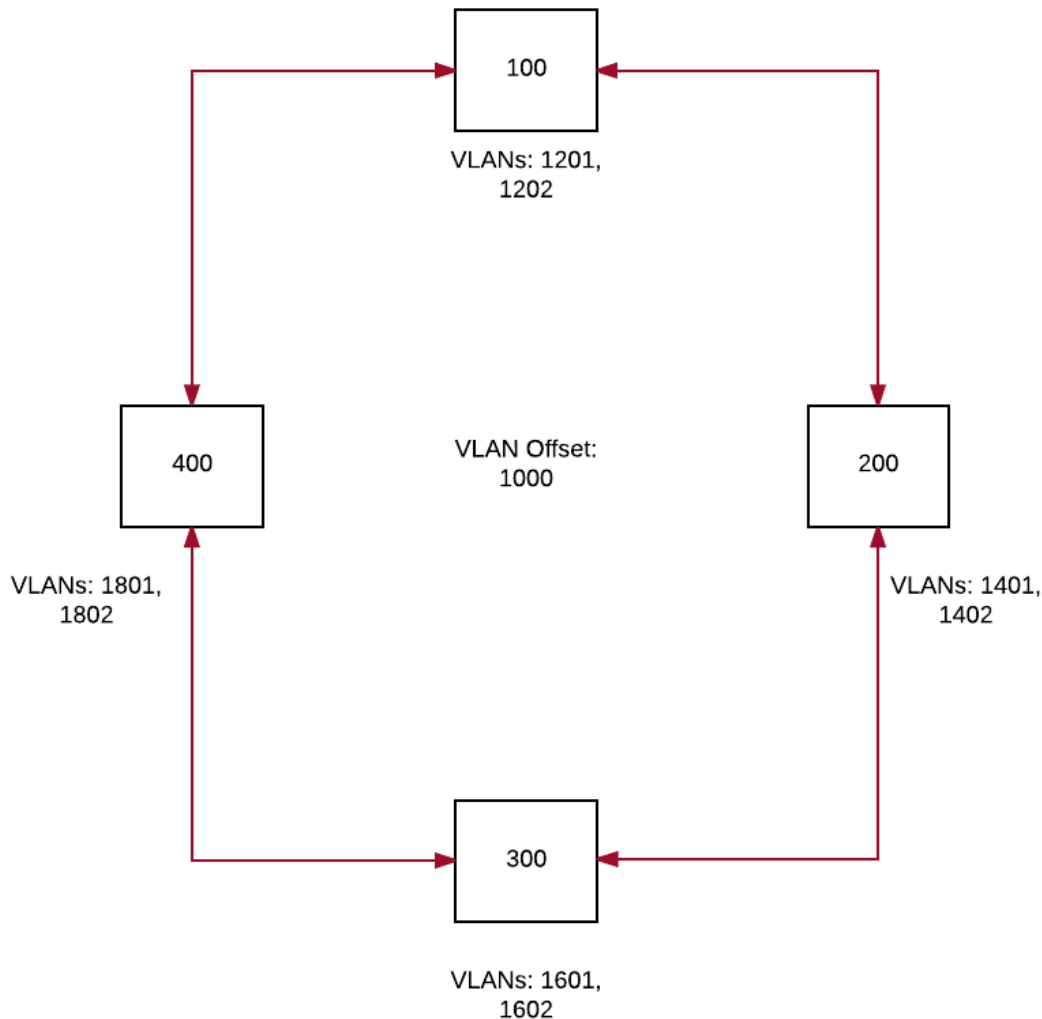
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## Application Notes

- I. The number of VLANs used in the ring for hitless switching is always equal to the number of nodes “in the ring” multiplied by 2. **Only nodes that are within the network ring are given VLAN assignments to be used for hitless switching.** The VLANs used by each node are determined using the following formulas:

- a. Main Path VLAN = [VLAN Offset + (2 x Node ID) + 1]
- b. Alternate Path VLAN = Main Path VLAN + 1

Example:

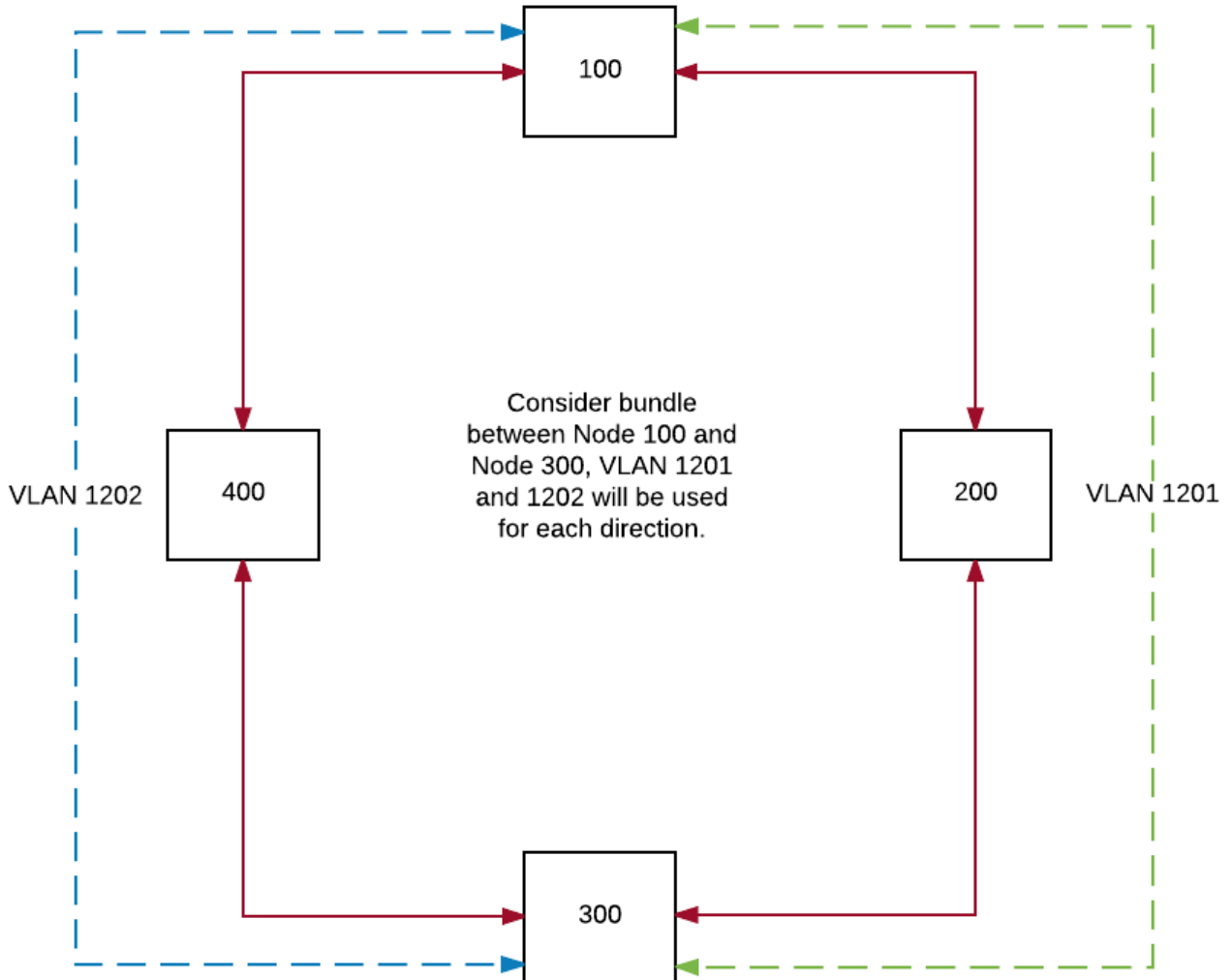


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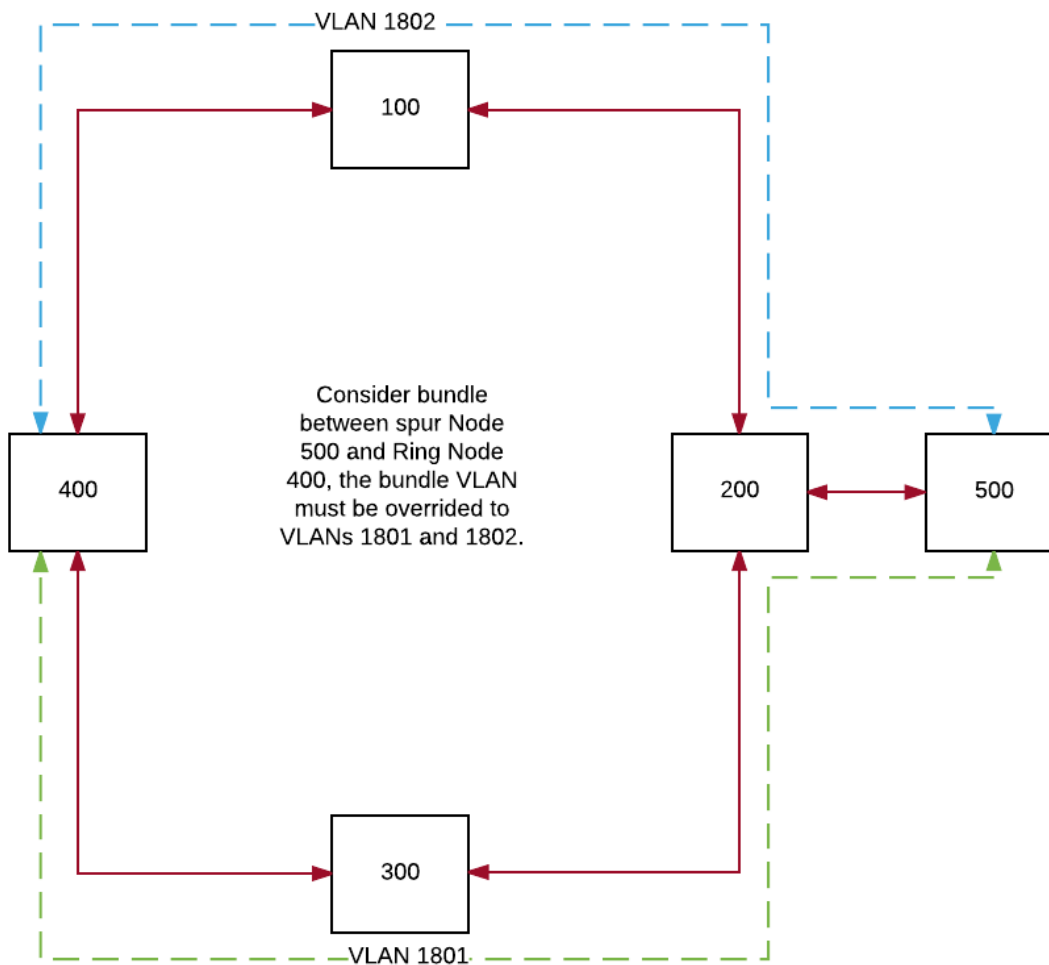
- II. When creating a TDM over IP traffic bundle between two eXmux nodes, the eXmux software compares the “Node IDs” of the two and uses the VLAN IDs assigned to the node with a lower “Node ID” to be used for propagating hitless TDM over IP data.

Example:

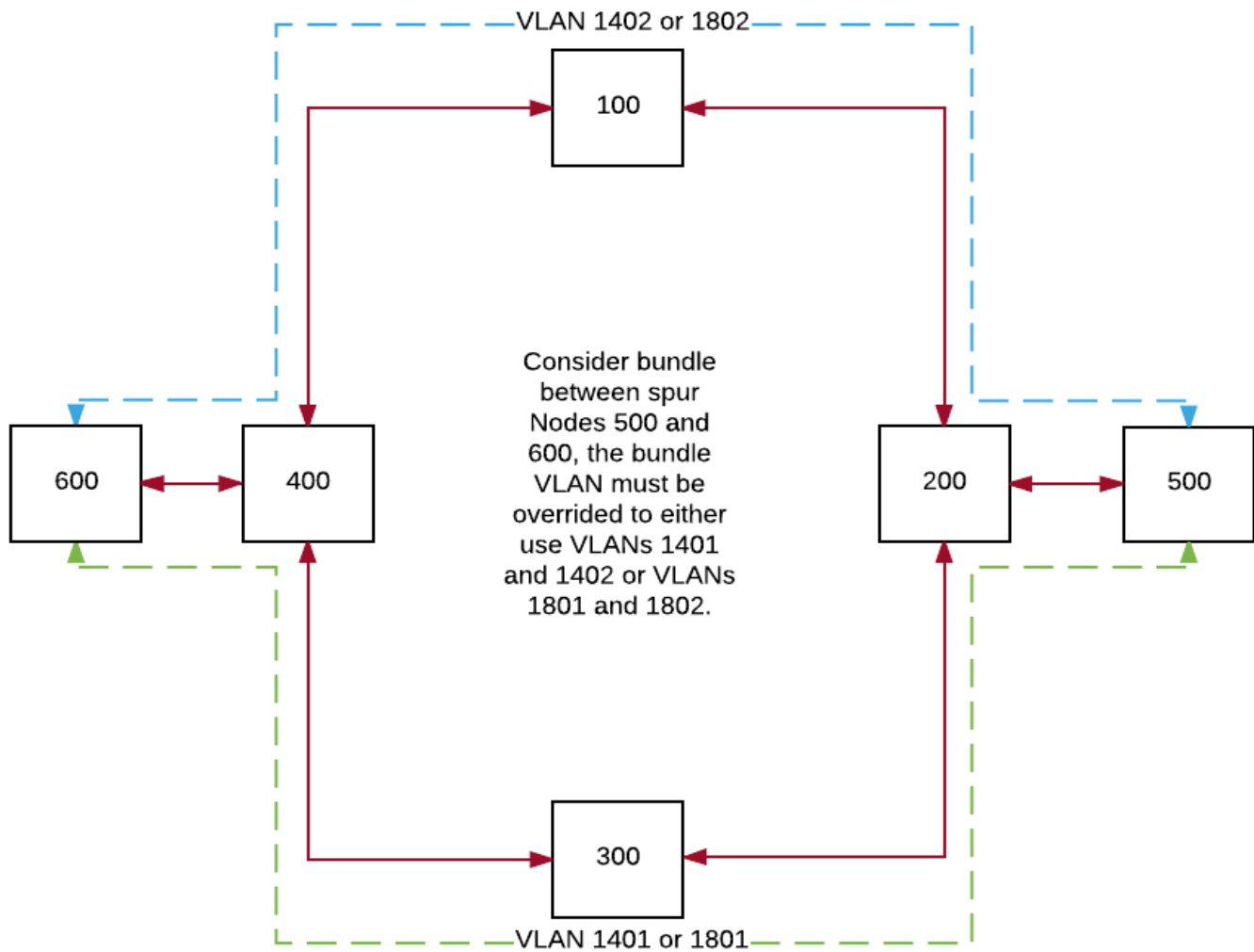


- III. Due to the nature stated on the 1<sup>st</sup> and 2<sup>nd</sup> notes, a limitation involving nodes that are spurred off the hitless ring is currently in place. Since no VLANs are assigned for spur nodes that can be propagated in the hitless ring, one must manually override the VLANs assigned for the bundles between the spur node and the node within the hitless ring or between two spur nodes that has TDM over IP traffic that needs to get propagated within the hitless ring.

Example 1:



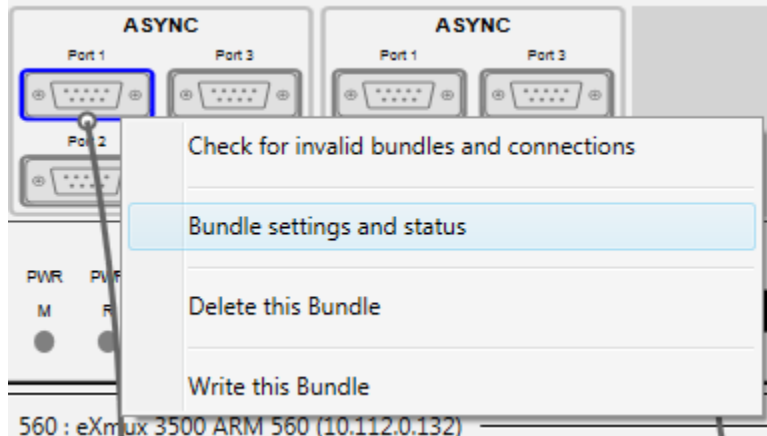
## Example 2:



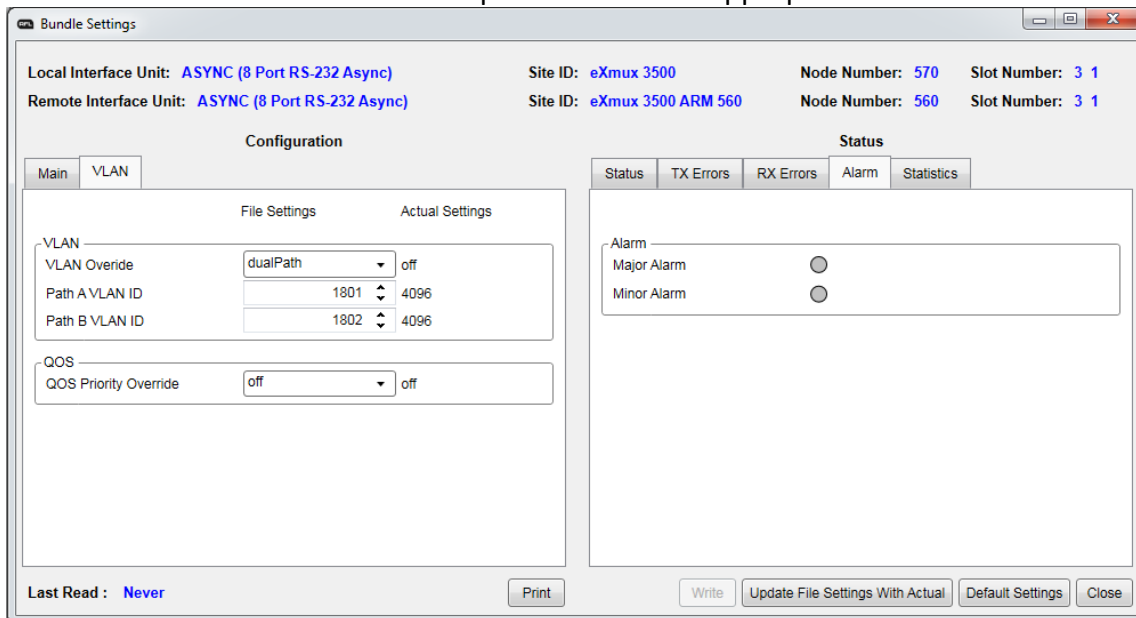
- IV. The VLAN override setting can be found after creating a bundle between two nodes in the eXmux VNMS mapping view.

Example:

1. Right click on a port included in the bundle
2. Choose “Bundle settings and status”



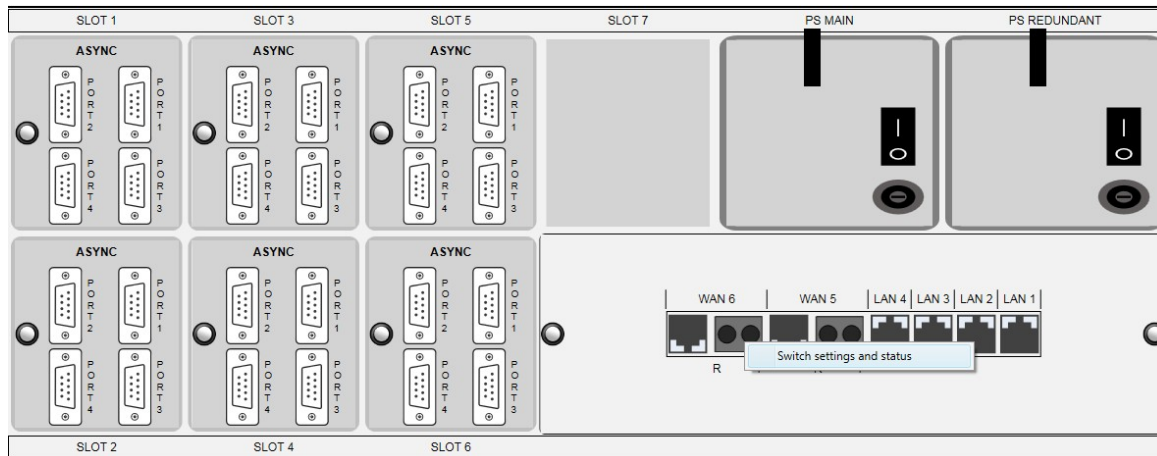
3. Choose dualPath as VLAN override option and set the appropriate VLANs on the “VLAN tab”.



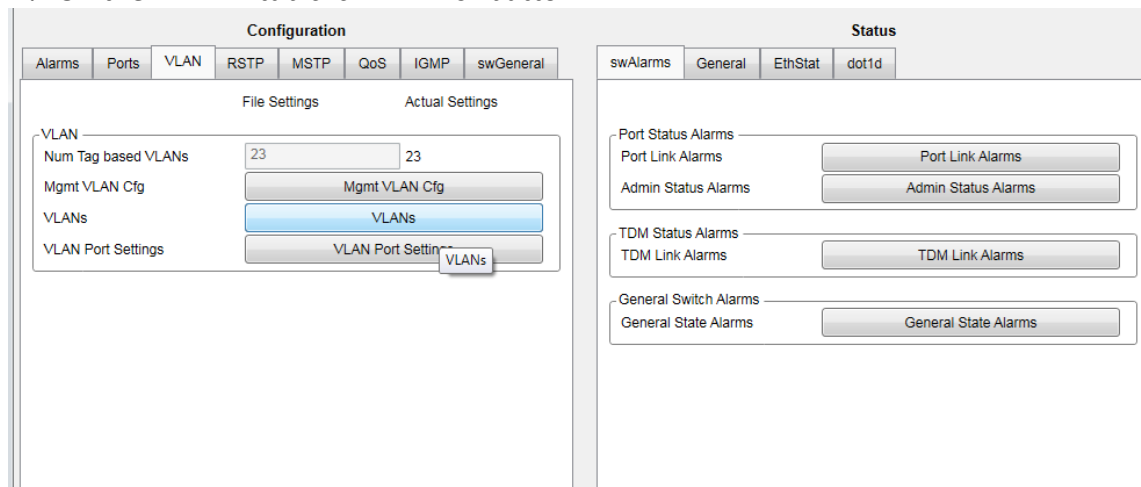
- V. VLANs assigned to nodes within the Hitless ring can be found by going to the eXmux Switch settings in the Visual Network Management Software.

Example:

1. Go to “Switch settings and status” on any node in the hitless ring.



2. On the “VLAN” tab click “VLANs” button



3. A new window will open up showing the list of all VLANs assigned to each node in the hitless ring.

Table View : eXmux 3500-ARM 150 \_ E2020 - VLANs

Interface Unit: E2020

Actual Settings		File Settings	
VLAN Name	VLAN ID	VLAN MSTI	
test	200	0	
node10_apath_vlan	1022	0	
node10_mpath_vlan	1021	0	
node20_apath_vlan	1042	0	
node20_mpath_vlan	1041	0	
node80_apath_vlan	1162	0	
node80_mpath_vlan	1161	0	
node100_apath_vlan	1202	0	
node100_mpath_vlan	1201	0	
node110_apath_vlan	1222	0	
node110_mpath_vlan	1221	0	
node140_apath_vlan	1282	0	
node140_mpath_vlan	1281	0	
node150_apath_vlan	1302	0	
node150_mpath_vlan	1301	0	
node240_apath_vlan	1482	0	
node240_mpath_vlan	1481	0	
node250_apath_vlan	1502	0	
node250_mpath_vlan	1501	0	

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- VI. Another consideration that needs to be taken into account since Spur nodes will need to use VLANs generated within a hitless ring in order to propagate traffic, the opposite behavior must be applied if an eXmux hitless ring is reverted back into normal operation mode. In other words, the VLANs used for the bundles going to a Spur node must be overridden back to default VLAN which in most cases will be VLAN 1.





## Appendix A:

Prior to version 7.1, Note #2 above is not being applied on any TDM over IP bundles between nodes and therefore each node encapsulates their TDM over IP traffic with their respective assigned VLANs. As a result, none of the nodes learn the TDM Engine MAC address of each on the correct VLAN domain and therefore would cause each to flood their TDM over IP packets across the network

## Reference Diagram:

