



Switch Clustering (SMLT/SLT/RSMLT/MSMLT) Supported Topologies and Interoperability with ERS 8600 / 5000 / 8300 / 1600

Document Version 1.2.0.0

Document Number: NN48500-555

1. Release Summary

Release Date: 26-January-2009

Purpose: This document shows the various supported topologies and features for Switch Clustering on the ERS portfolio. With each topology, please take note to where bridging, routing, and multicast are configured as these will vary between switch types.

The topologies shown in each example do not indicate scalability of the solutions. They are only representative to provide the topology architecture.

This document is not intended to show specific design or configuration parameters – for that information and scalability numbers, please refer to the Converged Campus Technical Solutions Guide (NN48500-516) and Switch Clustering using SMLT Technical Configuration Guide (NN48500-518).

2. Platforms / Software Releases

Platform	Software Release	Advanced License Req'd
Ethernet Routing Switch 8600	Release 4.1.1.1 or later	No
Ethernet Routing Switch 8300	Release 4.0.0.0 or later	Yes
Ethernet Routing Switch 1600 Series	Release 2.1.0.0 or later	No
Ethernet Routing Switch 5000 Series	Release 5.1.0.0 or later	Yes

Refer to the Release Notes for any known issues or limitations pertaining to Switch Clustering on the above products. Switch Clustering is supported on software releases prior to those listed above however, this document will use the above releases as a baseline for all interoperability topologies. If prior versions of software are being used, refer to the Release Notes and product documentation for supported topologies.

Newer software versions may be required to support specific topologies described in this document. In these instances, the required software versions are provided as additional notes to the topology.

3. Definitions

For more detailed information on Switch Clustering, please refer to:

- Converged Campus Technical Solution Guide (NN48500-516)
- Switch Clustering using SMLT Technical Configuration Guide (NN48500-518)

Switch Clustering (SC)

Switch Clustering is the logical aggregation of two Ethernet Routing Switch nodes forming one logical entity known as the Switch Cluster (SC). The two peer nodes in a SC are connected via an Inter-Switch Trunk (IST). The IST is used to exchange forwarding and routing information between the two peer nodes in the SC. Switch

Clustering uses SMLT, SLT, RSMLT, or MSMLT depending on the physical and logical network requirements. Switch Clustering is completely transparent to edge devices which connect to the Switch Cluster.

SLT

Single Link Trunking uses port-based connections at the Switch Cluster core. This feature allows for two uplinks per SLT group, one on each SC peer. The total number of SLT groups is based on the number of ports on the core switch less two which are required for the IST.

SMLT

Split MultiLink Trunking uses MLT-based connections at the Switch Cluster core. This feature allows for more than two uplinks per SMLT group. The total number of uplinks per group is limited by the number of links per group supported on the edge device. The total number of groups is based on the number of MLT groups supported on the core less one which is required for the IST.

RSMLT

Routed-SMLT (RSMLT) is an enhancement to SMLT enabling the exchange of Layer 3 information between peer nodes in a Switch Cluster for unparalleled resiliency and simplicity for both L3 and L2. RSMLT is deployed in any Layer 3 environment on the Switch Cluster; between multiple Switch Clusters in a core, between a layer 3 device and the Switch Cluster, or between a layer 2 device and the Switch Cluster. When deployed with a layer 2 edge, RSMLT is a superior alternative to VRRP – this feature is known as RSMLT-Edge.

MSMLT

Multicast SMLT combines Switch Clustering with Layer 3 PIM-SM Multicast. The supported topologies will vary based on the need for Layer 3 multicast routing in the core. These supported topologies are not bound by the unicast bridging and routing functionality, but work in conjunction with them to create useful design alternatives when both are required.

4. Document Updates

Version 1.1.0.0

ERS 8300 supports:

- #3 Triangle – Layer 2 Edge and Layer 3 Core with RSMLT Layer 2 Edge
- #4 Triangle – Layer 3 Edge and Layer 3 Core with RSMLT
- #9 Square – Layer 2 Edge and Layer 3 Core with VRRP
- #10 Square / Full Mesh – Layer 2 Edge and Layer 3 RSMLT Core

ERS 8300 does not support (correction from previous version):

- #7 Triangle MSMLT – Layer 3 PIM-SM Edge and Layer 3 PIM-SM Core

ERS 5000 supports:

- #9 Square – Layer 2 Edge (5500) and Layer 3 Core (8600) with VRRP

ERS 1600 supports:

- #9 Square – Layer 2 Edge and Layer 3 Core with VRRP with ERS 8300
- #9 Square – Layer 2 Edge and Layer 3 Core with VRRP with ERS 5500

Version 1.2.0.0

ERS 5000 supports:

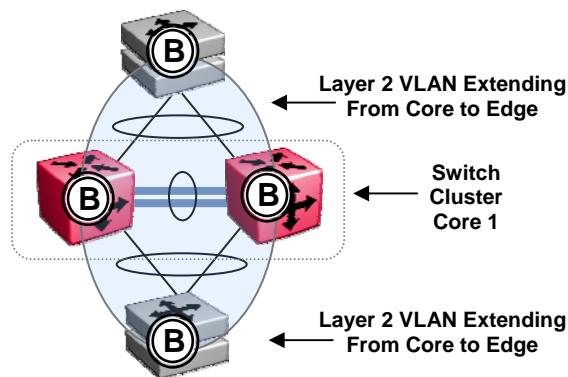
- #8 Square / Full Mesh – Layer 2 Edge and Layer 2 Core (Square / Full Mesh stack)
- #9 Square – Layer 2 Edge and Layer 3 Core in stack (Square / Full Mesh stack)

5. Supported Topologies

#1 Triangle – Layer 2 Edge and Layer 2 Core

Switch Clustering configuration with a single Switch Cluster Core and dual-connected edge devices. This topology represents a single VLAN spanning the edge devices. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported



Ⓟ = Bridging

Switch Cluster Core 1	Triangle Topology	Notes
ERS 8600	✓	
ERS 8300	✓	
ERS 5000	✓	Standalone / Stack
ERS 1600	✓	

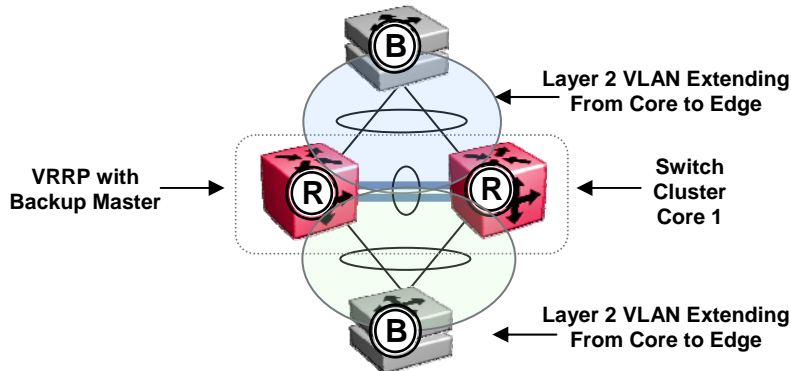
Additional Notes

- ERS 5000 does not support LACP over SMLT/SLT at this time.

#2 Triangle – Layer 2 Edge and Layer 3 Core with VRRP

Switch Clustering configuration with a single Switch Cluster Core and dual-connected edge devices. This topology represents different VLAN(s) spanning from each edge device(s) and those VLANs being routed at the Switch Cluster Core. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- The Switch Cluster core will have VRRP and Backup Master enabled per Layer 2 VLAN(s)



(R) = Routing

(B) = Bridging

Switch Cluster Core 1	Triangle Topology	Notes
ERS 8600	✓	
ERS 8300	✓	
ERS 5000	✓	Standalone / Stack
ERS 1600	✓	

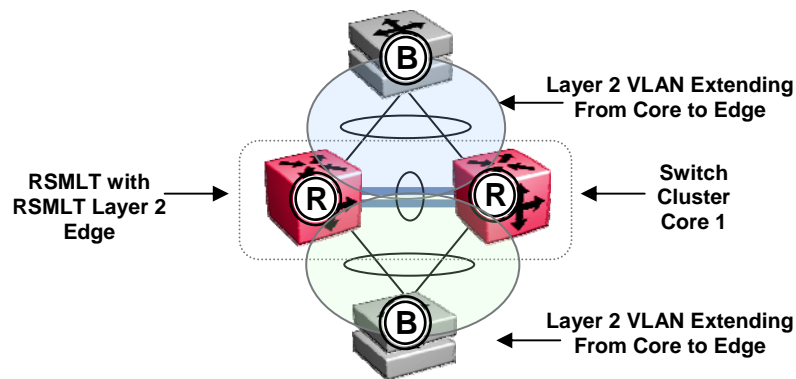
Additional Notes

- ERS 5000 does not support LACP over SMLT/SLT at this time.

#3 Triangle – Layer 2 Edge and Layer 3 Core with RSMLT Layer 2 Edge

Switch Clustering configuration with a single Switch Cluster Core and dual-connected edge devices. This topology represents different VLAN(s) spanning from each edge device(s) and those VLANs being routed at the Switch Cluster Core. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- The Switch Cluster core will have RSMLT Layer 2 Edge enabled per Layer 2 Edge VLAN(s)
- The RSMLT Layer 2 Edge feature is recommended as an alternative to VRRP
- RSMLT Layer 2 Edge and VRRP should not be enabled simultaneously on the same VLAN



Ⓡ = Routing
 Ⓟ = Bridging

Switch Cluster Core 1	Triangle Topology	Notes
ERS 8600	✓	
ERS 8300	✓	

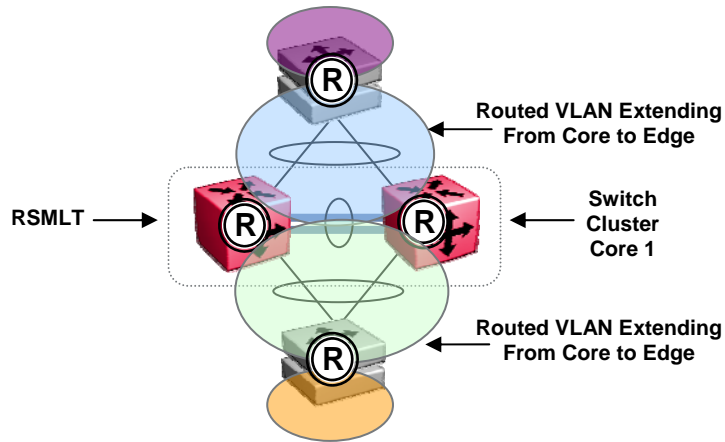
Additional Notes

- ERS 8600 RSMLT Edge support requires Release 4.1.4.0 or later.
- ERS 8300 RSMLT support requires Release 4.1.0.0 or later.

#4 Triangle – Layer 3 Edge and Layer 3 Core with RSMLT

Switch Clustering configuration with a single Switch Cluster Core and dual-connected edge devices. This topology represents routing from each the edge device(s) into the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- The Switch Cluster core will have RSMLT enabled on the VLANs routed to the edge devices
- The RSMLT feature will also permit VLANs to be bridged from the edge to the Switch Cluster Core if necessary



Ⓜ = Routing

Switch Cluster Core 1	Triangle Topology	Notes
ERS 8600	✓	
ERS 8300	✓	

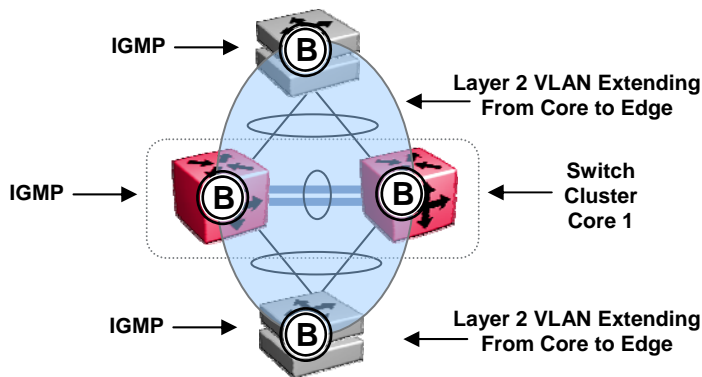
Additional Notes

- ERS 8300 RSMLT support requires Release 4.1.0.0 or later.

#5 Triangle Multicast – Layer 2 IGMP Edge and Layer 2 IGMP Core

Switch Clustering configuration with a single Switch Cluster Core and dual-connected edge devices. This topology represents a single VLAN spanning from each edge device(s). Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- The Switch Cluster Core and edge device(s) will have IGMP enabled on the Layer 2 VLAN(s).
- A multicast router or multicast querier function must be present on the network for IGMP snooping and proxy to work



ⓑ = Bridging

Switch Cluster Core 1	Triangle Topology	Notes
ERS 8600	✓	
ERS 8300	✓	
ERS 1600	✓	

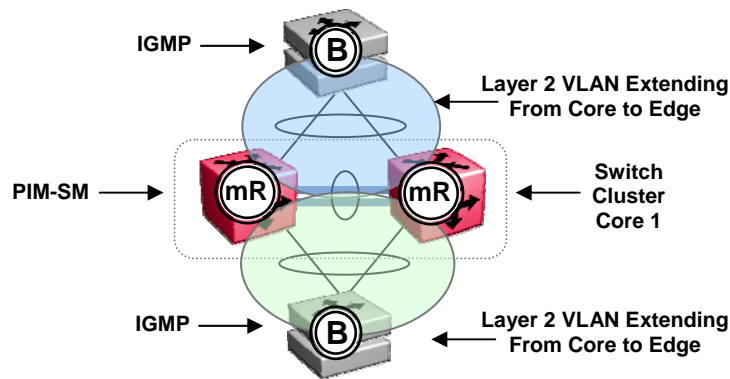
Additional Notes

- The ERS 8300 (Release 4.0.x or later) supports an IGMP Querier function. This can be enabled in layer 2 and therefore negates the requirement of a multicast router to perform the querier functionality.
- The ERS 5000 does not support IGMP over SMLT/SLT at this time and therefore cannot be used as a Switch Cluster Core in this topology.

#6 Triangle Multicast – Layer 2 IGMP Edge and Layer 3 PIM-SM Core

Switch Clustering configuration with a single Switch Cluster Core and dual-connected edge devices. This topology represents different VLAN(s) spanning from each edge device(s) and those VLANs being routed at the Switch Cluster Core. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- The edge device(s) will have IGMP enabled on the Layer 2 VLAN(s)
- The Switch Cluster Core will have PIM-SM enabled on the VLAN(s)



(mR) = Multicast Routing

(B) = Bridging

Switch Cluster Core 1	Triangle Topology	Notes
ERS 8600	✓	
ERS 8300	✓	
ERS 1600	✓	

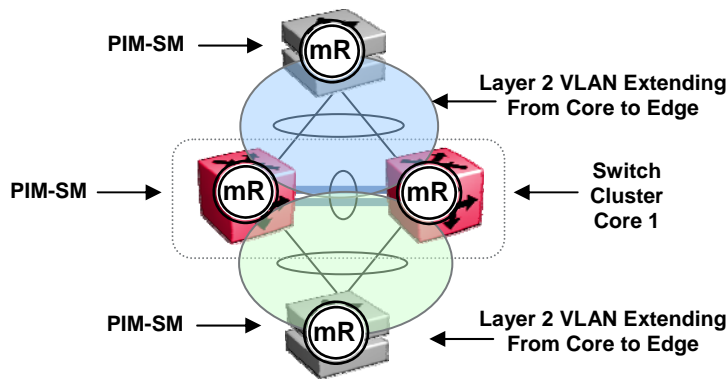
Additional Notes

- The ERS 5000 does not support PIM-SM over SMLT/SLT at this time and therefore cannot be used as a Switch Cluster Core in this topology.

#7 Triangle MSMLT – Layer 3 PIM-SM Edge and Layer 3 PIM-SM Core

Switch Clustering configuration with a single Switch Cluster Core and dual-connected edge devices. This topology represents different VLAN(s) spanning from each edge device(s) and those VLANs being routed at the Switch Cluster Core. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- The Switch Cluster Core and edge device(s) will have PIM-SM enabled on the VLAN(s)
- Switch Cluster Core 1 will have either VRRP/Backup Master or RSMLT Layer 2 Edge enabled per Layer 2 Edge VLAN(s)



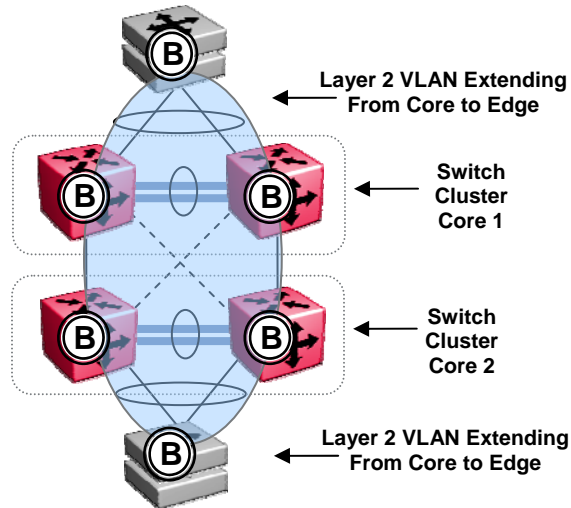
 = Multicast Routing

Switch Cluster Core 1	Triangle Topology	Notes
ERS 8600	✓	

#8 Square / Full Mesh – Layer 2 Edge and Layer 2 Core

Switch Clustering configuration with two Switch Cluster Cores and dual-connected edge devices. This topology represents a single VLAN spanning the edge devices and the Switch Cluster Cores. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported



(B) = Bridging

----- Connections required for Full Mesh Configuration

Switch Cluster Core 1	Switch Cluster Core 2	Square Topology	Full Mesh Topology	Notes
ERS 8600	ERS 8600	✓	✓	
ERS 8600	ERS 8300	✓	✓	
ERS 8600	ERS 1600	✓		
ERS 8600	ERS 5000	✓	✓	ERS 5000 Standalone or Stack
ERS 8300	ERS 8300	✓	✓	
ERS 8300	ERS 8600	✓	✓	
ERS 1600	ERS 1600	✓		
ERS 1600	ERS 8600	✓		
ERS 5000	ERS 5000	✓	✓	ERS 5000 Standalone or Stack
ERS 5000	ERS 8600	✓	✓	ERS 5000 Standalone or Stack

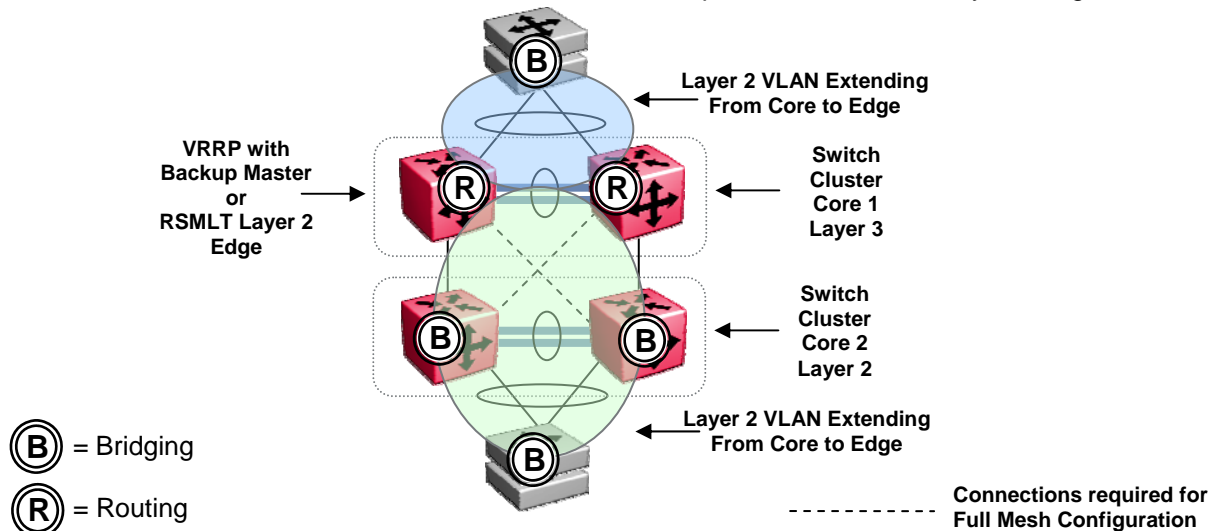
Additional Notes

- ERS 5000 does not support LACP over SMLT/SLT at this time.
- ERS 8600/ERS 5000 Stack in Square requires ERS 5000 Release 5.1.1 or later
- ERS 8600/ERS 5000 Stack in Full Mesh requires ERS 5000 Release 6.0.0 or later
- ERS 5000/ERS 5000 Stack in Full Mesh requires ERS 5000 Release 6.0.0 or later

#9 Square / Full Mesh – Layer 2 Edge and Layer 3 Core

Switch Clustering configuration with two Switch Cluster Cores and dual-connected edge devices. This topology represents different VLANs spanning the edge devices and the Switch Cluster Cores. Only one of the Switch Cluster Cores performs Layer 3 routing, while the other is strictly Layer 2. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Cores.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- Switch Cluster Core 1 will have either VRRP/Backup Master or RSMLT Layer 2 Edge enabled



Switch Cluster Core 1	Switch Cluster Core 2	Square Topology	Full Mesh Topology	Notes
ERS 8600	ERS 8600	✓	✓	
ERS 8600	ERS 8300	✓	✓	
ERS 8600	ERS 1600	✓		
ERS 8600	ERS 5000	✓	✓	ERS 5000 Standalone or Stack
ERS 8300	ERS 8300	✓	✓	
ERS 8300	ERS 8600	✓	✓	
ERS 8300	ERS 1600	✓		
ERS 8300	ERS 5000	✓	✓	ERS 5000 Standalone or Stack
ERS 1600	ERS 1600	✓		
ERS 1600	ERS 8600	✓		
ERS 1600	ERS 8300	✓		
ERS 1600	ERS 5000	✓		
ERS 5000	ERS 5000	✓	✓	ERS 5000 Standalone or Stack
ERS 5000	ERS 8600	✓	✓	ERS 5000 Standalone or Stack

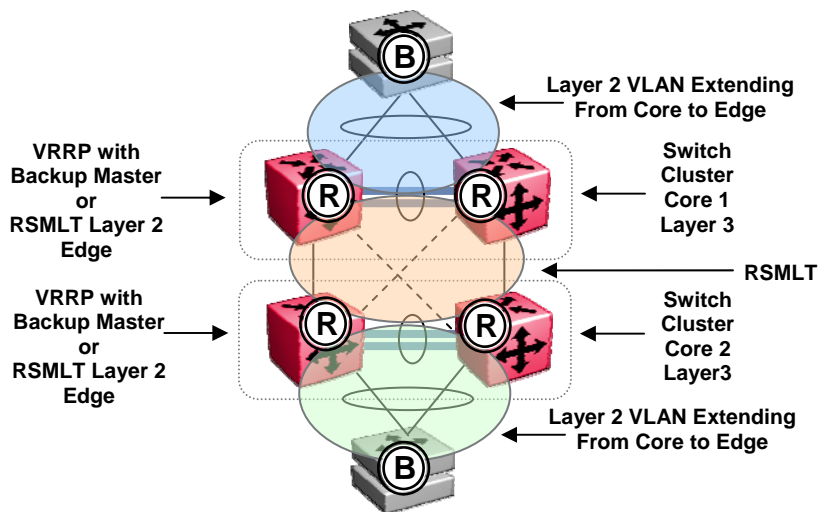
Additional Notes

- ERS 5000 does not support LACP over SMLT/SLT at this time.
- ERS 8600/ERS 5500 Stack in Square requires ERS 5500 Release 5.1.1 or later
- ERS 8600/ERS 5000 Stack in Full Mesh requires ERS 5000 Release 6.0.0 or later
- ERS 5000/ERS 5000 Stack in Full Mesh requires ERS 5000 Release 6.0.0 or later

#10 Square / Full Mesh – Layer 2 Edge and Layer 3 RSMLT Core

Switch Clustering configuration with two Switch Cluster Cores and dual-connected edge devices. This topology represents different VLANs spanning the edge devices and the Switch Cluster Cores. Each Switch Cluster Cores performs routing and uses RSMLT between the Switch Cluster cores running in conjunction with Static, RIP, OSPF, or BGP. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Cores.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- Switch Cluster Cores will have either VRRP/Backup Master or RSMLT Layer 2 Edge enabled per Layer 2 Edge VLAN(s)
 - If VRRP used, it will not be enabled on the RSMLT VLAN between Switch Cluster Cores
- A Layer 2 VLAN can be overlaid across this topology (see #8) if required



ⓑ = Bridging
 Ⓡ = Routing

----- Connections required for Full Mesh Configuration

Switch Cluster Core 1	Switch Cluster Core 2	Square Topology	Full Mesh Topology	Notes
ERS 8600	ERS 8600	✓	✓	
ERS 8600	ERS 8300	✓	✓	
ERS 8300	ERS 8300	✓	✓	
ERS 8300	ERS 8600	✓	✓	

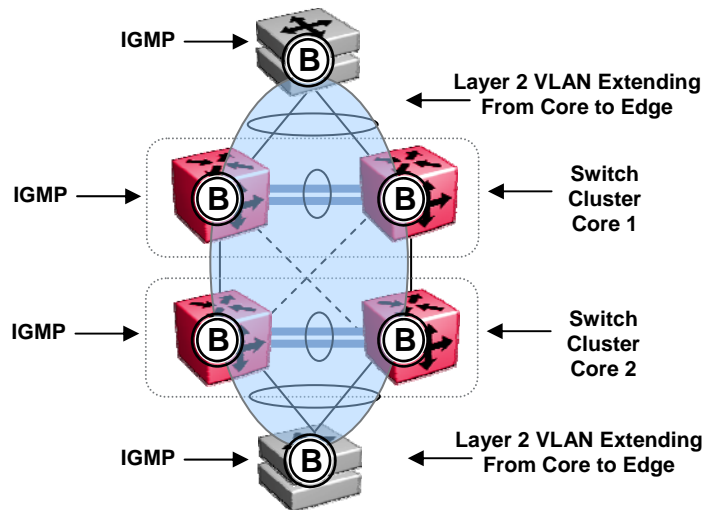
Additional Notes

- ERS 8300 RSMLT support requires Release 4.1.0.0 or later.

#11 Square / Full Mesh Multicast – Layer 2 IGMP Edge and Layer 2 IGMP Core

Switch Clustering configuration with two Switch Cluster Cores and dual-connected edge devices. This topology represents a single VLAN spanning from each edge device(s). Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Core.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- The Switch Cluster Cores and edge device(s) will have IGMP enabled on the Layer 2 VLAN(s)
- A multicast router or multicast querier function must be present on the network for IGMP snooping and proxy to work



(B) = Bridging

----- Connections required for Full Mesh Configuration

Switch Cluster Core 1	Switch Cluster Core 2	Square Topology	Full Mesh Topology	Notes
ERS 8600	ERS 8600	✓	✓	
ERS 8600	ERS 8300	✓	✓	ERS 8300 multicast querier
ERS 8600	ERS 1600	✓		
ERS 8300	ERS 8300	✓	✓	ERS 8300 multicast querier
ERS 8300	ERS 8600	✓	✓	ERS 8300 multicast querier
ERS 1600	ERS 1600	✓		
ERS 1600	ERS 8600	✓		

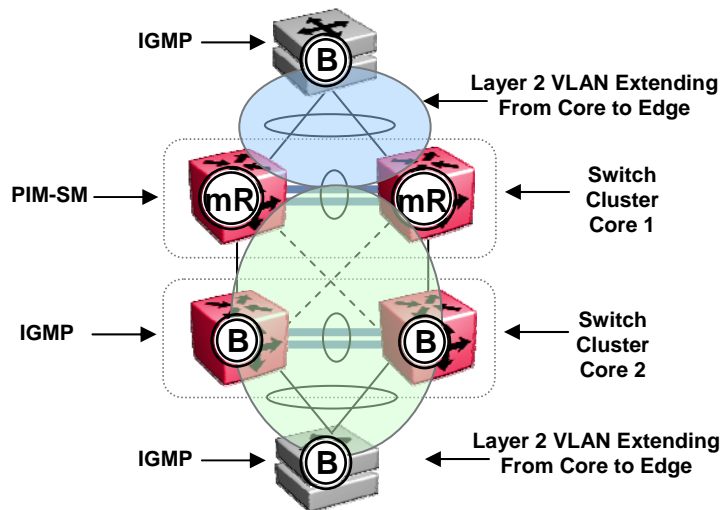
Additional Notes

- The ERS 8300 (Release 4.0.x or later) supports an IGMP Querier function. This can be enabled in layer 2 and therefore negates the requirement of a multicast router to perform the querier functionality.

#12 Square / Full Mesh MSMLT – Layer 2 IGMP Edge and Layer 3 PIM-SM Core

Switch Clustering configuration with two Switch Cluster Cores and dual-connected edge devices. This topology represents different VLANs spanning the edge devices and the Switch Cluster Cores. Only one of the Switch Cluster Cores performs Layer 3 multicast routing, while the other is strictly Layer 2. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Cores.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- Switch Cluster Core 1 will have PIM-SM enabled per Layer 2 VLAN(s)
- Switch Cluster Core 2 and the edge device(s) will have IGMP enabled
- Switch Cluster Core 1 will have either VRRP/Backup Master or RSMMLT Layer 2 Edge enabled per Layer 2 Edge VLAN(s)



(mR) = Multicast Routing

(B) = Bridging

----- Connections required for Full Mesh Configuration

Switch Cluster Core 1	Switch Cluster Core 2	Square Topology	Full Mesh Topology	Notes
ERS 8600	ERS 8600	✓	✓	
ERS 8600	ERS 8300	✓	✓	
ERS 8600	ERS 1600	✓		

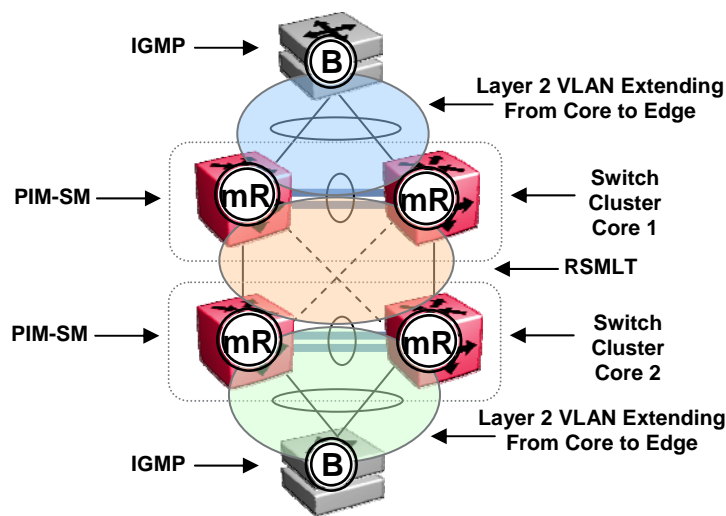
Additional Notes

- The ERS 5000 does not support IGMP over SMLT/SLT at this time and therefore cannot be used as a Switch Cluster Core in this topology.
- The ERS 5000 does not support PIM-SM over SMLT/SLT at this time and therefore cannot be used as a Switch Cluster Core in this topology.

#13 Square / Full Mesh MSMLT – Layer 2 IGMP Edge and Layer 3 PIM-SM Core

Switch Clustering configuration with two Switch Cluster Cores and dual-connected edge devices. This topology represents different VLANs spanning the edge devices and the Switch Cluster Cores. Both of the Switch Cluster Cores performs Layer 3 multicast routing, while the edge device(s) are Layer 2 IGMP. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Cores.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- Switch Cluster Cores will have PIM-SM enabled per Layer 2 VLAN(s)
- The edge device(s) will have IGMP enabled
- Switch Cluster Cores will have either VRRP/Backup Master or RSMLT Layer 2 Edge enabled per Layer 2 Edge VLAN(s)
 - If VRRP used, it will not be enabled on the RSMLT VLAN between Switch Cluster Cores



(mR) = Multicast Routing

(B) = Bridging

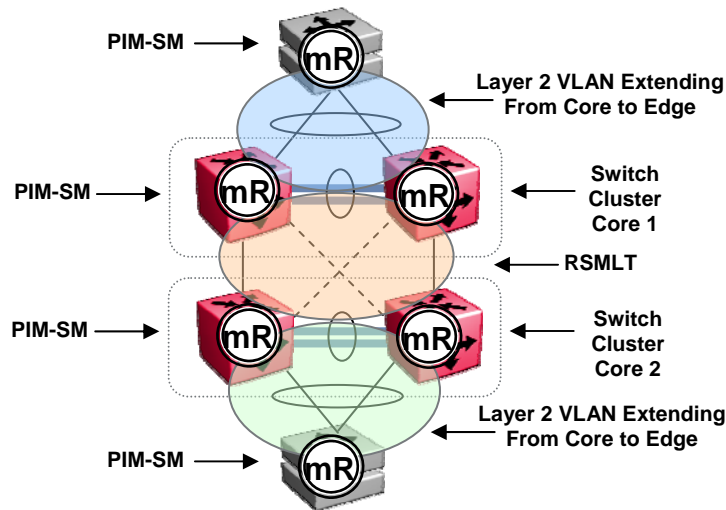
----- Connections required for Full Mesh Configuration

Switch Cluster Core 1	Switch Cluster Core 2	Square Topology	Full Mesh Topology	Notes
ERS 8600	ERS 8600	✓	✓	

#14 Square / Full Mesh MSMLT – Layer 3 PIM-SM Edge and Layer 3 PIM-SM Core

Switch Clustering configuration with two Switch Cluster cores and dual-connected edge devices. This topology represents different VLANs spanning the edge devices and the Switch Cluster Cores. Both of the Switch Cluster Cores as well as the edge device(s) performs Layer 3 multicast routing. Multiple VLANs can be configured on the edge devices and 802.1Q tagged to the Switch Cluster Cores.

- Any edge device that supports a form of Link Aggregation is supported
- Spanning Tree must be disabled on the edge device(s) link aggregation group
- SLT and SMLT configurations supported
- Switch Cluster Cores and edge device(s) will have PIM-SM enabled per Layer 2 VLAN(s)
- Switch Cluster Cores will have either VRRP/Backup Master or RSMLT Layer 2 Edge enabled per Layer 2 Edge VLAN(s)
 - If VRRP used, it will not be enabled on the RSMLT VLAN between Switch Cluster Cores



 = Multicast Routing

----- Connections required for Full Mesh Configuration

Switch Cluster Core 1	Switch Cluster Core 2	Square Topology	Full Mesh Topology	Notes
ERS 8600	ERS 8600	✓	✓	

Additional Notes

- The ERS 8300 is not supported in the core or at the edge in this topology.

5. Switch Clustering – Best Practice Feature Support

With the implementation of Switch Clustering, there are several protection features that are recommended for use to ensure a solid and resilient infrastructure. For a detailed discussion on each of these features and their recommended values, please refer to the Converged Campus Technical Solutions Guide (NN48500-516) and the Switch Clustering using SMLT Technical Configuration Guide (NN48500-518). The table below lists the protection features and their support in the various Ethernet Routing Switch platforms.

Hardware Platform	Software Release	cp-limit	ext-cp-limit	VLACP	SLPP
ERS 8600	3.7.0-3.7.4	Yes	N/A	Yes	N/A
ERS 8600	3.7.5-3.7.x	Yes	Yes ¹	Yes	N/A
ERS 8600	4.0.x	Yes	N/A	Yes	N/A
ERS 8600	4.1.x – 5.0.x	Yes	Yes ²	Yes	Yes
ERS 8300	3.x	Yes	N/A	N/A	N/A
ERS 8300	4.0.x	Yes	N/A	N/A	Yes
ERS 8300	4.1.x	Yes	N/A	Yes	Yes
ERS 5000	5.0.x – 5.1.x	N/A	N/A	Yes	N/A
ERS 5000	6.0.x	Yes	N/A	Yes	Yes
ERS 1600	2.1.x	Yes	N/A	N/A	N/A

¹ HardDown

² SoftDown

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