Ethernet Routing Switch
3500, 4000, 5900, 8000
Virtual Services Platform
4000, 7000, 7200, 8000, 9000

Engineering

> Link Aggregation Control Protocol 802.1AX (802.3ad) and VLACP for VSP and ERS Technical Configuration Guide

Avaya Data Solutions

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Abstract

This technical configuration guide (TCG) provides an overview on how to configure LACP 802.1AX (802.3ad) Link Aggregation for the Avaya Ethernet Routing Switch (ERS) and Virtual Services Platform (VSP) switches. Concepts will include LACP, LACP with SMLT, LACP with Single Link SMLT, and VLACP.

Acronym Key

Throughout this guide the following acronyms will be used:

- LACP: Link Aggregation Protocol
- VLACP: Virtual Link Aggregation Protocol
- MLT: Multilink Trunking

Revision Control

No	Date	Version	Revised By	Remarks
2	Sept 19, 2011	4.7	John Vant Erve	Added VSP 9000, updates regarding ERS4000 series and ERS5000 series. Added EDM configuration for LACP/VLACP
3	March 24, 2014	4.8	John Vant Erve	Added LACP update regarding rear-port mode on the VSP 7000. Added the VSP 4000. Added additional updated information pertaining to LACP.
4	February, 2015	4.9	John Vant Erve	Added interface lacp key to configuration example in chapter 5.5.
5	January, 2016	5.0	John Vant Erve	Addition of ERS 5900, VSP 7200, and VSP 8000

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Conventions

This section describes the text, image, and command conventions used in this document.

Symbols

Tip – Highlights a configuration or technical tip.

Note – Highlights important information to the reader.

Warning – Highlights important information about an action that may result in equipment damage, configuration or data loss.

Text

Bold text indicates emphasis.

Italic text in a Courier New font indicates text the user must enter or select in a menu item, button or command:

```
ERS5520-48T# show running-config
```

Output examples from Avaya devices are displayed in a Lucida Console font:

```
ERS5520-48T# show sys-info

Operation Mode:          Switch
MAC Address:             00-12-83-93-B0-00
PoE Module FW:           6370.4
Reset Count:             83
Last Reset Type:         Management Factory Reset
Power Status:            Primary Power
Autotopology:            Enabled
Pluggable Port 45:       None
Pluggable Port 46:       None
Pluggable Port 47:       None
Pluggable Port 48:       None
Base Unit Selection:     Non-base unit using rear-panel switch
sysDescr:                Ethernet Routing Switch 5520-48T-PWR
                         HW:02       FW:6.0.0.10  SW:v6.2.0.009
                         Mfg Date:12042004    HW Dev:H/W rev.02
```

1. Overview: 802.1AX (802.1ad) Link Aggregation Protocol (LACP)

IEEE 802.1AX (802.3ad) based link aggregation allows you to aggregate two or more links together to form Link Aggregation Groups (LAG's) such that a MAC client can treat the Link Aggregation Group as if it were a single link. Although IEEE 802.1AX-based link aggregation and MultiLink Trunking (MLT) features provide similar services, MLT is statically defined, whereas IEEE 802.1AX-based link aggregation is dynamic and provides more functionality through the link aggregation control protocol (LACP). LACP dynamically detects whether links can be aggregated into a link aggregation group and does so when links become available.

IEEE 802.1AX was designed for point-to-point link aggregation only. However, the Ethernet Routing Switch 8000, Ethernet Routing Switch 5000, Virtual Services Platform 7000, Virtual Services Platform 4000/7200/8000, and Virtual Services Platform 9000 have been implemented to provide extensions to support IEEE 802.3ad in Split MultiLink Trunking (SMLT) configurations, thereby allowing any IEEE 802.3ad-capable device to be connected to an SMLT aggregation pair.

1.1 LACP and Link-Layer Failure Detection

Aside from automatic link aggregation, a side benefit of running LACP is its ability to detect link-layer failure within a service provider's network. LACP packets are exchanged end-to-end, thus if a link in the core were to fail and the local port(s) do not register the failure, LACP will time out and remove the port from the LAG. The default LACP settings, with the long timers, will remove the port from the LAG in 90 seconds. If short timers were used, the port can be removed in 3 seconds.

1.2 LACP and SMLT

The IEEE 802.1AX Link aggregation control protocol can also be extended to a pair of SMLT switches. With this extension, the ERS8000, ERS5000, VSP 8000, VSP 7200, VSP 4000, VSP 7000, and VSP 9000 switch now provides a standardized external link aggregation interface to third party vendor IEEE 802.1AX implementations.

1.3 LACP – Link Speed

To maintain MLT and LAG stability during failover, Avaya recommends the use of CANA: you must configure the advertised speed to be the same for all MLT/LACP links. For 10/100/1000Mbps ports, ensure that CANA uses only one specific setting, for example, 1000-full or 100-full. Otherwise, a remote device could restart Auto-Negotiation and the link could use a different capability. In the case of LACP LAGs, ports of different speeds cannot join the same LAG.

It is important that each port uses only one speed and duplex mode. The use of CANA forces this setting. This way, all links in Up state are guaranteed to have the same capabilities. If Auto-Negotiation and CANA are not used, the same speed and duplex mode settings should be used on all ports of the MLT/LAG.

1.4 LACP – Adding or removing VLAN to an active LAG

To either add or remove a VLAN to an active LACP LAG, the following minimum software levels must be used:

- VSP 9000: 3.2.0
- VSP 7000: 10.2.0
- ERS 8800: 7.1.3
- ERS 5000: 6.3.0
- ERS 4000: 5.6.0

The VSP 4000, VSP 7200, and VSP 8000 support adding or removing a VLAN to an active LACP LAG.

Please note that LACP must still be disabled to either add or remove individual ports from a VLAN on a LACP-enable MLT.

1.5 VMware ESXi LACP

Although LACP is supported by VMware, it is still recommended to use WMware NIC teaming load balancing which does not require LACP active on the connecting switch, i.e. a regular MLT or SMLT/SLT can be used on the Avaya switch. For more information regarding VMware NIC teaming setup, please refer to the *Resilient Data Center Solutions using the VSP 7000 Technical Configuration Guide* publication number NN48500-645.

If you do choose to use LACP on the ESXi server, please note the following:

- LACP is available on ESXi 5.1, 5.5, and 6.0
- You will need to use Web Manger to create a LACP LAG
- Via Web Manager, you will need to create a Distributed Switch with a Distributed Port Group for the LAG group
- By default, VMware uses LACP long timers and you cannot change to LACP short timers via Web Mangers; LACP short timer can only be provisioned via the ESXi CLI

1.6 VLACP

Virtual LACP (VLACP) is an extension to LACP, used to detect end-to-end failure. VLACP takes the point-to-point hello mechanism of LACP and uses it to periodically send hello packets to ensure end-to-end reachability and provide failure detection (across any L2 domain). VLACP can detect a failure on a single leg (Tx or Rx) or both legs (both Tx and Rx) of a link. The benefit of this over LACP is that VLACP timers can be reduced to 30 milliseconds between a pair of ERS8000 switches or between a pair of VSP9000 switches; note that the ERS8000 requires either 8692SF with SuperMezz or an 8895SF for sub-100-ms failover.

Although functions such as *Remote fault indication (RFI)* or Far-*end fault indication (FEFI)* can be used to indicate link failure, there are some limitations with these mechanisms. The first limitation is that with either of these mechanisms, they terminate at the next Ethernet hop. Hence, failures cannot be detected on an end-to-end basis over multiple hops such as LAN Extension services. The second limitation is both of these mechanisms required Auto-Negotiation to be enabled on the Ethernet interface. Hence, if an

Ethernet interface does not support Auto-Negotiation; neither of these mechanisms can be used. The third limitation is if an Ethernet interface should fail and still provide a transmit signal, RFI nor FEFI will be able to detect a failure. Hence, the far-end interface will still think the link up and continue to transmit traffic.

VLACP will only work for port-to-port applications when there is a guarantee for a logical port-port match. It will not work in a port-to-multi-port scenario where there is no guarantee for a point-point match.

VLACP can also be used with Avaya's proprietary aggregation mechanism (MLT) to complement its capabilities and provide quick failure detection. VLACP is recommended for all SMLT access links when the links are configured as MLT to ensure both end devices are able to communicate. By using VLACP over Single-Port SMLT, enhanced failure detection is extended beyond the limits of the number of SMLT or LACP instances that can be created on an Avaya switch.

VLACP can also be used as a loop prevention mechanism in SMLT configurations. It also protects against CPU failures by causing traffic to be switched or rerouted to the SMLT peer in the case the CPU fails or gets hung up. Please refer to the *Switch Clustering using Split Multi-Link Trunking (SMLT) with Technical Configuration Guide* for more details. The publication number for this document is NN48500-518.

Please note that VLACP does not perform link aggregation. Is it simply used to detect end-to-end link failures and can be enabled over single links or even MLT trunks. VLACP does not require LACP to be enabled; LACP and VLACP are independent features.

When configuring VLACP, both ends of the link must be configured with the same EtherType, Multicast MAC address, and timers. By default, the VLACP parameters across all VSP and ERS switches are the same with the exception of the FastPeriodicTimer which is set to 200ms on the ERS 8000, VSP 9000, VSP 8000, VSP 7200, and VSP 4000, and 500ms on all other switches. When connecting, for example, a VSP 8000 to a VSP 7000, ERS 5900, ERS 4000 or ERS 5000, the recommendation is to use 500ms FastPeriodicTimers with ShortTimeout and a TimeoutScale of 5 in order to achieve fast failover.

Although you can enable VLACP with LACP, Avaya does not recommend using VLACP and LACP on the same links. If VLACP is used with LACP, there is no difference in how VLACP and LACP bring down a port if no LACP or VLACP PDUs are received. VLACP will declare the VLACP status as down and will report the event in the log file whereas LACP will not synchronize, not activate Collecting and Distributing on this port, and not report a message in the log file. The end result is the same where the port will block traffic; the physical layer for this port will remain up.

For the VSP 9000, VSP 8000, VSP 7200, VSP 4000, and ERS8000, when you enable VLACP, the link is immediately put into non-forwarding state until a VLACP PDU is received.

The switch is able to detect certain type's unidirectional communication outage. With the addition of two VLACP Protocol Data Unit (PDU) subtypes, DOWN and HOLD, the switch manages certain operational situations better. For example:

- When a VLACP partner stops receiving PDUs from the other end (often due to certain types of unidirectional communication failures) the partner transmits a VLACP PDU that contains the DOWN subtype. The DOWN subtype informs the other end that the partner is no longer receiving VLACP PDUs and has declared the link down. The partner declares the link down and maintains this state until it

receives a TXOK message.

- When ports are being initialized, if a port immediately transitions to active, in some cases the switch can temporarily forward traffic to a black hole. With the VLACP HOLD enhancement, a core switch running SMLT can transmit a VLACP PDU with the HOLD subtype when ports are not ready to forward traffic. The VLACP PDU HOLD subtype informs the partner that even though the link is up, the partner should not use the link until it receives an appropriate VLACP TXOK message.

1.6.1 VLACP – Ethernet Routing Switch 8000

The Avaya Ethernet Routing Switch 8800/8600 can provide sub-100 millisecond failover using short timers on the 8692 SF/CPU with SuperMezz or on the 8895 SF/CPU.

The Ethernet Routing Switch 8800/8600 supports sub-100 millisecond failover, but not as a best practice general recommendation. This functionality is only supported between two Ethernet Routing Switch 8800/8600 switches, generally across the core of a square or a full mesh multiple cluster design. As an environment is scaled, sub-100 millisecond failover may not be stable. Therefore, if you enable this feature, minimize the number of links running sub-100 millisecond operation. Upon implementing sub-100 millisecond links or timers, if any VLACP instability is seen, increase the timers.

Starting in the 5.1.5 release, the ERS 8800 added a VLACP hold enhancement. During SMLT node failure scenarios, traffic loss may be observed in certain scaled SMLT configurations with hundreds of SLTs, hundreds of ports and tens of VLANs. The root cause for the traffic loss was that the ERS 8000 ports would come up prematurely at the physical layer causing the remote end to start sending traffic toward the ERS 8000 that just came up. On the ERS 8000 that just rebooted, the communication between the line cards and the CP may take several seconds in such scaled configurations. This resulted in black-holing the traffic arriving on such ports which were physically up but all operational configurations was not yet performed on those ports by the CP. The VLACP SUBTYPE HOLD feature introduces a new VLACP PDU with a new subtype HOLD to help reduce traffic loss in such scenarios.

The goal of this new implementation is to "hold down" all VLACP enabled links for a specific period of time after a reboot. This prevents remote VLACP enabled devices that understand the new VLACP HOLD PDU from sending data to the ERS 8000. This will ensure that all VLACP enabled ports on the ERS 8000 have had sufficient time to come up with all operational configuration and are ready to receive and forward the ingress traffic.

1.6.2 VLACP – Virtual Services Platform 7000

If Shortest Path Bridging is enabled on the IST, it is recommended to not enable VLACP and also not enable the untagged frame discard option on the IST port members.

1.6.3 VLACP – Virtual Services Platform 4000 / 7200 / 8000 / 9000

Virtual Services Platform 4000/7200/8000/9000 can attain sub-100-ms failover time. Sub-100-ms convergence guarantees ultra-fast convergence for critical business and multimedia applications. The switch software uses the following VLACP timers:

- fast periodic timer—100 to 20 000 ms; default 200 ms
- slow periodic timer—10 000 to 30 000 ms; default 30 000 ms

Though you can configure Virtual Services Platform switch ports with a VLACP fast periodic timer of sub-100 ms, this configuration is not stable in scaled networks, and therefore not supported.

1.6.4 VLACP Flap Detect and Damping

Link instability or packet loss can cause the Virtual Link Aggregation Control Protocol (VLACP) state of a link to toggle (flap) rapidly, bringing services (such as IP multicast) up and down in rapid succession. This behavior can cause system-wide instability, including high CPU utilization. VLACP flap detect and damping is used to automatically shut down selected VLACP links until a network administrator is able to resolve the root cause of the VLACP flapping. VLACP flap detect and damping does not support auto-recovery, therefore a network administrator must re-enable the interface manually.

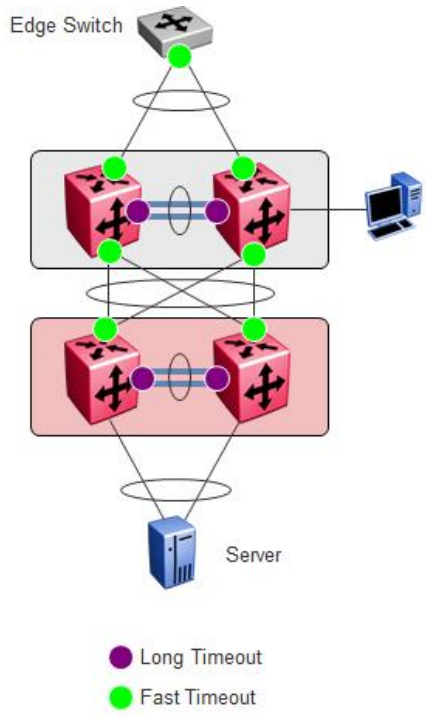
When enabled, VLACP flap detect and damping shuts off a selected VLACP link if the interface flaps a specified number of times within a user-defined time frame. For example, VLACP flap detect and damping is configured, by default, to detect 3 events within a 60 second time frame. On detection of the first event, the VLACP flap timer is started and counts off how many VLACP events occur within 60 seconds. If the number of events reaches 3 before the end of the timer, the flapping interface is shut down, the timer stops and returns to 0, and the system generates a trap and log.

VLACP flap detect and damping is disabled by default, and should only be enabled after consultation with Avaya Client Services. Although there is some interaction with existing LACP link flap functionality, Avaya recommends that you do not use the VLACP flap dampening feature on an LACP-enabled interface.

1.7 VLACP Recommendations for SMLT Clusters

It is recommended to enable VLACP over all IST, SMLT, and SLT links. Please note, the IST link is in reference to the traditional IST used on the ERS 8000, ERS 5000, and VSP 9000. On the VSP 4000, VSP 7200, and VSP 8000, a vIST is used and there is no dedicated physical IST LAG group. For MLTs, VLACP should be enabled on each port member. Overall, use the following recommended values:

Short Timeout = Timeout Scale * Fast Periodic Timer **Long Timeout = Timeout Scale * Slow Periodic Timer**				
Connection Type	**Fast Timer**	**Slow Timer**	**Timeout**	**Timeout Scale**
Uplink	500ms	N/A	Short	5
IST	N/A	10000	Long	3



Enable VLACP

- Globally and on each individual uplink and IST port
- Both ends must have matching Multicast MAC, EtherType, and Timers
- Do not enable VLACP and LACP on the same links
- Do not enable VLACP on IST port members on the VSP 7000

For directly connected point-to-point links

- Use reserved multicast MAC *01:80:c2:00:00:0f*
- Ensures packet is not flooded across a defaulted switch

For end to end connections traversing intermediate networks

- Use default MAC *01:80:c2:00:11:00*

1.8 LACP – Rear-Port Mode on Virtual Services Platform 7000

The VSP 7000 by default operates in Fabric Interconnect stacking mode. The VSP 7000 can be provisioned in rear-port mode where the rear Fabric Interconnect ports will be treated as multiple virtual ports over the 4 physical Fabric Interconnect Ports. When in rear-port mode, the VSP 7000 operates in a standalone mode.

Two modes of operation are available in rear-port mode, standard or Shortest Path Bridging (SPB). Standard mode allows all the switch standard features minus SPB across the rear ports, i.e. Spanning Tree, OSPF, RIP, etc. In SPB mode, in the 10.2 release Shortest Path Bridging is supported while in the 10.3 both SPB and SMLT is supported. Hence, when FI Mesh is required, rear-port mode with operational state of SPB needs to be provisioned. The diagram shows the FI port speeds available depending if Standard or SPB operational state is enabled.

To provide greater plug n 'play capability over the virtual ports when rear-port mode is enabled, LACP link aggregation and VLAN tagging are automatically enabled. This ensures that multiple virtual ports which may run within a single cable or if multiple FI cables are run in parallel that all virtual ports are automatically treated as one link. This simplifies any protocol adjacency such as IS-IS or OSPF. When you issue rear-ports mode all virtual ports will have their LACP state set to true, the LACP Admin Key to 4095 and LACP hashing mode be set to advance.

Color	Physical Fabric Interconnect Port	Rear Port Mode	Throughput	Ports
Black	FI Up (right) Top	Standard	240Gbps	34, 35, 36
		SPB	240Gbps	
Red	FI Down (left) Top	Standard	240Gbps	38, 39, 40
		SPB	160Gbps	38, 39
Blue	FI Up (right) Bottom	Standard	80Gbps	33
		SPB	80Gbps	
Blue	FI Down (left) Bottom	Standard	80Gbps	37
		SPB	80Gbps	

Figure 1 – FI Rear Port Details

When rear-port is enabled, the following is applied:

- The LACP Admin Key is set to 4095
- LACP hashing mode is set to advance
- VLAN tagging is automatically enabled
- The LACP timeout is set to short
- LACP aggregation is enabled on all rear-ports (ports 33 to 40)

Please note that if the rear-port mode is provisioned in standard mode supporting SMLT over the rear ports, the default LACP configuration must first be removed prior to enabling the IST. LACP is not supported on an IST, but, can still be enabled on the SLT/SMLT port members.

Please refer to the *Resilient Data Center Solutions using the VSP 7000 Technical Configuration Guide*, publication number NN48500-645, for more details regarding using Fabric Connect with the VSP 7000.

1.9 LACP and Minimum Link – ERS 8000

The ERS 8000 minimum link (MinLink) setting defines the minimum number of active links from 1 to 8 required for a LAG to remain in the forwarding state. If the number of active links is less than the MinLink setting, the entire LAG is declared down. If MinLink is not provisioned, the LAG is always declared up if one physical link of the LAG is up.

The maximum number of active links in a LAG is 8. It is possible to configure up to 16 links where 8 links will be in Standby mode. If a link goes down, Standby links will take precedence over MinLink. When an active link goes down, the standby link with the lowest port number will immediately become active.

Please note that MinLink is not supported with SMLT as the minimum number of links with SMLT can only be set to 1.

1.10 LACP and VLACP Support on Avaya Products

Table 1: LACP and VLACP Support on Avaya Products

Switch	LACP Support	VLACP Support	Scaling
VSP 9000	Yes	Yes	• 512 Link Aggregation Groups ○ A maximum of 8 active links are supported per LAG.[Note 1] ○ A maximum of 8 standby links are supported per LAG. [Note 1] ○ Up to 16 ports can be configured in a LAG (8 active and 8 standby ports) • 128 VLACP interfaces
VSP 7000	Yes (10.3 or higher)	Yes	• 64 Link Aggregation Groups using MLT ○ A maximum of 8 active links are supported per LAG.[Note 1] • SMLT ○ 20 Link Aggregation Groups using SMLT ○ 100 Link Aggregation Groups using SLT
VSP 4000	Yes	Yes	• 24 Link Aggregation Groups ○ A maximum of 8 active links are supported per LAG.[Note 1] ○ A maximum of 8 standby links are supported per LAG. [Note 1] ○ Up to 16 ports can be configured in a LAG (8 active and 8 standby ports) • Up to 50 VLACP interfaces
VSP 7200	Yes	Yes	• 54 (up to 72 with channelization) Link Aggregation Groups ○ A maximum of 8 active links are supported per LAG.[Note 1] ○ A maximum of 8 standby links are supported per LAG. [Note 1] ○ Up to 16 ports can be configured in a LAG (8 active and 8 standby ports) • Up to 54 (72 with channelization) VLACP interfaces
VSP 8000	Yes	Yes	• 84 (up to 96 with channelization) Link Aggregation Groups ○ A maximum of 8 active links are supported per

			LAG.[Note 1] ○ A maximum of 8 standby links are supported per LAG. [Note 1] ○ Up to 16 ports can be configured in a LAG (8 active and 8 standby ports) • Up to 84 (96 with channelization) VLACP interfaces
ERS 8600 /8800 R/RS(8800)-modules	Yes	Yes	• 128 Link Aggregation Groups ○ A maximum of 8 active links are supported per LAG.[Note 1] ○ A maximum of 8 standby links are supported per LAG. [Note 1] ○ Up to 16 ports can be configured in a LAG (8 active and 8 standby ports) • Up to 96 VLACP interfaces
ERS 5900	Yes	Yes	• 32 Link Aggregation Groups ○ A maximum of 8 active links are support per LAG
ERS 4000	Yes	Yes	• 32 Link Aggregation Groups ○ A maximum of 8 active links are support per LAG.
ERS 3500	Yes	Yes	• 6 Link Aggregation Groups ○ Maximum of 4 active links are support per LAG [Note 3]
ERS 5000	Yes	Yes	• 32 Link Aggregation Groups ○ A maximum of 8 active links are support per LAG. • SMLT – Maximum LACP Groups ○ Up to 5 LACP/SMLT ○ Up to 12 LACP/SLT

Note 1: The maximum number of active links in a Link Aggregation group is 8; however, it is possible to configure up to 16 links in a LAG. The 8 links that are not active are in Standby mode. Should an active link be disable, the backup link with the lowest port number will immediately become active.

Note 2: All links in a trunk group must have the same speed and must be full duplex.

Note 3: Maximum of 4 active links are supported per LAG, with a fifth standby link which can be added to a trunk group. The four highest priority links form a trunk group for the LAG, while the next lowest priority link remains in standby mode.

2. Configuration Rules and Guidelines

2.1 Link Aggregation Rules

- All ports in a link aggregation group must be operating in full-duplex mode (defined by the IEEE standard).
- All ports in a link aggregation group must be running same data rate (defined by the IEEE standard).
- All ports in a link aggregation group must be in the same VLAN or VLAN's.
- Ports in a LAG can be distributed over different modules.
- Link aggregation is compatible with the Spanning Tree Protocol (STP/RSTP/MSTP); STP/MSTP normally should be disabled with on all SMLT ports.
- Link aggregation group(s) must be in the same STP/MSTP MSTI group(s).
- On the ERS 8000, if the NTSTG parameter is set is disabled, STP BPDUs are transmitted only on one link. If NTSTG is enabled the ERS 8000 sends BPDUs on ALL links of an aggregation group. For interoperability with Cisco, NTSTG should be disabled.
- On the VSP 4000, VSP 7200, VSP 8000, and VSP 9000, link aggregation is compatible with MSTP. Assign all LAG ports to the same MSTP groups.
- To correctly enable tagging in LACP applications, you first need to disable LACP on the port, enable tagging on the port, and then re-enable LACP.
- LACP-enabled ports with the same key must have the same VLAN membership. On LACP-disabled ports with the same key, VLAN membership can be different. This usually happens when you add VLANs to or delete VLANs from these ports. But before LACP is re-enabled on these ports, VLAN membership must be the same for ports with the same key.
- In regards to stackable switches, i.e. VSP 7000, ERS 4000, ERS 5000, and ERS 3500 in stack mode, ports in a link aggregation group can be on different units to form a distributed LAG (DLAG).
- SLPP Guard cannot be enabled on ports that are members of MLT, DMLT, LACP, or LAGs.

2.2 SMLT Network Design Considerations

- LACP should not be enabled on the IST ports, recommended to use MLT configuration with VLACP long timers.
- It is recommended to use the reserved multicast MAC address of 01:80:c2:00:00:0f for the VLACP MAC address for all Ethernet applications. This does not apply if you use an Ethernet over a LAN Extension service where it is recommended to use the default VLACP MAC.
- The LACP keys on the SMLT core switches must match.
- Spanning Tree is disabled by default on a port level when SMLT is enabled
- In regards to the ERS 8000, the MLT NT-STG option is automatically set to disabled as soon as LACP is enabled in a MLT group. With this options disabled, Spanning Tree is forwarded on one port. This allows compatibility with Cisco. If a port fails in a LAG, the BPDU MAC is still valid on the other LAG ports.

- If you configure LACP for SMLT, you must configure the same LACP smlt-sys-id on both cluster switches. This will ensure that the access switch only see one unique LACP system identifier and will avoid loss of data. It is recommended to use the base MAC address from one cluster switches as the LACP smlt-sys-id or you could create a new system identifier as long as the identifier is the same on both cluster switches.
- If you use LACP in an SMLT square configuration, the LACP ports must have the same keys for that SMLT LAG. Please note the VSP 7000 and ERS 5000 does not support LACP in an SMLT square.
- When using LACP with Single-Port SMLT, the LACP key is defined automatically. It cannot be defined by the user.
- LACP system priority should not be changed once LACP is enabled on one or more SMLTs and also enabled at port level. If some ports are joined into the desired MLT after dynamic configuration changes, enter the following ACLI command:
    - `ERS8000(config)#`***`interface mlt {number}`***
    - `ERS8000(config-mlt)#`***`no lacp enable`***
    - `ERS8000(config-mlt)#`***`lacp enable`***

2.3 SMLT Network Design Considerations – ERS 5000

- LACP should not be enabled on the IST ports, recommended to use MLT configuration with VLACP long timers. Only SMLT and SLT links support LACP
- It is recommended to use the reserved multicast MAC address of 01:80:c2:00:00:0f for the VLACP MAC address for all Ethernet applications. This does not apply if you use an Ethernet over a LAN Extension service where it is recommended to use the default VLACP MAC
- The LACP keys on the SMLT core switches must match
- When you configure LACP over SMLT, you must use LACP advanced port mode to prevent loops. LACP port-mode advance allows an LACP enabled port to remain in a blocking state if the port is removed from the Link Aggregation Group (LAG)
- Prior to release 6.2.0, Spanning Tree is not disabled by default on a port level when SMLT is enabled; in release 6.2.0 or higher, STP is automatically disabled on the IST, SMLT, and SLT ports
- Release 6.3 or higher is required to add/remove VLANs without disabling LACP on the ports
- Release 6.2.0 or higher is required to add a static LACP key to a Trunk ID binding *(lacp key <1-4095> mlt id <1-32> smlt-id <1-512>)*
- The SMLT System ID base MAC should be configured when LACP is enabled on SMLT access links. This will ensure that the access switch only see one unique LACP system identifier. You can create a new system identifier or simply use the base system identifier from one of the SMLT cluster switches
- For a stack of 2 units, enable stack forced-mode; this feature will keep the SMLT/SLT/IST ports up on a unit failure
- If using LACP short timers, no more than 8 LAGs can be supported
- Triangle SMLT topologies are only supported with using SMLT over LACP
- At least 2 LAG members are required per SMLT cluster switch for SMLT configurations. One LAG member per cluster switch is not supported; use SLT is only one port member is used

2.4 SMLT Network Design Considerations – VSP 7000

- IST links do not support LACP, only SMLT and SLT links support LACP
- It is recommended to not enable VLACP on IST links that also has Shortest Path Bridging enabled
- SMLT with LAG is not supported in a Square SMLT topology
- The SMLT System ID base MAC should be configured when LACP is enabled on SMLT access links. This will ensure that the access switch only see one unique LACP system identifier. You can create a new system identifier or simply use the base system identifier from one of the SMLT cluster switches.
- When you configure LACP over SMLT, you must use LACP advanced port mode to prevent loops. LACP port-mode advance allows an LACP enabled port to remain in a blocking state if the port is removed from the Link Aggregation Group (LAG).
- If *rear-port* mode is enabled
    - LACP is enabled by default when rear-port mode is enabled using the following settings
        - LACP administration key is set to 4095
        - LACP operating mode for rear ports is set to active
        - LACP rear ports time-out value is set to short
        - LACP for rear ports is set to enable
    - Rear port mode allows the VSP 7000 Series to automatically aggregate multiple connections between adjacent units without additional configuration.
    - You must disable the default LACP mode before you enable IST on the rear ports; LACP is not supported on IST links where only SMLT and SLT links support LACP
- To prevent the formation of a loop, you must configure the same speed (10/100/1000/10000) for LAC ports on an edge switch and LAC ports on an SMLT aggregation switch.
- Release 10.2 or higher is required to add/remove VLANs without disabling LACP on the ports
- Release 10.3 or higher is required to add a static LACP key to a Trunk ID binding *(lacp key <1-4095> mlt id <1-64> smlt-id <1-512>*)
- For a stack of 2 units, enable stack forced-mode; this feature will keep the SMLT/SLT/IST ports up on a unit failure

It is recommended to use the reserved multicast MAC address of 01:80:c2:00:00:0f for the VLACP MAC address for all Ethernet applications. This does not apply if you use an Ethernet over a LAN Extension service where it is recommended to use the default VLACP MAC.

For the VSP 7000, if Shortest Path Bridging (SPB) is enabled, it is important to not enable the *filter-untagged-frame* option on the IST port members. Also, the default PVID of all IST ports must be the primary B-VLAN ID. This will happened automatically providing SPB is enable first prior to enabling the IST.

2.5 ERS and VSP 7000 – LACP port mode

The IEEE 802.1AX standard specifies that links that are not successful candidates for aggregation (for example, links to devices that cannot perform aggregation, or links that are manually set as non-aggregable) can continue to operate as individual LACP links. However, LACP-enabled, STP-disabled ports that operate as individual links can potentially cause network loops.

You can specify the desired behavior of non-aggregable LACP links on the switch:

- ***Default mode***: In the default mode, if an LACP-enabled port is connected to a non-LACP partner port and the link fails to converge with the link partner, the port state moves to the forwarding state. This is the standard behavior from earlier software releases. The default mode is compatible with standard LACP.
- ***Advance mode***: In the Advance mode, if an LACP-enabled port is connected to a non-LACP partner port and the link fails to converge with the link partner, the port state remains in the blocking state. This behavior is applied only to LACP-enabled ports that have STP disabled and prevents potential loops from forming in the network.

The Advance mode is not compatible with IEEE 802.1AX standard LACP.

The Advance mode is also useful when a trunk port is removed from a trunk configuration. Currently, an active LACP trunk port can be removed from the trunk configuration if the link partner disables LACP or if PDU reception times out. Each LACP mode handles this scenario as follows:

- ***Default mode***: The default mode implementation removes the active LACP trunk port from the active trunk configuration, and the port functions as a regular standalone active port. The port state is determined by STP when you enable STP, but is set to forwarding when you disable STP on the port.
- ***Advance mode***: In the Advance mode, LACP-enabled ports that have STP disabled remain in the blocking state. This prevents potential loops from forming in the network.

2.6 ERS and VSP 7000 – LACP minimum port requirement

All ERS and VSP 7000 switches require at least 2 active port members for a LACP LAG. If a LAG group consists of only 2 ports and is operational, failure of one to the two LAG ports will cause the switch to recover traffic to the remaining active port. However, upon a switch reboot where only one of the two ports is up, the LACP LAG will not come up.

In an SMLT environment, it is important to have two LAG port members on each cluster switch. However, a SLT can be used for applications where only a single port to each cluster switch is required.

2.7 LACP and Spanning Tree Interaction

The operation of the LACP module is only affected by the physical link state or its LACP peer status. When a link goes up and down, the LACP module will be notified. The STP forwarding state does not affect the operation of LACP module. LACPDU can be sent even if the port is in STP blocking state.

Unlike legacy MLTs, configuration changes (such as speed, duplex mode, and so on) to a LAG member port is not applied to all the member ports in this MLT. Instead, the changed port is taken out of the LAG and the corresponding aggregator and user is alerted when such a configuration is created.

In contrast to MLT, IEEE 802.1AX-based link aggregation does not expect BPDUs to be replicated over all ports in the trunk group. By default if Spanning Tree is enabled, the stackable switches will send and transmit STP BPDUs only one the first link in the LAG. On the ERS8000 only, you can enable STP BPDUs across all ports if you like by enabling the NTSTG option. Be aware that this parameter is applicable to all trunk groups that are members of this spanning tree group. This is necessary when interworking with devices that only send BPDUs out one port of the LAG.

If you plan to disable Spanning Tree, you must do so after LACP have been configured. Spanning Tree will not be disabled if you disable it prior to configuring LACP on a port.

2.8 Routing Considerations

If OSPF is enabled on the port, do not set the LACP periodic transmission timer to less than one second.

3. Configuring LACP

Please take into consideration the following items when configuring LACP.

LACP Priority

LACP priority is configured at the system level and at the port level

- *Port Priority* – used to determine which ports are aggregated into LAG as a standby-port configuration if more than the maximum numbers of ports supported in a LAG are configured. If the port priority is the same, then the lower MAC equals higher priority.
- *System Priority* – used to generate the switch ID when communicating with other switches. For SMLT applications, this is used to determine a master/slave relationship between the SMLT switches. It is recommended to leave this value to default. If it is changed, it is recommended to disable LACP and then enabling it once the value is changed.

LACP Keys

LACP keys are used to determine which ports are eligible to be aggregated into a LAG. The LACP keys are defined when configuring the MLT and defined under the ports. The ports whose keys match the MLT's key will be able to be aggregated in that MLT.

- Keys need not match between two LACP peers.
- Keys must match on SMLT core switches when using LACP with SMLT.

LACP Timers

Customization of the failover times is achieved by changing the LACP timer attributes. Please note that these values are set by default to match the IEEE 802.1AX values, if they are changed, these values must match on the ports participating in aggregation between two DUTs.

Any changes to these values at the global level for the ERS8000, VSP 4000/7200/8000, and VSP 9000 will be reflected on all ports. Or, these values can be changed on a per port level. The following displays the default timer settings.

timeout: 3
fast-periodic-time: 1000 (ms)
slow-periodic-time: 30000 (ms)

The user can choose to use either the fast or slow timer, this is set on the port level. By default, the long timer is used. Hence, a link is determined ineligible to be aggregated if it does not receive an LACPDU for a period of:

timeout x slow-periodic-time = 3 x 30s = 90s

Should the user decide to use the fast-periodic-time instead, by default, the timeout period now becomes 3 x 1000 ms = 3 seconds. This change must be made to all ports participating in link aggregation, as well as the ports on the partnering node.

3.1 ERS 8000, VSP 4000, VSP 7200, VSP 8000, VSP 9000

3.1.1 Global LACP Parameters

LACP is configured globally by using the following command:

```
VSP-8284XSQ(config)#lacp ?

  aggr-wait-time      Set aggregation wait time globally
  enable              Enable lacp
  fast-periodic-time  Set fast periodic time globally
  slow-periodic-time  Set slow periodic time globally
  smlt-sys-id         Set lacp system id globally
  system-priority     Set lacp system priority globally
  timeout-scale       Set timeout scale globally
```

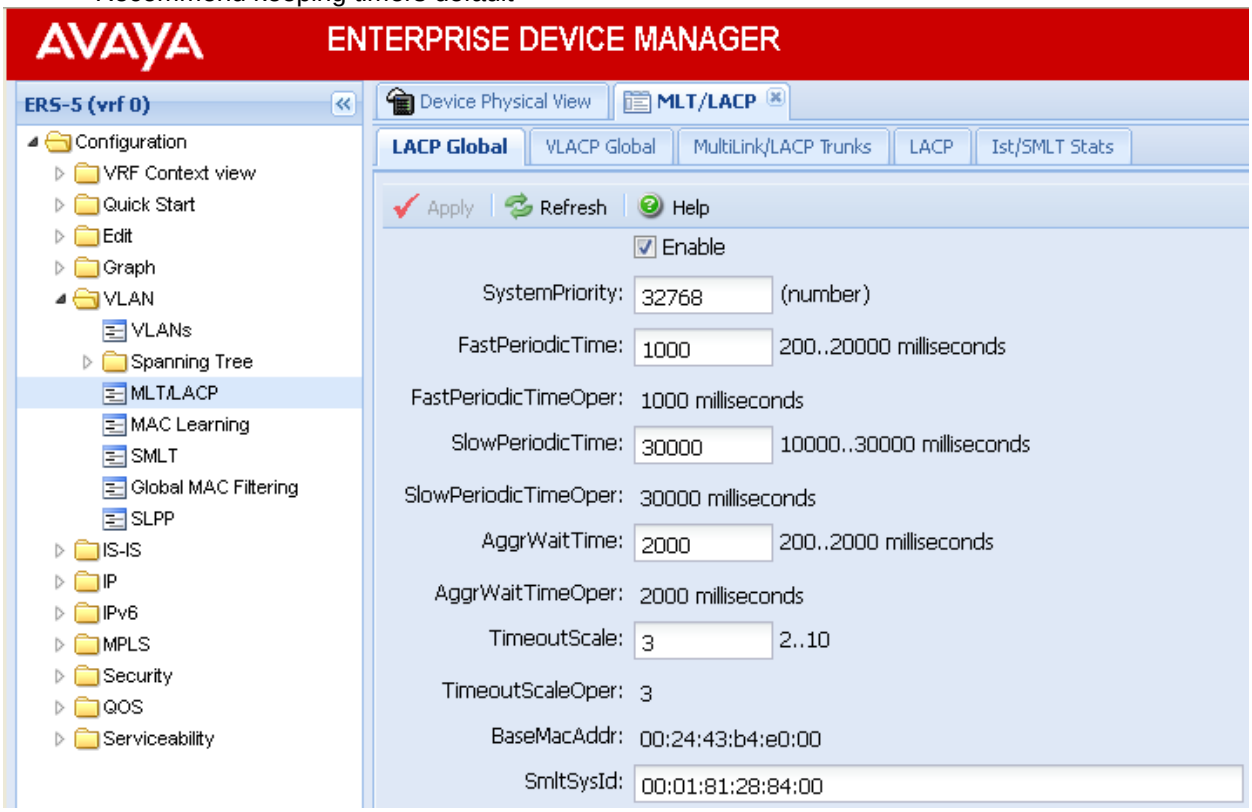
where:

Parameter	Description
aggr-wait-time <200-2000>	Configures the aggregation wait time (in milliseconds) globally. The default value is 2000.
enable	Enables LACP globally. The default value is disabled.
fast-periodic-time <200–20000>	Configures the fast periodic time (in milliseconds) globally. The default value is 1000.
slow-periodic-time <10000–30000>	Configures the slow periodic time globally. The default value is 30000.
smlt-sys-id <BaseMac>	Configures the LACP system ID globally. Enter a MAC address in the following format: 0x00:0x00:0x00:0x00:0x00:0x00:0x00.
system-priority <0-65535>	Configures the LACP system priority globally. The default value is 32768.
timeout-scale <2-10>	Configures the timeout scale globally. The default value is 3.

3.1.1.1 Via EDM

Go to *VLAN -> MLT/LACP -> LACP Global*

- Check Enable to enable LACP globally
- Recommend keeping timers default



3.1.2 LACP Interface Parameters

LACP must also be enabled on all desired ports by using the following command:

```
VSP-8284XSQ(config)#interface gigabitEthernet 2/1

VSP-8284XSQ(config-if)#lacp ?

  aggr-wait-time           Value in milliseconds for aggregation wait time
  aggregation              Individual port or aggregatable
  enable                   Enable lacp on port
  fast-periodic-time       Value in milliseconds for fast-periodic-time
  key                      Set aggregation key for this port
  mode                     Set lacp mode to be active or passive
  partner-key              Set partner admin key
  partner-port             Set partner admin port
  partner-port-priority    Set partner admin port priority
  partner-state            Set partner admin state
  partner-system-id        Set partner admin system id
  partner-system-priority  Set partner admin system priority
  priority                 Set port priority
  slow-periodic-time       Value in milliseconds for slow periodic time
  system-priority          Set system priority for this port
  timeout-scale            Timeout = periodic-time * timeout-scale
  timeout-time             Use long or short timeout
```

where:

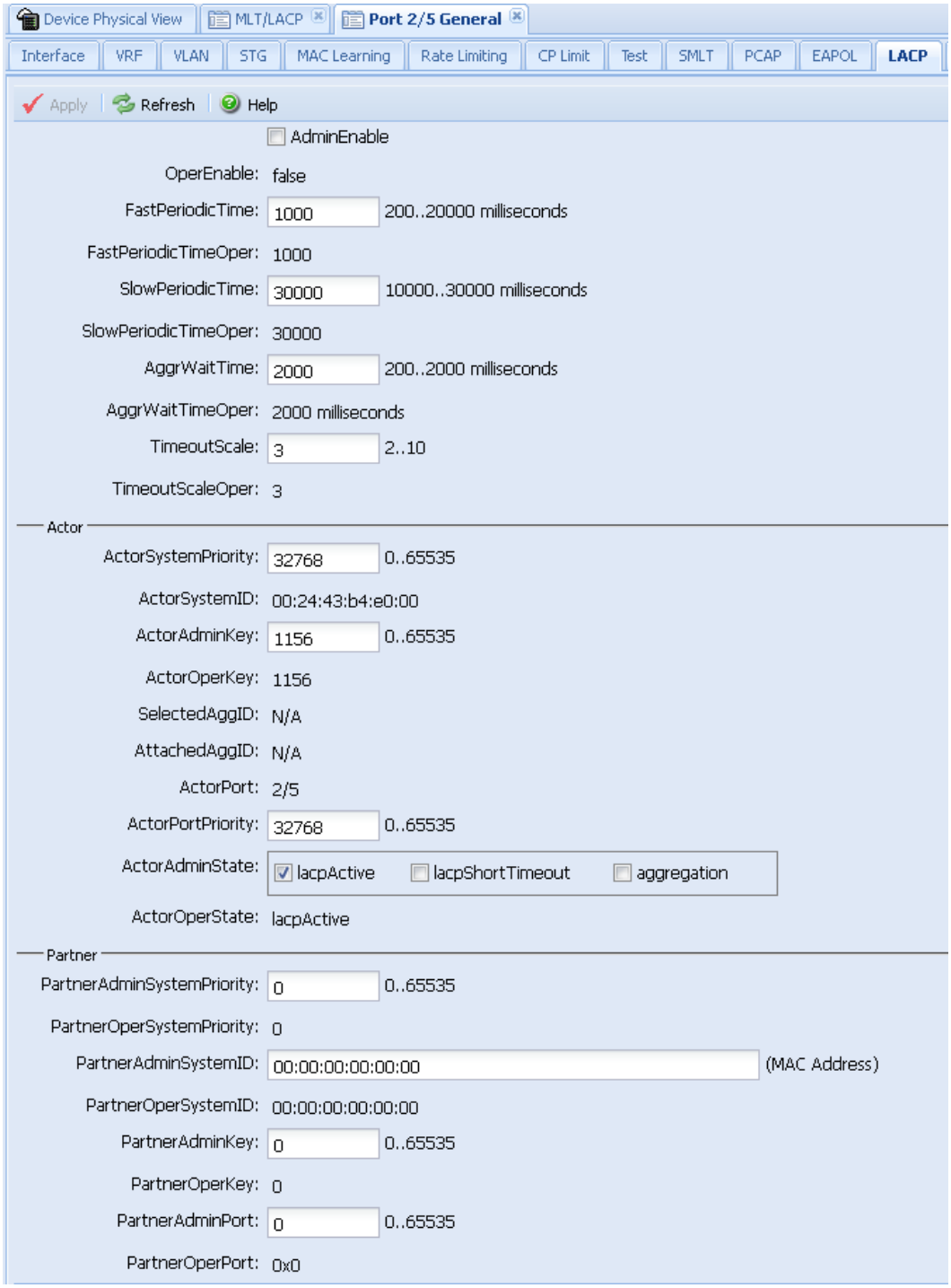
Parameter	Description
aggr-wait-time <200–2000>	Configures the aggregation wait time (in milliseconds) for this port. The default is 2000.
aggregation enable	Enables aggregation on the port, which makes it an aggregated link.
enable	Enables LACP for this port. The default is disabled.
fast-periodic-time <200–20000>	Configures the fast periodic time (in milliseconds) for this port. The default is 1000 ms.
key <1-512|defVal>	Configures the aggregation key for this port. Enter the aggregation key value or defVal (1024 + IfIndex)
mode {active | passive}	Configures the LACP mode to be active or passive.
partner-key <0–65535>	Configures the partner administrative key.

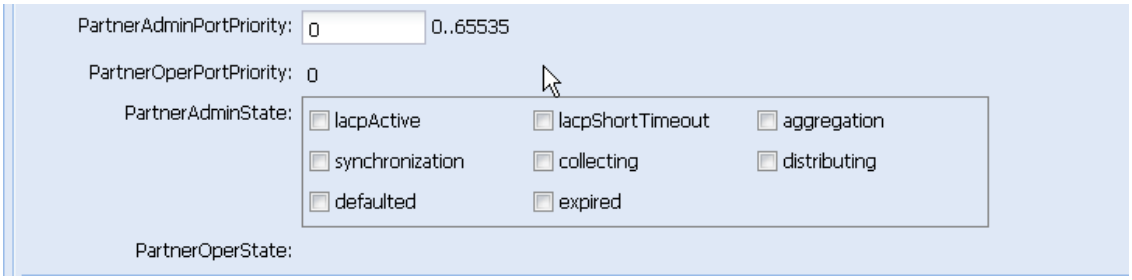
Parameter	Description
partner-port <0–65535>	Configures the partner administrative port value.
partner-port-priority <0–65535>	Configures the partner administrative port priority value.
partner-state <0-255|0-255>	Configures the partner administrative state bitmask. Specify the partner administrative state bitmap in the range 0x0–0xff. The bit to state mapping is Exp, Def, Dis, Col, Syn, Agg, Time, and Act. For example, to set the two partner-state parameters • Act = true • Agg = true Specify a value of 0x05 (bitmap = 00000101).
partner-system-id <Mac>	Configures the partner administrative system ID. Specify a MAC address in the format 0x00:0x00:0x00:0x00:0x00:0x00:0x00.
partner-system-priority <0–65535>	Configures the partner administrative system priority value.
priority <0–65535>	Configures the port priority. The default value is 32768. To set this option to the default value, use the **default** operator with the command.
slow-periodic-time <10000-30000>	Configures the slow periodic time for this port. The default is 30000 ms. To set this option to the default value, use the **default** operator with the command.
system-priority <0-65535>	Configures the system priority for this port. The default is 32768.
timeout-scale <2-10>	Configures a timeout scale for this port. The default value is 3. The LACP timeout is equal to the slow periodic time or fast periodic time multiplied by the timeout-scale, depending how you configure the timeout-time variable.
timeout-time {long|short}	Configures the timeout to either long or short.

3.1.2.1 Via EDM

Go to *Device Physical View*

- Right-click on port
- Select *Edit General* and go to *LACP* tab





3.1.3 LACP MLT Parameters

3.1.3.1 Via ACLI

LACP is configured under MLT by using the following command:

```
ERS8000(config)#interface mlt 1
ERS8000(config-mlt)#lacp ?
  enable           Enable lacp on mlt interface
  key              Set lacp aggregator key
  min-links        Set min-links value  **Not available on VSP 4000/7200/8000/9000
  system-priority  Set lacp system priority
```

Please note, the min-link parameter is only available on the ERS 8000 platform

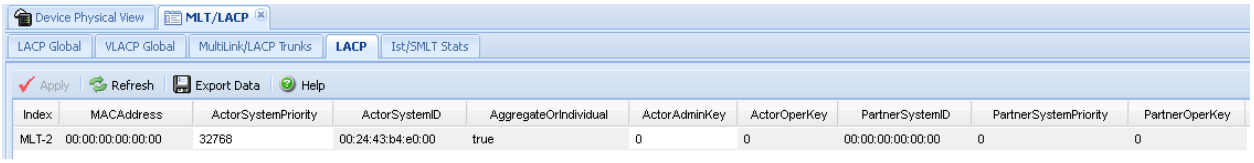
where:

Parameter	Description
enable	Enables LACP on the MLT interface.
key <0-512>	Configures the LACP aggregator key for a specific MLT. • *0-512* is the LACP actor admin key.
min-link <1-8>	Set minimum link number from 1 to 8. The default value is 1. This parameter is only available on the ERS 8000
System-priority <0-65535>	Configures the LACP system priority for a specific MLT. • 0-65535 is the system priority.

3.1.3.2 Via EDM

Go to *Configuration -> VLAN -> MLT/LACP*

- Via *MultiLink/LACP Trunks* tab, add MLT first
- Next, go to the LACP tab



3.1.4 LACP Key

There are three types of keys as listed in the table below. When the lower 10 bits are all zeros, it represents a wild card key that can only be assigned to an aggregator. Only keys defined in the table are considered valid. Invalid keys cannot be assigned to either a port or an aggregator.

Table 2: LACP Key

Type	Upper 6 Bits 15-10	Lower 10 Bits 1-0	Description
Group	000000	1 to Max number of MLTs	Keys for aggregators that are capable of aggregation. These aggregators will be associated with physical aggregation hardware's.
Individual	000001	Valid Port Number	Keys for aggregators that are NOT capable of aggregation. These aggregators will only have individual links.(default)
SLT	000010	Valid Port Number	Keys for aggregators associated with SLT links. These aggregators will send out LACPDUs saying they are capable of aggregation, but it will not have more than one link or associated with physical aggregation hardware.

Two ports can be assigned the same key only if they are of the same type, have the same speed and VLAN membership. Port in auto negotiation mode can be assigned the same key as ports with same type. LACP can only be enabled on full duplex port. If a port becomes half duplex due to auto negotiation, it will be forced to operate as an individual port. If a port picks up a speed different from other member ports in the same LAG, it will be forced to operate as an individual port.

3.2 VSP 7000 and ERS Stackable Switch - ACLI

3.2.1 Default LACP Global

3.2.1.1 Via ACLI

The default lacp system-priority is set for 32768 and can be changed by using the following command:

- `ERS-Stackable(config)#`***`lacp ?`***

```
Change LACP parameters
key              Configure LACP Key to MLT mappings
port-mode        Set LACP port-mode
smlt-sys-id      Configure SMLT system ID for LACP
system-priority  Set LACP system priority
```

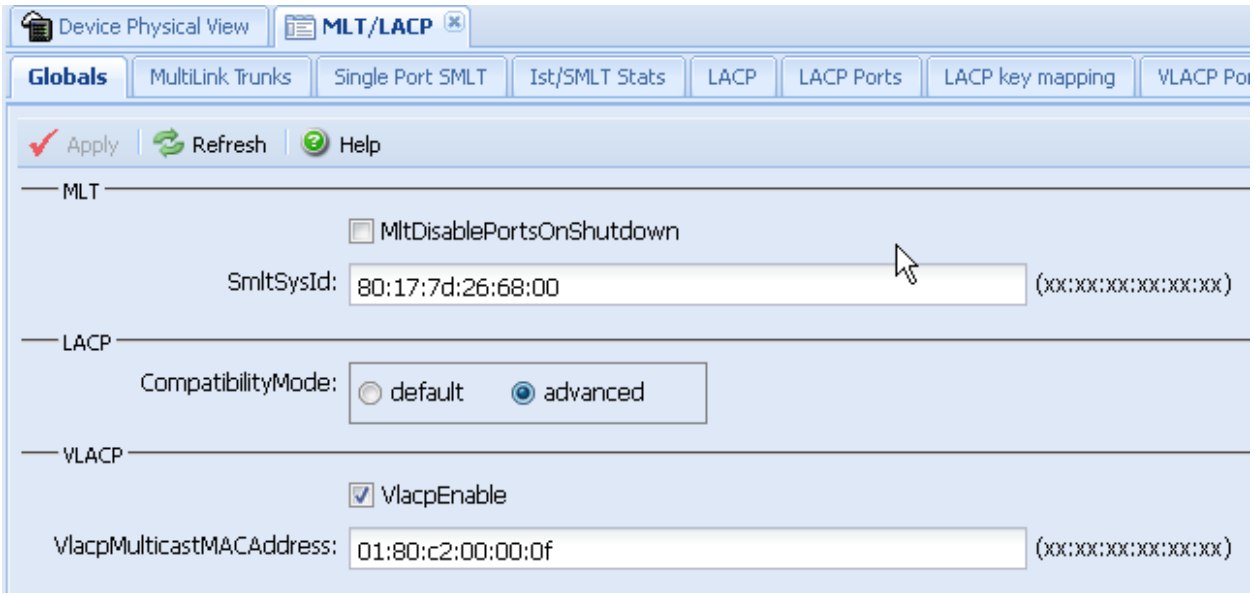
where:

Item	Description
key	Binds an MLT group to an administrative key and to an MLT ID using the ACLI command *lacp key <1-4096> mlt-id <1-32 or 1-64> or lacp key <1-4096> mlt-id <1-32 or 1-64> smlt-id <1-512>* . To free an MLT group, enter the ACLI command *default lacp key <1-4095>* where the MLT ID for that particular LACP becomes 0.
port-mode	Sets the LACP port mode • Default – default LACP port mode • Advance – advanced LACP port mode. Under advance mode if a LACP port does not receive LACPDU from the far end, LACP will put the port in Blocking to prevent a loop. This is required to prevent any loops due to misconfiguration and is mandatory for LACP/SMLT scenarios
smlt-sys-id	Sets the SMLT MAC address where one of the cluster switches base MAC is selected as the SMLT system MAC. The same MAC needs to be configured on both SMLT cluster switches. To configure the default SMLT MAC address, use the ACLI command *default lacp smlt-sys-id* • <BaseMac> is the MAC address in the format {0000.0000.0000}.
system-priority	Sets the LACP system-side LACP priority. The factory default priority value is 32768

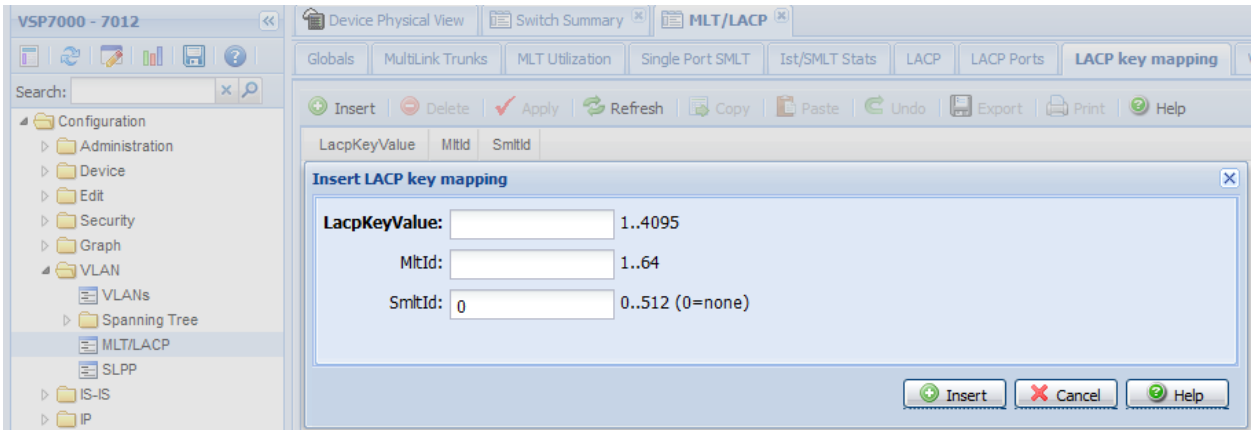
You can create a static LACP key to a Trunk ID binding using ACLI command *lacp key <1-4096> mlt-id <1-32 or 1-64>* or *lacp key <1-4096> mlt-id <1-32 or 1-64> smlt-id <1-512>.* This feature provides a static way of associating a LAG with a MLT group ID. By default, the MLT ID is dynamically assigned usually stating at the highest MLT ID, either 32 or 64, depending on the switch model, unless already used.

3.2.1.2 Via EDM

Go to *Configuration -> VLAN -> MLT/LACP -> Globals*



Go to *Configuration -> VLAN -> MLT/LACP -> LACP key mapping -> Insert* if you wish to manually map a LACP key to MLT ID and/or SMLT ID.



3.2.2 LACP Interface Parameters

3.2.2.1 Via ACLI

LACP must also be enabled on all desired ports by using the following command:

- `ERS-Stackable(config)#`***`interface ethernet all`***
- `ERS-Stackable(config-if)#`***`lacp ?`***

```
Configure LACP port parameters
  aggregation    Enable port aggregation mode
  clear-stats    Clear LACP statistics
  key            Set key value for ports
  mode           Set LACP port mode
  priority       Set port priority
  timeout-time   Set port timeout
```

where:

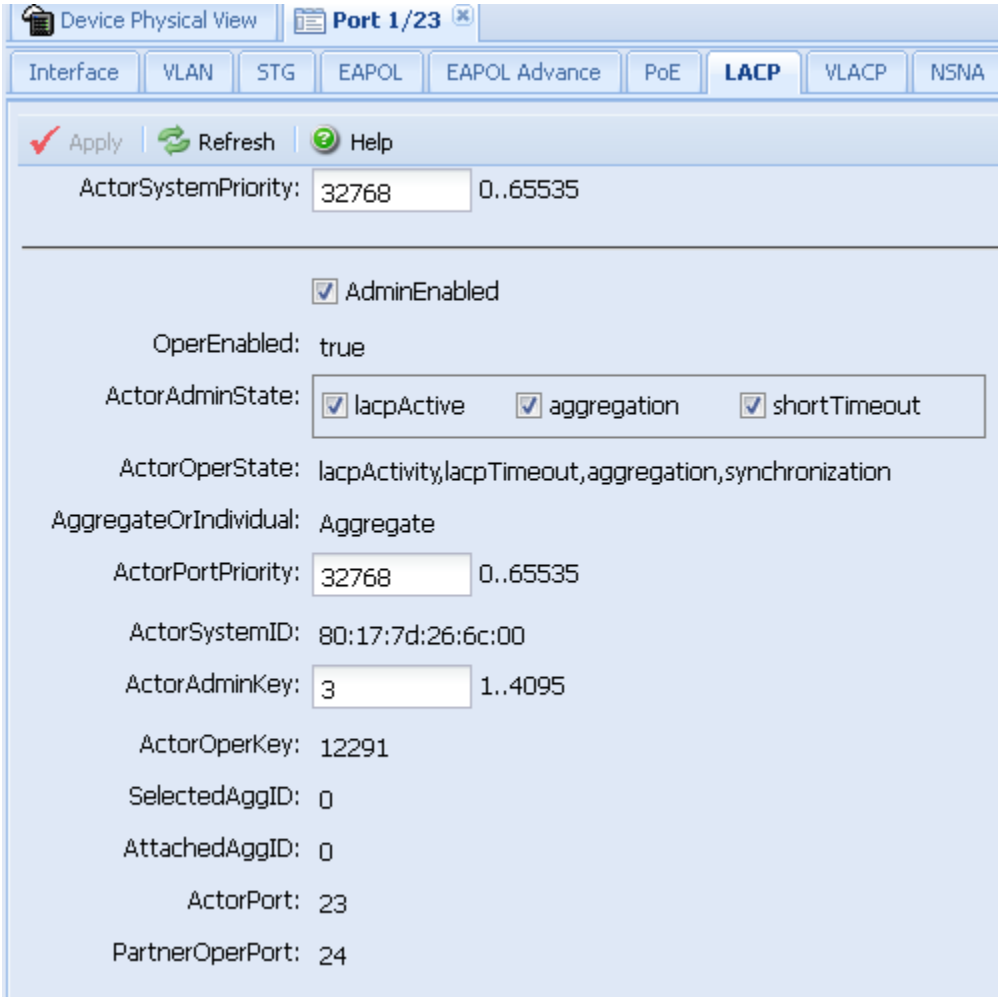
Item	Description
aggregation	Enable or disable aggregation on this port
clear-stats	Clears the LACP statistics
key	Sets LACP aggregation key for a specific port-type. • Value is in the range from 1 to 4095
mode	Sets the LACP mode: • Active = AdminEnabled + ActorAdminState(lacpActive) • Passive = AdminEnabled • Off = AdminDisabled
priority	The priority value assigned to this aggregation port. • Value is in the range 0 to 65535
timeout-time	Set the timer for ether long or short.

For example, to enable LACP aggregation on port 3, enter the following command:

- `ERS-Stackable(config)#`***`interface ethernet all`***
- `ERS-Stackable(config-if)#`***`lacp aggregation port 3 enable`***

3.2.2.2 Via EDM

Select the port where you wish to enable LACP, right-click it and select *Edit*. Go to the LACP tab as shown below.



3.3 VSP 7000 – LACP Rear-Port Mode Configuration

Rear port mode is enabled in either normal or SPBM mode by entering the following command:

- `7024XLS(config)#`***`rear-port mode [normal|spbm]`***

When rear-port mode is enabled, by default, the following settings are automatically applied:

```
lacp port advance
vlan ports 33-40 tagging tagAll
interface ethernet ALL
lacp key port 33-40 4095
lacp timeout-time port 33-40 short
lacp mode port 33-40 active
lacp aggregation port 33-40 enable
exit
```

4. Configuring VLACP

4.1 ERS 8000, VSP 4000, VSP 7200, VSP 8000, VSP 9000

4.1.1 Interface Level

VLACP is configured via the interface level using the command shown below.

```
8284XSQ(config)#interface gigabitEthernet <slot/port>
8284XSQ(config-if)#vlacp ?
  enable               Enable vlacp on port
  ethertype            Vlacp protocol identification
  fast-periodic-time   Value in miliseconds for fast periodic time
  funcmac-addr         Multicast mac address used for VLACPDU
  slow-periodic-time   Value in miliseconds for slow periodic time
  timeout              Use long or short timeouts
  timeout-scale        Timeout = periodic-time * timeout-scale
```

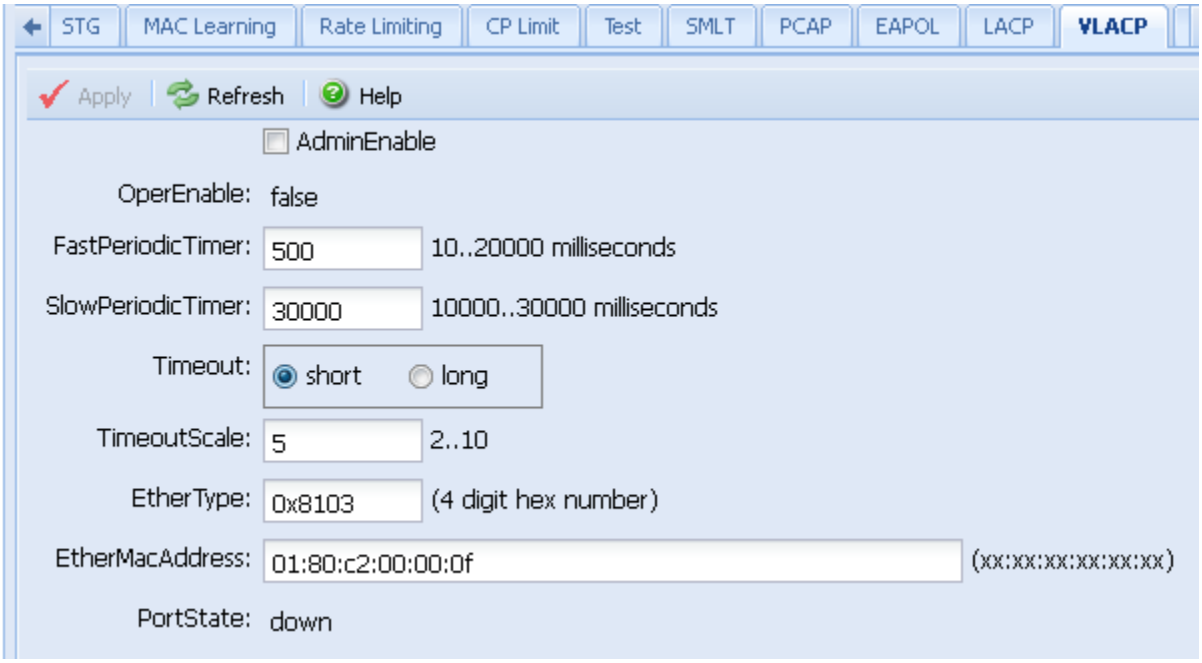
where:

Parameters and Variables	Description
info	Displays current level parameter settings and next level directories.
enable	Enables VLACP for a specific port-type.
disable	Disables VLACP for a specific port-type.
fast-periodic-time <milliseconds>	Sets the fast periodic time value (in milliseconds) for a specific port-type. The default value is 200 ms • *milliseconds* is the fast periodic time value, an integer value in the range 200 and 20,000 ms. **Note:** The fast periodic time value of 200 ms is not supported for this software release. The minimum supported fast periodic time value is 400 ms.
slow-periodic-time <milliseconds>	Sets the slow periodic time value (in milliseconds) for a specific port-type. The default value is 30,000 ms • *milliseconds* is the slow periodic time value, an integer value in the range 10,000 and 30,000 ms.

Parameters and Variables	Description
timeout <long|short>	Sets the port to use the long or short timeout value: • *long* sets the port to use the timeout-scale value * the slow-periodic-tim value. • *short* sets the port to use the timeout-scale value * the fast-periodic-tim value. For example, if you set the timeout-scale *value* to 3, and the fast-periodic-time *value* to 400 ms, the timer will expire within 1200 to 1400 ms.
timeout-scale <*integer*>	Sets a timeout scale for a specific port-type (where timeout-scale = periodic-time * timeout-scale). The default value is 3. • *integer* is the timeout scale value, an integer value in the range 1 and 10.
ethertype <integer>	Sets the VLACP protocol identification for this port. • *integer* is the ethertype value, an integer value in the range 1 and 65535.
macaddress <mac>	Sets the Multicast MAC address used for the VLACPDU. Required parameters: • *mac* is the MAC address in the following format: 0x00:0x00:0x00:0x00:0x00:0x00:0x00

4.1.1.1 Via EDM

Select the port where you wish to enable VLACP, right-click it and select *Edit General*. Go to the VLACP tab as shown below.



4.1.2 Global Level

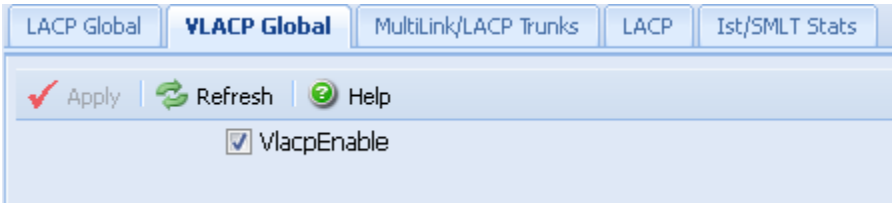
4.1.2.1 Via ACLI

The following command enables VLACP globally:

- `ERS8000(config)#`***`vlacp enable`***

4.1.2.2 Via EDM

Go to *Configuration -> VLAN -> MLT/LACP -> VLACP Global*



4.2 VSP 7000 and ERS Stackable Switch - ACLI

4.2.1 Interface Level

4.2.1.1 Via ACLI

VLACP is configured via the interface level using the command shown below.

```
ERS-Stackable(config)#interface ethernet all
ERS-Stackable(config-if)#vlacp port <port> ?
  enable               Enable VLACP for the port(s)
  ethertype            Set the ethertype value of VLACP
  fast-periodic-time   Set the fast-periodic time interval
  funcmac-addr         Set the mac-addr to exchange VLACPDU from end-to-end
                       perspective
  slow-periodic-time   Set the slow periodic time interval
  timeout              Set the timeout type
  timeout-scale        Set the timeout scale
```

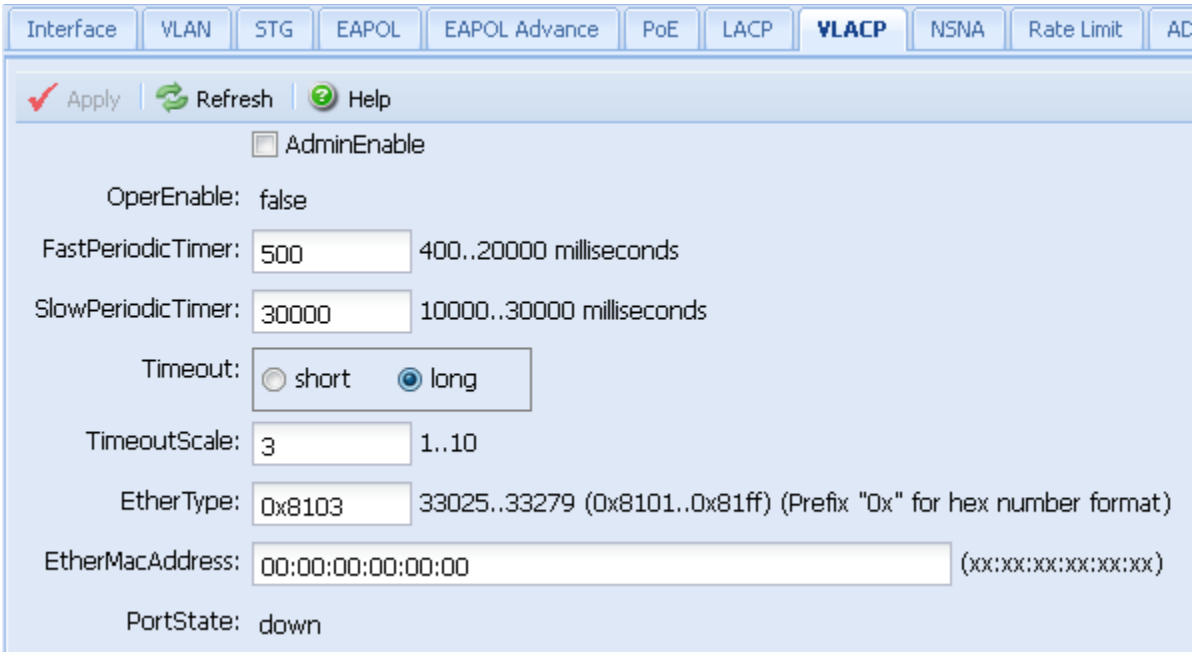
where:

Parameters and Variables	Description
<port-type>	Specifies the port type. In the current software release, port type must be Ethernet.
<slot/port> enable|disable	Specifies the slot and port number. Enables or disables VLACP.
timeout <*long/short*>	Specifies whether the timeout control value for the port is a long or short timeout. • *long* sets the port timeout value to: (timeout-scale value) x (slow-periodic-time value). • *short* sets the port's timeout value to: (timeout-scale value) x (fast-periodic-time value). For example, if the timeout is set to short while the timeout-scale value is 3 and the fast-periodic-time value is 200 ms, the timer expires within 400 to 600 ms. Default is long.
fast-periodic-time <*integer*>	Specifies the number of milliseconds between periodic VLACPDU transmissions using short timeouts. The range is 500-20000 milliseconds. Default is 500.
slow-periodic-time <*integer*>	Specifies the number of milliseconds between periodic VLACPDU transmissions using long timeouts. The range is 10000-30000 milliseconds. Default is 30000.

Parameters and Variables	Description
timeout-scale <*integer*>	Sets a timeout scale for the port, where timeout = (periodic time) x (timeout scale). The range is 1-10. Default is 3.
funcmac-addr <*mac*>	Specifies the address of the far-end switch/stack configured to be the partne of this switch/stack. If none is configured, any VLACP-enabled switch communicating with the local switch through VLACP PDUs is considered to be the partner switch.
ethertype <*integer*>	Sets the VLACP protocol identification for this port. Defines the ethertype value of the VLACP frame. The range is 1 to 65535. Default is 8103.

4.2.1.2 Via JDM

Select the port where you wish to enable VLACP, right-click it and select *Edit*. Go to the VLACP window as shown below.



4.2.2 Global Level

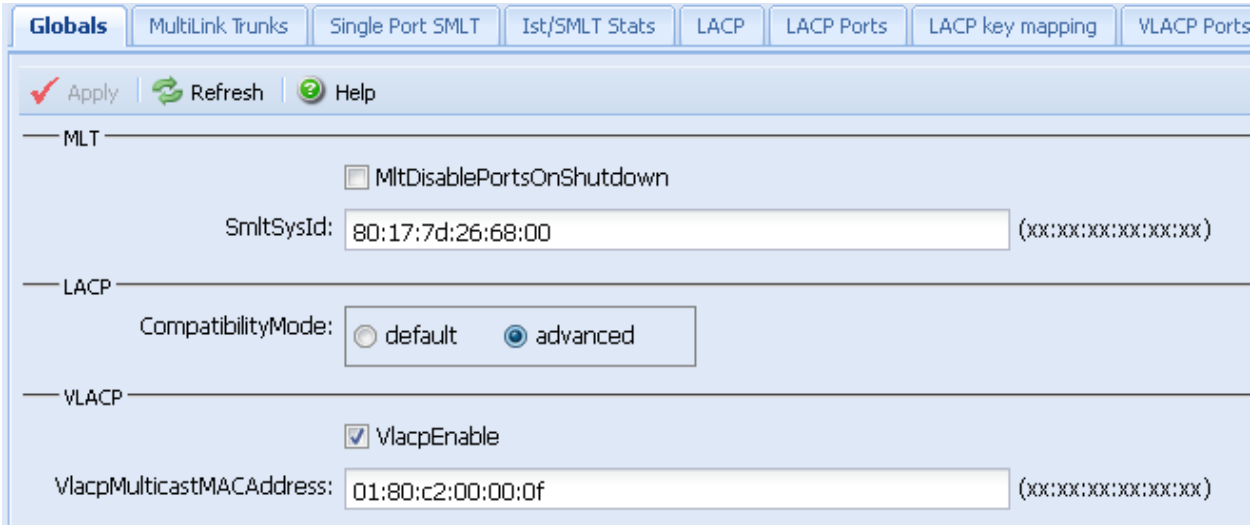
Global setting to enable VLACP:

```
ERS-Stackable(config)#vlacp enable
ERS-Stackable(config)#vlacp macaddress <H.H.H or xx.xx.xx.xx.xx.xx or xx-xx-xx-xx-xx-xx>
```

Please note an ERS Stackable switch only supports one VLACP MAC address configured at a global level

4.2.2.1 Via JDM

Go to *Configuration -> VLAN -> MLT/LACP -> Globals*



5. Configuration Examples

5.1 LACP Configuration Example: Base Scenario, Point-to-Point

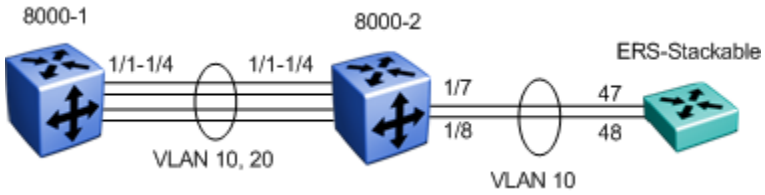


Figure 2: LACP Basic Configuration Example

For this example, we will configure the following:

- Enable Spanning Tree – default setting
- A Link Aggregation Group (LAG) is configured between Ethernet Routing Switches 8800 8000-1 and 8000-2 with 4 link members and the following items:
  - VLANs 10 and 20 will be tagged across the LAG
  - LACP key = 1
  - MLT ID = 1
  - LACP Timer = Short using the default fast-periodic-time of 1 second resulting in a timeout period of 3 seconds using the default timeout-scale of 3
- A LAG between 8000-2 and ERS-Stackable with 2 link members and the following items:
  - VLAN 10 will be tagged across the LAG
  - LACP key = 2
  - MLT ID = 2
  - LACP Timer = Short using the default fast-periodic-time of 1 second resulting in a timeout period of 3 seconds using the default timeout-scale of 3

In order to change the VLAN port membership or VLAN tagging on the MLT port members, it is required to disable LACP on the port(s), add the VLAN and associate it to the LACP ports, and then re-enable LACP on the ports.

5.1.1 Configuration

5.1.1.1 Go to configuration mode

```
config terminal
```

5.1.1.2 LACP Configuration

Create MLT 1 using key 1. On 8000-2, also create MLT 2 using key 2 for the ERS-Stackable.

On the ERS 8000, the MLT LACP key configured must be the same as the LACP key value entered at the interface level.

MLT configuration is only required on the ERS8600/8800. Do not create an MLT for the ERS-Stackable. By default, the first LACP group will be added to last MLT group on the ERS-Stackable

8001-1:

```
8000-1:5(config)#mlt 1
8000-1:5(config)#mlt 1 ntstg enable
8000-1:5(config)#interface mlt 1
8000-1:5(config-mlt)#lacp enable key 1
8000-1:5(config-mlt)#exit
```

8001-2:

```
8000-2:5(config)#mlt 1
8000-2:5(config)#mlt 1 ntstg enable
8000-2:5(config)#interface mlt 1
8000-2:5(config-mlt)#lacp enable key 1
8000-2:5(config-mlt)#exit
8000-2:5(config)#mlt 2
8000-2:5(config)#mlt 2 ntstg enable
8000-2:5(config)#interface mlt 2
8000-2:5(config-mlt)#lacp enable key 2
8000-2:5(config-mlt)#exit
```

5.1.1.3 Create VLANs

8001-1:

```
8000-1:5(config)#vlan port 1/1-1/4 tagging tagAll
8000-1:5(config)#vlan members remove 1 1/1-1/4
8000-1:5(config)#vlan create 10 type port 1
8000-1:5(config)#vlan members add 10 1/1-1/4
8000-1:5(config)#vlan create 20 type port 1
8000-1:5(config)#vlan members add 20 1/1-1/4
```

8001-2:

```
8000-2:5(config)#vlan port 1/1-1/4,1/7,1/8 tagging tagAll
8000-2:5(config)#vlan members remove 1 1/1-1/4,1/7,1/8
8000-2:5(config)#vlan create 10 type port 1
8000-2:5(config)#vlan members add 10 1/1-1/4,1/7-1/8
8000-2:5(config)#vlan create 20 type port 1
8000-2:5(config)#vlan members add 20 1/1-1/4
```

ERS Stackable:

```
ERS-Stackable(config)#vlan ports 47,48 tagging tagall
ERS-Stackable(config)#vlan create 10 type port
ERS-Stackable(config)#vlan configcontrol automatic
ERS-Stackable(config)#vlan members add 10 35,47-48
ERS-Stackable(config)#vlan members remove 1 47,48
ERS-Stackable(config)#vlan ports 47-48 pvid 10
```

Please note the default VLAN/PVID on the ERS-Stackable and ERS 8000 must match for LACP to come up. The default VLAN ID must match with its partner. On an ERS-Stackable switch, the default VLAN PVID is normally always 1 whereas this is not the case with the ERS8000. Hence, the reason for entering the ACLI command *vlan ports 47-48 pvid 10* on the ERS-Stackable switch. To view the default VLAN, enter the ACLI command *show interface gigabitEthernet vlan 1/7,1/8* via 8000-2 and *show vlan interface info 47,48* on the ERS-Stackable switch.

5.1.1.4 Configure LACP on Aggregation Ports

The key used must be the same as that used in step 1 when setting up the MLT. Although the key must be same on all ports on the switch, they can be different on the remote switch.

8000-1:

```
8000-1:5(config)#interface gigabitEthernet 1/1-1/4
8000-1:5(config-if)#lacp key 1
8000-1:5(config-if)#lacp timeout-time short
8000-1:5(config-if)#lacp aggregation enable
8000-1:5(config-if)#lacp enable
8000-1:5(config-if)#exit
```

8000-2:

```
8000-2:5(config)#interface gigabitEthernet 1/1-1/4
8000-2:5(config-if)#lacp key 1
8000-2:5(config-if)#lacp timeout-time short
8000-2:5(config-if)#lacp aggregation enable
8000-2:5(config-if)#lacp enable
8000-2:5(config-if)#exit
8000-2:5(config)#interface gigabitEthernet 1/7-1/8
8000-2:5(config-if)#lacp key 2
8000-2:5(config-if)#lacp timeout-time short
8000-2:5(config-if)#lacp aggregation enable
8000-2:5(config-if)#lacp enable
8000-2:5(config-if)#exit
```

ERS Stackable:

```
ERS-Stackable(config)#interface ethernet 47-48
ERS-Stackable(config-if)#lacp key 2
ERS-Stackable(config-if)#lacp mode active
ERS-Stackable(config-if)#lacp timeout-time short
ERS-Stackable(config-if)#lacp aggregation enable
ERS-Stackable(config-if)#exit
```

5.1.1.5 Enable LACP Globally

8000-1 & 8000-2: Same configuration on both switches

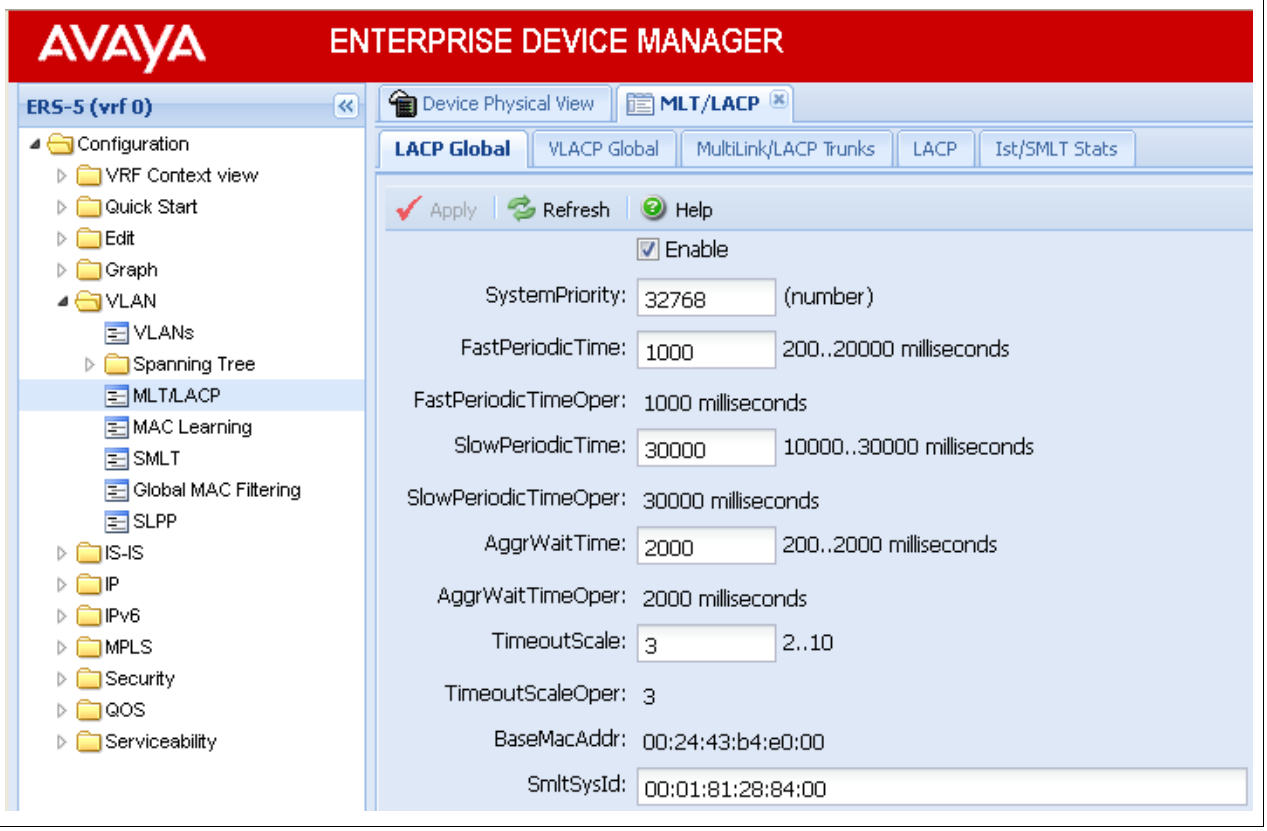
```
8000-1:5(config)#lacp enable
```

5.1.2 EDM LACP Configuration – 8000-1

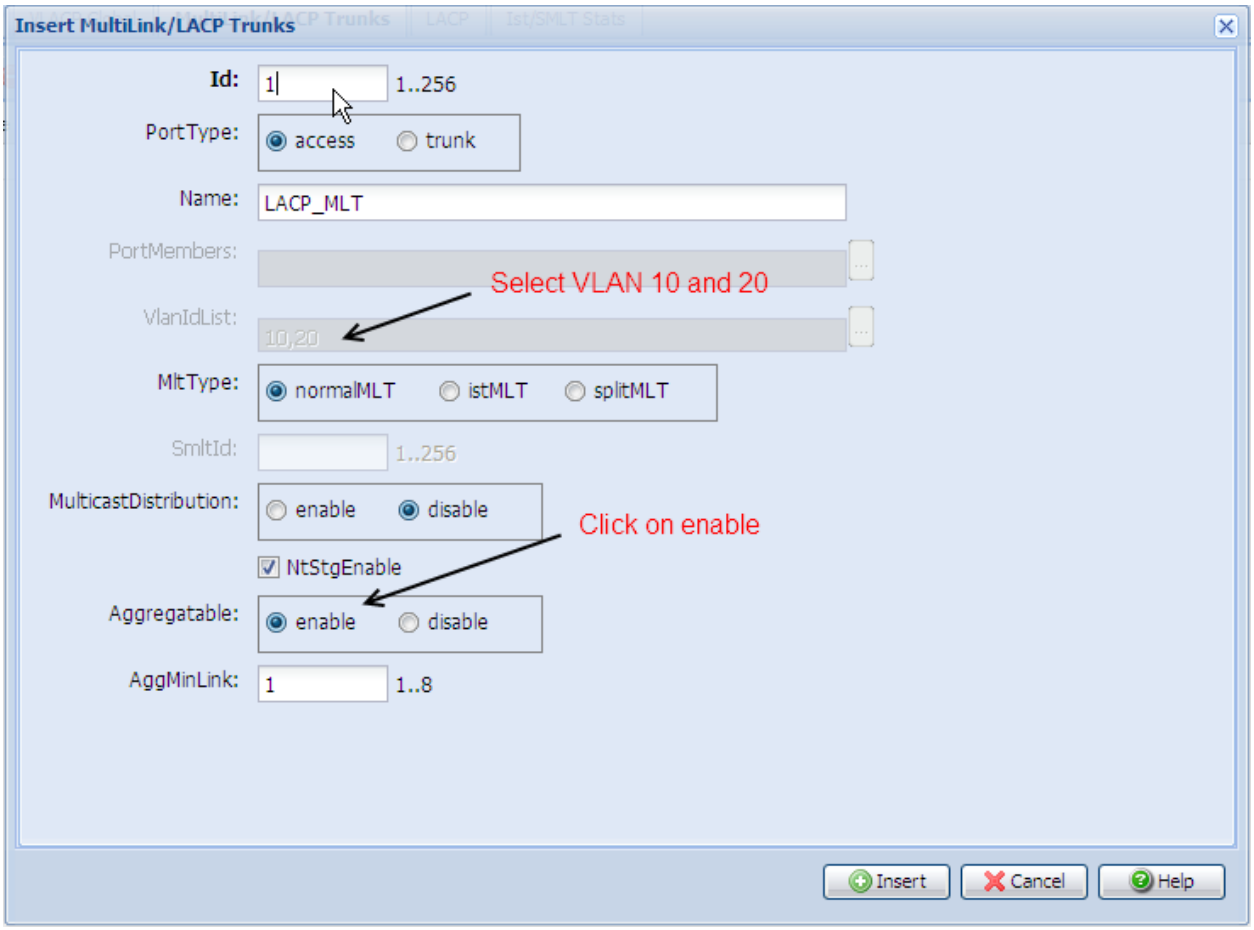
The following screenshots describe the configuration process for the above example using EDM. Assume the following:

- VLAN 10 and 20 have already been created.
- Ports 1/1-1/4 is tagging enabled and are members of VLAN 10 and 20.
- Both switches are mirror images of each other so the same commands can be entered in both.

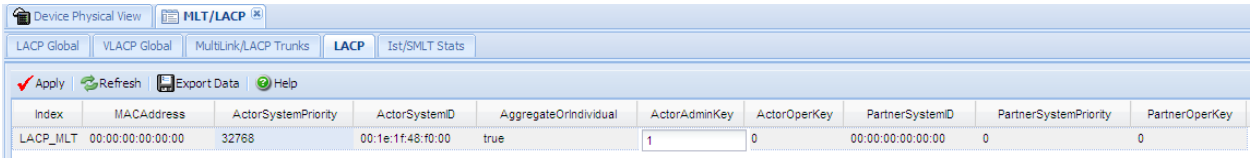
8000-1 Step 1 – Go to *Configuration -> VLAN -> MLT/LACP -> LACP*. LACP is enabled by default and recommended to keep default settings



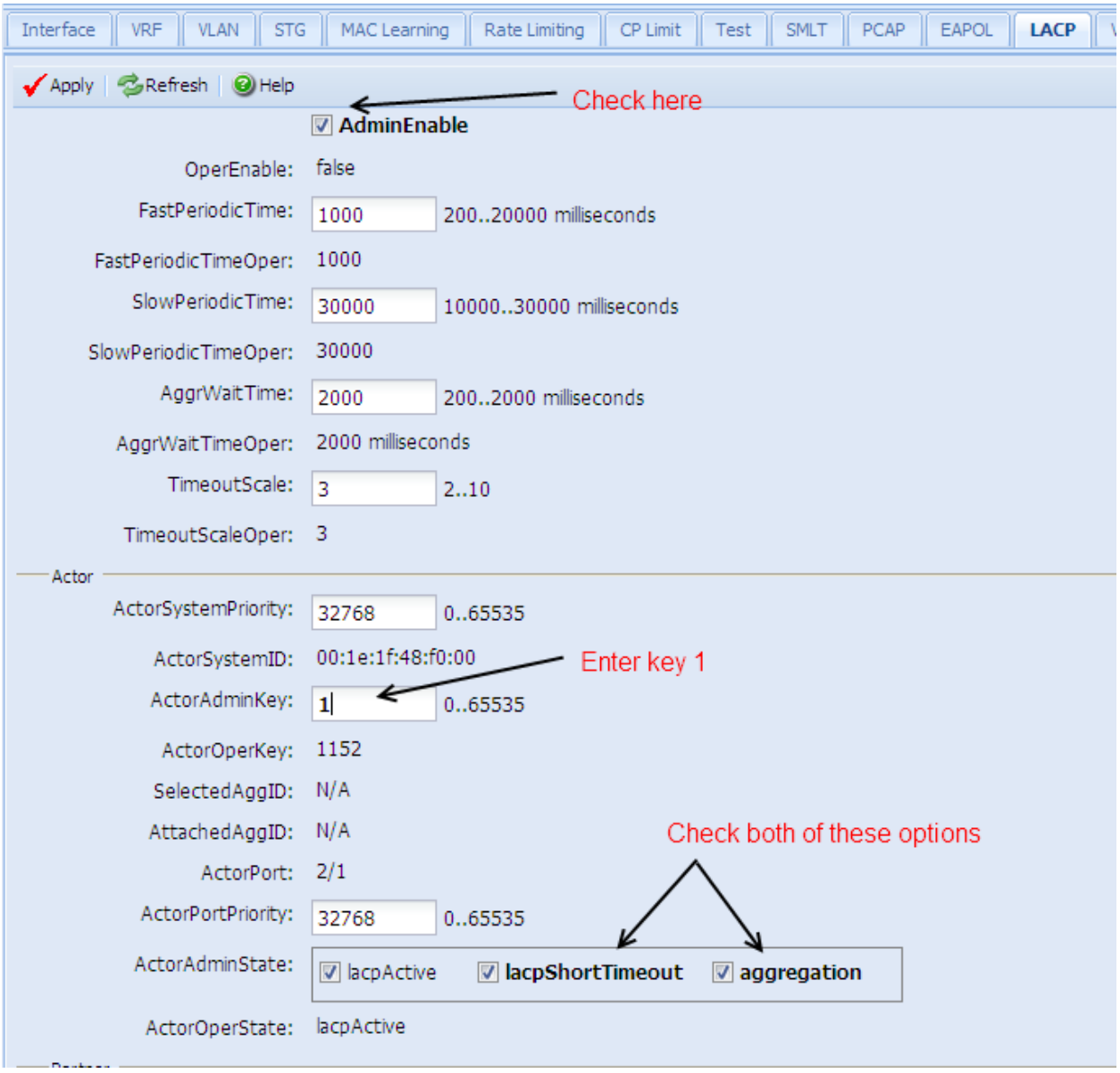
8000-1 Step 2 – Go to *Configuration -> VLAN -> MLT/LACP -> Multilink/LACP Trunks* and click on *Insert*



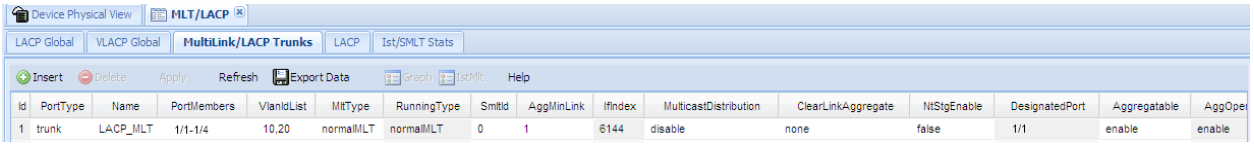
8000-1 Step 3 – Go to *Configuration -> VLAN -> MLT/LACP -> LACP* and via *ActorAdminKey* window, enter *1* for the MLT Index create above in the previous step



8000-1 Step 4 – Go to the *Device Physical View* tab and click on each of the LAG ports (1/1 to 1/4), right-click the mouse key, and select *Edit General.* Go to the LACP tab as shown below. Three fields need to be changed in the order as shown below. After each change, press *Apply* button.



8000-1 Step 5 – Once the ports have been configured, the MLT should look like the following, note that ports 1/3-1/4 are not enabled thus do not show up as port members:



5.1.3 Verification

5.1.3.1 Verify MLT /LACP Operation

Verify the MLT instance is operational

```
show mlt
show mlt <mlt #>
```

Results:

8000-2:

```
================================================================================
                                    Mlt Info
================================================================================
                          PORT     SVLAN  MLT    MLT         PORT          VLAN
MLTID IFINDEX NAME        TYPE     TYPE   ADMIN  CURRENT     MEMBERS       IDS
--------------------------------------------------------------------------------
1    6144   8000-1        trunk    normal norm    norm      1/1-1/4           10 20
2    6145   edge-1        trunk    normal norm    norm      1/7-1/8           10

                 MULTICAST              DESIGNATED    LACP       LACP
MLTID IFINDEX    DISTRIBUTION  NT-STG   PORTS         ADMIN      OPER
--------------------------------------------------------------------------------
1       6144      disable      enable   1/1          enable       up
2       6145      disable      enable   1/7          enable       up

                 ENCAP
MLTID IFINDEX    DOT1Q
--------------------------------------------------------------------------------
1        6144     enable

2        6145     enable


MLTID IFINDEX   PORT   STATUS   MC-LIMIT   BC-LIMIT
--------------------------------------------------------------------------------
1        6144    1/1 enabled   10000      10000
1        6144    1/2 enabled   10000      10000
1        6144    1/3 enabled   10000      10000
1        6144    1/4 enabled   10000      10000
2        6145    1/7 enabled   10000      10000
2        6145    1/8 enabled   10000      10000
```

ERS Stackable:

```
Id Name              Members                 Bpdu   Mode           Status  Type
-- ----------------- ----------------------- ------ -------------- ------- ------
32 Trunk #32         47-48                   Single DynLag/Basic   Enabled Trunk
```

On each ERS8000, verify the following information:

Option	Verify
VLAN IDS	Verify that the VLAN ids assigned to the IST and SMLT MLT are correct: • MLT 1: Member of VLANs *10* & *20* with port members *1/1-1/4* • MLT 2: Member of VLAN *10* with port member *1/7* and *1/8* on 8000-2 only
LACP ADMIN	Displays as *enabled* for MLT ID *1* and *2*. The value *enabled* indicates that the LACP have been enabled.
LACP OPER	Displays as *up* for MLT ID *1* and *2*. The value *up* indicates that LACP is operational.
IFINDEX	This value indicated is the index number which is used to view individual state for an LACP instance. Please see next step below.

On ERS-STACKABLE, verify the following information:

Option	Verify
Members	Displays as *47-48* for MLT ID 32. The value *enabled* indicates that the LACP port members
Bpdu	*Single* indicates that BPDUs are transmitted and received on a single port in the LAG. In a LACP group, BPDUs are transmitted and received only on the first link in the group
Mode	*DynLag* indicated a dynamic association of link-aggregated ports with a trunk group using basic (MAC based) load balancing. Advance mode can be selected by entering the ACLI command *mlt 32 loadbalance advance.*
Type	Displays as *Trunk* for MLT ID 32 indicating the VLANs are tagged.

5.1.3.1.1 Verify LACP Operations

Verify LACP operation

ERS8000:

```
show lacp interface mlt <MLT index #>
# use the show mlt command to get the MLT index number
```

Results:

8000-2:

```
8000#show lacp interface mlt 6145
================================================================================
                          LACP Aggregator Information
================================================================================
                     MAC               COLLECTOR     AGGR     PORT
MLTID IFINDEX        ADDR              MAXDELAY      ORINDI   MEMBERS
--------------------------------------------------------------------------------
2     6145        00:80:2d:ba:d4:06    32768         aggr     1/7-1/8

--------------------------------------------------------------------------------
                    OPER         MIN         OPERLAST
MLTID IFINDEX       STATE        LINK        CHANGE
--------------------------------------------------------------------------------
2     6145          up           1           0 day(s), 04:11:41

--------------------------------------------------------------------------------
                    ACTOR       ACTOR           ACTOR       ACTOR
MLTID IFINDEX       SYSPRIO     SYSID           ADMINKEY    OPERKEY
--------------------------------------------------------------------------------
2     6145          32768    00:80:2d:ba:d4:00     2         2

--------------------------------------------------------------------------------
                    PARTNER      PARTNER         PARTNER
MLTID IFINDEX       SYSPRIO      SYSID           OPERKEY
--------------------------------------------------------------------------------
2     6145          32768    00:0e:c0:f3:64:00     8194
```

On the ERS 8000, verify the following information as per this example using 8000-2:

Option	Verify
AGGR ORINDI PORT MEMBERS	Displays as *aggr* with port members *1/7- 1/8*. This indicates that the LACP aggregation is operation with port members *1/7-1/8* as shown for the MLT IFINDEX *6145* (MLT 2).
OPER STATE	Displays as *up*. The value *up* indicates that LACP is operational.
ACTOR ADMINKEY ACTOR OPERKEY	Displays as *2*. This value indicated the LACP key configured and used. Please note that the keys need not match between two LACP peers. In this example

	we used the same key for ease of configuration.

5.1.3.1.2 Verify LACP Interface Operation

Verify LACP interface operation

ERS8000:

```
show lacp interface gigabitEthernet <port #>
```

ERS Stackable:

```
show lacp port <port #>
show lacp debug member <port #>
```

Results:

8000-2:

```
8000-2#show lacp interface gigabitethernet 1/7,1/8
================================================================================
                                Actor Admin
================================================================================
INDEX SYS    SYS               KEY    PORT   PORT   STATE
      PRIO   ID                           PRIO
--------------------------------------------------------------------------------
1/7   32768 00:80:2d:ba:d4:00 2      0x46    32768 act         short aggr
1/8   32768 00:80:2d:ba:d4:00 2      0x47    32768 act         short aggr

================================================================================
                                Actor Oper
================================================================================
INDEX KEY    SELECTED ATTACHED AGGR  STATE
           AGGR ID  AGGR ID
--------------------------------------------------------------------------------
1/7   2      6145     6145     true  act         short aggr sync col dis
1/8   2      6145     6145     true  act         short aggr sync col dis

================================================================================
                               Partner Admin
================================================================================
INDEX SYS    SYS               KEY    PORT   PORT   STATE
      PRIO   ID                           PRIO
--------------------------------------------------------------------------------
1/7   0      00:00:00:00:00:00 0      0x0     0      pas         long indi
1/8   0      00:00:00:00:00:00 0      0x0     0      pas         long indi

================================================================================
                            Partner Operational
================================================================================
INDEX SYS    SYS               KEY    PORT   PORT   STATE
      PRIO   ID                           PRIO
```

```
--------------------------------------------------------------------------------
1/7    32768 00:0e:c0:f3:64:00 8194  0x2f    65535 act        short aggr sync col dis
1/8    32768 00:0e:c0:f3:64:00 8194  0x30    65535 act        short aggr sync col dis

================================================================================
                                LACP Extention
================================================================================
INDEX ADMIN    OPER    FAST    SLOW    AGGRWAIT TIMEOUT FAST    SLOW    AGGRWAIT TIMEOUT
      ENABLED ENABLED TIME    TIME    TIME     SCALE   TIME    TIME    TIME     SCALE
                      ADMIN   ADMIN   ADMIN    ADMIN   OPER    OPER    OPER     OPER
--------------------------------------------------------------------------------
1/7    true    true    1000    30000   2000     3       1000    30000   2000     3
1/8    true    true    1000    30000   2000     3       1000    30000   2000     3
```

ERS Stackable:

```
ERS-Stackable#show lacp port 47,48
                                    Admin Oper          Trunk Partner
Port Priority Lacp    A/I Timeout Key   Key   AggId Id    Port    Status
---- -------- ------- --- ------- ----- ----- ----- ----- ------- -------
47   65535    Active  A   Short   2     8194  8224  32    70      Active
48   65535    Active  A   Short   2     8194  8224  32    71      Active

ERS-Stackable#show lacp debug member 47,48
Port AggrId TrunkId Rx State      Mux State     Partner Port
---- ------ ------- ------------- ------------- ------------
47   8224   32      Current       Ready         70
48   8224   32      Current       Ready         71
```

Via 8000-2, verify the following information:

Option	Verify
STATE AGGR	The state should be displayed as act (active) with port members 1/7 and 1/8 while AGGR should be displayed as true. This indicates that the LACP aggregation is operation and active. The anonym meanings are as follows: • *Short*: indicates LACP short timer is used • *Aggr*: Aggregation, indicates the port has become part of an aggregation otherwise it be displayed as "*indi*" for individual • *Sync*: Synchronization, indicates whether or not the port in in-sync or not • *Col*: Collecting, indicates whether or not the receiving of LACP packets on the port • *Dis*: Distributing, indicate whether or not the transmitting of LACP packets on the port

Via ERS Stackable, verify the following information:

Option	Verify
Lacp Status	Displays as *Active* for MLT ID 32. This indicates LACP is configured, enabled, and operation with partner.
Timeout	Displays as *Short* for MLT ID 32. This indicates that LACP Short Timer has been configured.
Admin Key	Displays as 2. This indicates the LACP configured on this interface.
Rx State	Displays as *Current* if LACP is Rx information is valid. Otherwise, the value displayed could be Expired, Defaulted, Initialized, LacpDisabled, or PortDisabled.
Mux State	Displays as *Ready* indicating that ports 47 and 48 are ready to transmit and receive. Otherwise, the value displayed could be Detached, Waiting, or Attached.

5.2 VSP 8000 SMLT Cluster with LACP

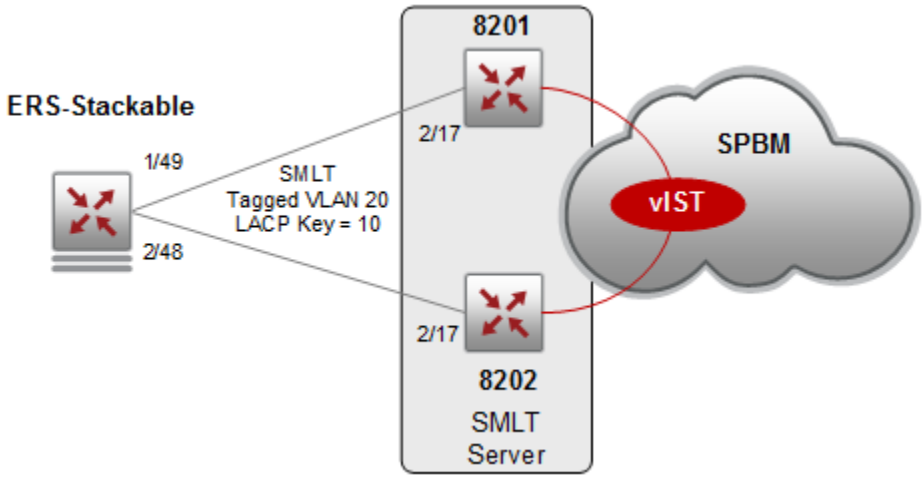


Figure 3: LACP between ERS8000 and ERS-Stackable

For this example, we will configure the following:

- A Link Aggregation Group (LAG) is configured between the VSP 8000 triangle topology and a ERS Stackable .
    - VLANs 20 will be tagged across the LAG
    - ISID 82002 will be used on the cluster switches
    - LACP key = 10
    - MLT ID = 10
    - LACP Timeout = Fast
- For this application to work, we will need to configure the SMLT System Identifier so that LACP global identifier is the same on both 8000-1 and 8000-2. Although you can use any MAC address, we will simple use the LACP identifier from 8000-1 to avoid any possible duplicate addresses.
- Assuming both 8000-1 and 8000-2 are setup as an SMLT cluster, we will also enable the recommended SMLT parameter such as SLPP and Ext-CP-Limit
- For more detail on configuring SMLT, please refer to the document titled ” Switch Clustering using Split-Multilink Trunking (SMLT) Technical Configuration Guide”, document number NN48500-518.

Please note that in order for LACP to work all links must be operating at the same speed. If LACP does not come up, please check that the interfaces on both ERS8000 switches in the SMLT cluster are operating at the same speed.

5.2.1 SMLT Cluster Configuration

For this example, the VSP 8000 cluster is connected to an SBPM core. The SBPM base configuration used in this example is based on the following configuration.

8201	8202

config terminal
spbm
prompt "8201"
router isis
  sys-name "8201"
  manual-area 49.0001
  spbm 1
  spbm 1 nick-name 0.82.01
  spbm 1 b-vid 4051-4052 primary 4051
exit
vlan create 4051 name "BVLAN-1" type spbm-bvlan
vlan create 4052 name "BVLAN-2" type spbm-bvlan
router isis enable
interface GigabitEthernet <slot/port>
  no shutdown
  no spanning-tree mstp force-port-state enable
  isis
  isis spbm 1
  isis enable
exit
cfm sbbm enable
	config terminal
	spbm
	prompt "8202"
	router isis
	  sys-name "8202"
	  manual-area 49.0001
	  spbm 1
	  spbm 1 nick-name 0.82.02
	  spbm 1 b-vid 4051-4052 primary 4051
	exit
	vlan create 4051 name "BVLAN-1" type spbm-bvlan
	vlan create 4052 name "BVLAN-2" type spbm-bvlan
	router isis enable
	interface GigabitEthernet <slot/port>
	  no shutdown
	  no spanning-tree mstp force-port-state enable
	  isis
	  isis spbm 1
	  isis enable
	exit
	cfm sbbm enable

5.2.1.1 Create vIST VLAN

Create VLAN 2 and ISID 82002 will be used by the Virtual Inter Switch Trunk (vIST).

8201:

```
8201:1(config)#vlan create 2 name "vlan2_IST" type port-mstprstp 0
8201:1(config)#vlan i-sid 2 82002
8201:1(config)#interface Vlan 2
8201:1(config-if)#ip address 10.8.2.1 255.255.255.252
8201:1(config-if)#exit
```

8202:

```
8201:1(config)#vlan create 2 name "vlan2_IST" type port-mstprstp 0
8202:1(config)#vlan i-sid 2 82002
8202:1(config)#interface Vlan 2
8202:1(config-if)#ip address 10.8.2.2 255.255.255.252
8202:1(config-if)#exit
```

5.2.1.2 Get ISIS System ID

```
8201:1#show isis system-id
```

```
================================================================================
                                ISIS System-Id
================================================================================
SYSTEM-ID
--------------------------------------------------------------------------------
b0ad.aa47.0884

8202:1#show isis system-id

================================================================================
                                ISIS System-Id
================================================================================
SYSTEM-ID
--------------------------------------------------------------------------------
e45d.523c.4884
```

5.2.1.3 Create vIST

Create the vIST using the SPBM System ID and vIST VLAN IP from the peer vIST cluster switch.

8201:

```
8201:1(config)#virtual-ist  peer-ip 10.8.2.2 vlan 2
8201:1(config)#router isis
8201:1(config-isis)#spbm 1 smlt-peer-system-id e45d.523c.4884
8201:1(config-isis)#exit
```

8202:

```
8202:1(config)#virtual-ist  peer-ip 10.8.2.1 vlan 2
8202:1(config)#router isis
8202:1(config-isis)#spbm 1 smlt-peer-system-id b0ad.aa47.0884
8202:1(config-isis)#exit
```

5.2.1.4 VSP 8000 LACP and SMLT Configuration

8201 & 8202: Same configuration on both switches

```
8201:1(config)#mlt 10
8201:1(config)#interface mlt 10
8201:1(config-if)#lacp key 10
8201:1(config-if)#lacp enable
8201:1(config-if)#smlt
8201:1(config-if)#exit
8201:1(config)#lacp enable
```

5.2.1.5 Create Access VLANs

8201 & 8202: Same configuration on both switches

```
8201:1(config)#vlan ports 2/17 tag tagall
8201:1(config)#vlan create 20 type port-mstprstp 0
8201:1(config)#vlan members 20 2/17
8201:1(config)#vlan members remove 1 2/17
8201:1(config)#vlan i-sid 20 200020
```

ERS Stackable:

```
ERS-Stackable(config)#vlan ports 1/49,2/48 tagging tagall
ERS-Stackable(config)#vlan create 20 type port cist
ERS-Stackable(config)#vlan configcontrol automatic
ERS-Stackable(config)#vlan members add 20 1/49,2/48
ERS-Stackable(config)#vlan members remove 1 1/49,2/48
```

5.2.1.6 Configure LACP on Aggregation Ports

Please note, in the vIST cluster, the LACP SMLT System ID must be the same on both cluster switches. For this example, we will use the System ID from switch 8201.

8201 & 8202: Same configuration on both switches

```
8201:1(config)#interface gigabitEthernet 2/17
8201:1(config-if)#lacp key 10
8201:1(config-if)#lacp aggregation enable
8201:1(config-if)#lacp timeout-time short
8201:1(config-if)#lacp enable
8201:1(config-if)#exit
8201:1(config)#lacp smlt-sys-id b0:ad:aa:47:08:00
```

To view the global LACP System ID, enter the following command:

```
8201:1#show lacp
================================================================================
                            Lacp Global Information
================================================================================
                SystemId: b0:ad:aa:47:08:00
            SmltSystemId: b0:ad:aa:47:08:00
                    Lacp: enable
         system-priority: 32768
                 timeout-admin: 3
     fast-periodic-time-admin: 1000
     slow-periodic-time-admin: 30000
         aggr-wait-time-admin: 2000
                 timeout-oper: 3
     fast-periodic-time-oper: 1000
```

```
            slow-periodic-time-oper: 30000
                aggr-wait-time-oper: 2000
```

ERS Stackable:

```
ERS-Stackable(config)#interface ethernet 1/49,2/48
ERS-Stackable(config-if)#lacp key 10
ERS-Stackable(config-if)#lacp mode active
ERS-Stackable(config-if)#lacp timeout-time short
ERS-Stackable(config-if)#lacp aggregation enable
ERS-Stackable(config-if)#spanning-tree mstp learning disable
ERS-Stackable(config-if)#exit
```

5.2.1.7 Add VLAN to MLT ID

8201 & 8202: Same configuration on both switches

```
8201:1(config)#vlan mlt 20 10
```

5.2.1.8 SLPP

SLPP will be enabled globally and only on the SMLT access port 2/17 for VLAN 20. On the SMLT primary switch we will set the SLPP packet-rx-threshold to 5, while on the SMLT secondary switch we will set the SLPP packet-rx-threshold to 50 assuming only one VLAN is used. For this example, we will pick 8000-1 as the primary switch.

The recommended SLPP receive threshold value for the primary switch is 5 and 50 for the secondary switch in an SMLT cluster for this very simply configuration using the one VLAN.

SLPP should only be enabled on the SMLT access ports.

8201:

```
8201:1(config)#slpp vid 20
8201:1(config)#slpp enable
8201:1(config)#interface gigabitEthernet 2/17
8201:1(config)#slpp packet-rx-threshold 50
8201:1(config)#slpp packet-rx
8201:1(config)#exit
```

8201:

```
8201:1(config)#slpp vid 20
8201:1(config)#slpp enable
8201:1(config)#interface gigabitEthernet 2/17
8201:1(config)#slpp packet-rx-threshold 5
8201:1(config)#slpp packet-rx
8201:1(config)#exit
```

5.2.1.9 Discard Untagged Frames

It is recommended to enable discard untagged frames on all IST and SMLT ports.

8201 & 8202: Same configuration on both switches

```
8201:1(config)#interface gigabitEthernet 2/17
8201:1(config-if)#untagged-frames-discard
8201:1(config-if)#exit
```

5.2.2 Verification

5.2.2.1 Verify MLT /LACP Operation

Verify the MLT instance is operational

```
show mlt
show mlt <mlt #>
```

Results:

8201:

```
================================================================================
                                    Mlt Info
================================================================================
                          PORT     MLT    MLT         PORT          VLAN
MLTID IFINDEX NAME        TYPE     ADMIN  CURRENT     MEMBERS       IDS
--------------------------------------------------------------------------------
10   6153   MLT-10        trunk    smlt    smlt      2/17             20

                DESIGNATED    LACP       LACP
MLTID IFINDEX   PORTS         ADMIN      OPER
--------------------------------------------------------------------------------
10      6153    2/17           enable      up

                                                                  WHICH PORTS
              WHERE       LOCAL              REMOTE               PROGRAMMED
MLTID NAME    CREATED     PORT MEMBERS       PORT MEMBERS         IN DATA PATH
--------------------------------------------------------------------------------
10    MLT-10  LOC & REM   2/17               2/17                 LOCAL & REMOTE

                ENCAP                              PVLAN        VID
MLTID IFINDEX   DOT1Q      LOSSLESS    PVLAN       TYPE         TYPE          FLEX-UNI
--------------------------------------------------------------------------------
10     6153     enable     disable     disable     -            -             disable
```

ERS Stackable:

```
Id Name              Members                Bpdu    Mode            Status  Type
-- ----------------- ---------------------- ------ --------------- ------- ------
32 Trunk #32         1/49,2/48              Single DynLag/Basic    Enabled Trunk
```

On each VSP 8000 in the switch cluster verify the following information:

Option	Verify
VLAN IDS	Verify that the VLAN ids assigned to the SMLT MLT are correct: • MLT 10: Member of VLANs *20* with port members *2/17* • MLT 2: Member of VLAN *10* with port member *1/7* and *1/8* on 8000-2 only

LACP ADMIN	Displays as *enabled* for MLT ID *10*. The value *enabled* indicates that the LACP have been enabled.
LACP OPER	Displays as *up* for MLT ID *10.* The value *up* indicates that LACP is operational.
IFINDEX	This value indicated is the index number which is used to view individual state for an LACP instance. Please see next step below.

On ERS-STACKABLE, verify the following information:

Option	Verify
Members	Displays as *1/49,2/48* for MLT ID 32. The value *enabled* indicates that the LACP port members
Bpdu	*Single* indicates that BPDUs are transmitted and received on a single port in the LAG. In a LACP group, BPDUs are transmitted and received only on the first link in the group
Mode	*DynLag* indicated a dynamic association of link-aggregated ports with a trunk group using basic (MAC based) load balancing. Advance mode can be selected by entering the ACLI command *mlt 32 loadbalance advance.*
Type	Displays as *Trunk* for MLT ID 32 indicating the VLANs are tagged.

5.2.2.2 Verify SMLT System ID

Verify SMLT System ID is the same on both cluster switches and LACP is enabled

VSP 8000:

```
show lacp
```

Results:

8201:

```
================================================================================
                            Lacp Global Information
================================================================================
               SystemId: b0:ad:aa:47:08:00
            SmltSystemId: b0:ad:aa:47:08:00
                    Lacp: enable
        system-priority: 32768
                timeout-admin: 3
     fast-periodic-time-admin: 1000
     slow-periodic-time-admin: 30000
         aggr-wait-time-admin: 2000
                timeout-oper: 3
     fast-periodic-time-oper: 1000
     slow-periodic-time-oper: 30000
         aggr-wait-time-oper: 2000
```

8202:

```
================================================================================
                            Lacp Global Information
================================================================================
                SystemId: e4:5d:52:3c:48:00
            SmltSystemId: b0:ad:aa:47:08:00
                    Lacp: enable
         system-priority: 32768
                 timeout-admin: 3
      fast-periodic-time-admin: 1000
      slow-periodic-time-admin: 30000
          aggr-wait-time-admin: 2000
                 timeout-oper: 3
      fast-periodic-time-oper: 1000
      slow-periodic-time-oper: 30000
          aggr-wait-time-oper: 2000
```

5.2.2.3 Verify LACP Interface Operation

Verify LACP interface operation

VSP 8000:

```
show lacp interface gigabitEthernet <port #>
```

ERS Stackable:

```
show lacp port <port #>
show lacp debug member <port #>
```

Results:

8201:

```
8201:1#show lacp interface gigabitEthernet 2/17
================================================================================
                                  Actor Admin
================================================================================
INDEX SYS    SYS                KEY    PORT   PORT   STATE
      PRIO   ID                            PRIO
--------------------------------------------------------------------------------
2/17  32768 b0:ad:aa:47:08:00 10     0x110    32768 act                short aggr

================================================================================
                                  Actor Oper
================================================================================
INDEX KEY    SELECTED ATTACHED AGGR  STATE
             AGGR ID  AGGR ID
--------------------------------------------------------------------------------
```

```
2/17  10    6153     6153     true  act               short aggr sync col dis

================================================================================
                                Partner Admin
================================================================================
INDEX SYS   SYS               KEY   PORT  PORT  STATE
      PRIO  ID                          PRIO
--------------------------------------------------------------------------------

2/17  0     00:00:00:00:00:00 0     0x0     0     pas               long indi

================================================================================
                              Partner Operational
================================================================================
INDEX SYS   SYS               KEY   PORT  PORT  STATE
      PRIO  ID                          PRIO
--------------------------------------------------------------------------------
2/17  32768 cc:f9:54:b0:38:01 12298 0x31    32768 act               short aggr sync
col dis

================================================================================
                                LACP Extention
================================================================================
INDEX ADMIN   OPER    FAST   SLOW   AGGRWAIT TIMEOUT FAST   SLOW   AGGRWAIT TIMEOUT
      ENABLED ENABLED TIME   TIME   TIME     SCALE   TIME   TIME   TIME     SCALE
                      ADMIN  ADMIN  ADMIN    ADMIN   OPER   OPER   OPER     OPER
--------------------------------------------------------------------------------
2/17  true    true    1000   30000  2000     3       1000   30000  2000     3
```

ERS Stackable:

```
ERS-Stackable#show lacp port 1/49,2/48
Unit/Port Priority Lacp    A/I Timeout Key   Key   AggId Id    Port    Status
--------- -------- ------- --- ------- ----- ----- ----- ----- ------- -------
1/49      32768    Active  A   Short   10    12298 8224  32    272     Active
2/48      32768    Active  A   Short   10    12298 8224  32    272     Active

ERS-Stackable#show lacp debug member 1/49,2/48
Unit/Port AggrId TrunkId Rx State      Mux State     Partner Port
--------- ------ ------- ------------- ------------- ------------
1/49      8224   32      Current       Ready         272
2/48      8224   32      Current       Ready         272
```

Via 8201, verify the following information:

Option	Verify
STATE AGGR	The state should be displayed as act (active) with port member 2/17 while AGGR should be displayed as true. This indicates that the LACP aggregation is operation and active. The anonym meanings are as follows:

	• *Short*: indicates LACP short timer is used • *Aggr*: Aggregation, indicates the port has become part of an aggregation otherwise it be displayed as "*indi*" for individual • *Sync*: Synchronization, indicates whether or not the port in in-sync or not • *Col*: Collecting, indicates whether or not the receiving of LACP packets on the port • *Dis*: Distributing, indicate whether or not the transmitting of LACP packets on the port

Via ERS Stackable, verify the following information:

Option	Verify
Lacp Status	Displays as *Active* for MLT ID 32. This indicates LACP is configured, enabled, and operation with partner.
Timeout	Displays as *Short* for MLT ID 32. This indicates that LACP Short Timer has been configured.
Admin Key	Displays as 2. This indicates the LACP configured on this interface.
Rx State	Displays as *Current* if LACP is Rx information is valid. Otherwise, the value displayed could be Expired, Defaulted, Initialized, LacpDisabled, or PortDisabled.
Mux State	Displays as *Ready* indicating that ports 1/49 and 2/48 are ready to transmit and receive. Otherwise, the value displayed could be Detached, Waiting, or Attached.

5.3 LACP Interoperability between ERS 8000 and Cisco Catalyst 6500

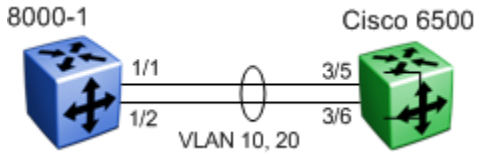


Figure 4: LACP between ERS8000 and Cisco 6500

For this example, we will configure the following

- A Link Aggregation Group (LAG) is configured between 8000-1 and Cisco Catalyst 6500.
  - VLANs 10 and 20 will be tagged across the LAG
  - LACP key = 4
  - MLT ID = 2
  - LACP Timeout = Long
  - Configure ERS8000 to force it to only use the Cisco LACP port number and system id.

5.3.1 8000-1 Configuration

5.3.1.1 Go to configuration mode

```
config terminal
```

5.3.1.2 LACP Configuration

```
8000-1:5(config)#mlt 2
8000-1:5(config)#interface mlt 2
8000-1:5(config-mlt)#lacp enable key 4
8000-1:5(config-mlt)#exit
```

5.3.1.3 Disable Spanning Tree

```
8000-1:5(config)#interface gigabitEthernet 1/1-1/2
8000-1:5(config-mlt)#spanning-tree stp 1 disable
8000-1:5(config-mlt)#exit
```

5.3.1.4 Create VLANs

```
8000-1:5(config)#vlan port 1/1-1/2 tagging tagAll
8000-1:5(config)#vlan members remove 1 1/1-1/2
8000-1:5(config)#vlan create 10 type port 1
8000-1:5(config)#vlan members add 10 1/1-1/2
8000-1:5(config)#vlan create 20 type port 1
```

```
8000-1:5(config)#vlan members add 20 1/1-1/2
```

5.3.1.5 Configure LACP on Aggregation Ports

Configure LACP on ports 1/1-1/2 using key 4. The key used must be the same as that used in step 1 when setting up the MLT. In this case, we will configure the lacp partner key. We also need to configure the partner port.

```
8000-1:5(config)#interface gigabitEthernet 1/1
8000-1:5(config-if)#lacp key 4
8000-1:5(config-if)#lacp partner-port 773
8000-1:5(config-if)#lacp partner-port-priority 32768
8000-1:5(config-if)#lacp partner-system-id 00:0f:35:3b:89:66
8000-1:5(config-if)#lacp aggregation enable
8000-1:5(config-if)#lacp enable
8000-1:5(config-if)#exit
8000-1:5(config)#interface gigabitEthernet 1/2
8000-1:5(config-if)#lacp key 4
8000-1:5(config-if)#lacp partner-port 774
8000-1:5(config-if)#lacp partner-port-priority 32768
8000-1:5(config-if)#lacp partner-system-id 00:0f:35:3b:89:66
8000-1:5(config-if)#lacp aggregation enable
8000-1:5(config-if)#lacp enable
8000-1:5(config-if)#exit
```

To get the partner port on a Cisco Catalyst 6500, use the command '*show lacp internal detail*' and then convert the hexadecimal value from Cisco to the decimal value used by the ERS8600. To get the lacp partner-system-id, use the Cisco command '*show lacp sys-id*' to get the MAC address of the interface(s) you are connecting to.

5.3.1.6 Enable LACP Globally

```
8000-1:5(config)#lacp enable
```

5.3.2 Cisco Catalyst 6500 Configuration

In regards to the Cisco Catalyst 6500, configure LACP on port 3/5 and 3/6, disable Spanning Tree, and configure Port-Channel 4. Channel-group 4 on interface 3/5 and 3/6 automatically generates the LACP aggregate interface port-channel 4 with Key 4.

```
!
spanning-tree mode pvst
no spanning-tree optimize bpdu transmission
no spanning-tree vlan 1-4094
!
interface Port-channel4
```

```
 no ip address
 switchport
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 10
 switchport trunk allowed vlan 10,20
 switchport mode trunk

!
vlan internal allocation policy ascending
vlan dot1q tag native
vlan access-log ratelimit 2000
!
interface GigabitEthernet3/5
 no ip address
 switchport
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 10
 switchport trunk allowed vlan 10,20
 switchport mode trunk
 channel-protocol lacp
 channel-group 4 mode active
!
interface GigabitEthernet3/6
 no ip address
 switchport
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 10
 switchport trunk allowed vlan 10,20
 switchport mode trunk
 channel-protocol lacp
 channel-group 4 mode active
```

5.4 ERS8000 SMLT Cluster with LACP and SLT with VLACP Configuration Example

In this example, ERS-Stackable-1 and ERS-Stackable-2 are used as the SMLT Clients. ERS-Stackable-1 will be configured with dynamic link aggregation using LACP. ERS-Stackable-2 will be configured with static link aggregation using MLT with VLACP configured using a short fast-periodic-timer of 500ms. Note that any switch that supports LACP can be used as an LACP-enabled SMLT client. Likewise, any switch that support any form of static link aggregations such as MLT or EtherChannel can also be used as a SMLT client, but without VLACP. As both ERS-STACKABLE-1 and ERS-Stackable-2 are SMLT access switches, we will enable STP FastStart and broadcast/multicast rate limiting on the user ports.

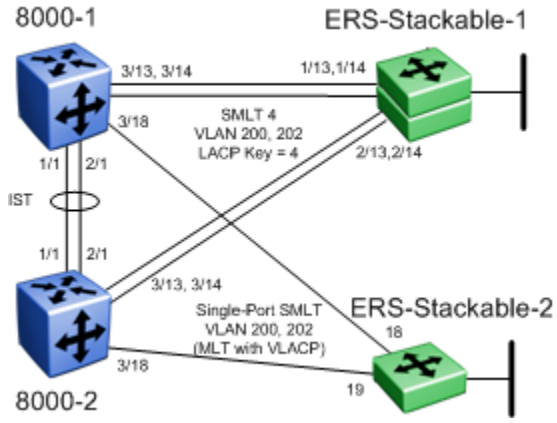


Figure 5: ERS8000 SMLT with LACP and SLT with VLACP

If you have both SLPP and LACP enabled on the ERS 8000 cluster, disabling LACP on the edge switch will trigger SLPP to shut down usually just one side of the SMLT cluster. You will need to disable and re-enable the port(s) shut down by SLPP on the SMLT cluster switch affect once LACP is re-enabled on the edge switch.

Although we start this configuration example with the SMLT Cluster, actually ERS-Stackable-1 should be configured first.

5.4.1 SMLT Cluster and Edge Switch Configuration

5.4.1.1 Go to configuration mode

```
config terminal
```

5.4.1.2 Create IST

Create VLAN 1900 and Multilink Trunking 1 (MLT 1) to be used by the Inter Switch Trunk (IST) with port members 1/1 and 2/1.

8000-1:

```
8000-1(config)#vlan create 1900 name IST type port 1
8000-1(config)#mlt 1
8000-1(config)#mlt 1 name IST
8000-1(config)#mlt 1 member 1/1,2/1
8000-1(config)#mlt 1 encapsulation dot1q
8000-1(config)#vlan 1900 mlt 1
8000-1(config)#interface vlan 1900
8000-1(config-if)#ip address 2.1.1.1 255.255.255.252
8000-1(config-if)#exit
8000-1(config)#interface mlt 1
8000-1(config-mlt)#ist peer-ip 2.1.1.2 vlan 1900
8000-1(config-mlt)#ist enable
8000-1(config-mlt)#exit
```

8000-2:

```
8000-2(config)#vlan create 1900 name IST type port 1
8000-2(config)#mlt 1
8000-2(config)#mlt 1 name IST
8000-2(config)#mlt 1 member 1/1,2/1
8000-2(config)#mlt 1 encapsulation dot1q
8000-2(config)#vlan 1900 mlt 1
8000-2(config)#interface vlan 1900
8000-2(config-if)#ip address 2.1.1.2 255.255.255.252
8000-2(config-if)#exit
8000-2(config)#interface mlt 1
8000-2(config-mlt)#ist peer-ip 2.1.1.1 vlan 1900
8000-2(config-mlt)#ist enable
8000-2(config-mlt)#exit
```

5.4.1.3 Enable VLACP on IST per members

Multilink Trunking 1 (MLT 1) will be used for the IST with port members 1/1 and 2/1. 802.1Q tagging will be enabled on all IST port members and Spanning Tree will be disabled on all IST port members by default. VLACP will be enabled on the IST trunk.

It is recommended to use the reserved multicast MAC address of 01:80:c2:00:00:0f for the VLACP MAC address.

By default, unless you specify the VLACP timeout, the default setting of *long* will be used. Hence, we do not have to configure the VLACP timeout for the IST.

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#interface gigabitEthernet 1/1,2/1
8000-1(config-if)#vlacp funcmac-addr 01:80:c2:00:00:0f
8000-1(config-if)#vlacp slow-periodic-time 10000
8000-1(config-if)#vlacp enable
8000-1(config-if)#exit
8000-1(config)#vlacp enable
```

5.4.1.4 Create MLT with LACP Key and Add SMLT ID 4

Create MLT 4 using key 4. Note: the key value must be the same as the port key.

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#mlt 4
8000-1(config)#interface mlt 4
8000-1(config-mlt)#lacp key 4
8000-1(config-mlt)#lacp enable
8000-1(config-mlt)#smlt 4
8000-1(config-mlt)#exit
```

5.4.1.5 Create VLANs on SMLT cluster and ERS Stackables

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)# vlan ports 3/13,3/14,3/18 tagging tagAll
8000-1(config)#vlan members remove 1 3/13,3/14,3/18
8000-1(config)#vlan create 200 type port 1
8000-1(config)#vlan members add 200 3/13-3/14,3/18
8000-1(config)#vlan create 202 type port 1
8000-1(config)#vlan members add 202 3/13,3/14,3/18
```

ERS-STACKABLE-1: Create VLANs 200 and 202

```
ERS-Stackable-1(config)#vlan ports 1/13,1/14,2/13,2/14 tagging tagall
ERS-Stackable-1(config)#vlan configcontrol automatic
ERS-Stackable-1(config)#vlan members remove 1 1/13-14,2/13-14,1/19,2/19
```

```
ERS-Stackable-1(config)#vlan create 200 type port
ERS-Stackable-1(config)#vlan members add 200 1/13-15,2/13-15
ERS-Stackable-1(config)#vlan create 202 type port
ERS-Stackable-1(config)#vlan members add 202 1/13-14,2/13-14,1/19,2/19
```

ERS-Stackable-2: Create VLANs 200 and 202

```
ERS-Stackable-2(config)#vlan ports 18,19 tagging tagall
ERS-Stackable-2(config)#vlan configcontrol automatic
ERS-Stackable-2(config)#vlan members remove 1 18-20,22
ERS-Stackable-2(config)#vlan create 200 type port
ERS-Stackable-2(config)#vlan members add 200 18-19,22
ERS-Stackable-2(config)#vlan create 202 type port
ERS-Stackable-2(config)#vlan members add 202 18-20
```

5.4.1.6 SLT-129 to ERS-Stackable-2

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#interface gigabitEthernet 3/18
8000-1(config-if)#smlt 129
8000-1(config-if)#exit
```

5.4.1.7 Add Access VLANs to IST MLT 1

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#vlan mlt 200 1
8000-1(config)#vlan mlt 202 1
```

5.4.1.8 Configure LACP on SMLT Cluster and ERS-Stackable-1

Please note, in the IST cluster, the LACP SMLT System ID must be the same on both cluster switches. For this example, we will use the System ID from switch 8000-1.

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#interface gigabitEthernet 3/13,3/14
8000-1(config-if)#lacp key 4
8000-1(config-if)#lacp aggregation enable
8000-1(config-if)#lacp timeout-time short
8000-1(config-if)#lacp enable
8000-1(config-if)#exit
8000-1(config-if)#lacp smlt-sys-id 00:01:81:28:84:00
```

To view the global LACP System ID, enter the following command

```
8000-1# show lacp info
=====================================================
```

```
                          Lacp Global Information
================================================
               SystemId: 00:01:81:28:84:00
           SmltSystemId: 00:01:81:28:84:00
                   Lacp: enable
      system-priority: 32768
              timeout-admin: 3
    fast-periodic-time-admin: 1000
    slow-periodic-time-admin: 30000
        aggr-wait-time-admin: 2000
              timeout-oper: 3
    fast-periodic-time-oper: 1000
    slow-periodic-time-oper: 30000
        aggr-wait-time-oper: 2000
```

ERS-Stackable-1:

```
ERS-Stackable-1(config)#interface ethernet all
ERS-Stackable-1(config-if)#lacp key port 1/13-14,2/13-14 4
ERS-Stackable-1(config-if)#lacp mode port 1/13-14,2/13-14 active
ERS-Stackable-1(config-if)#lacp aggregation port 1/13-14,2/13-14 enable
ERS-Stackable-1(config-if)#no spanning-tree port 1/13-14,2/13-14 stp 1
ERS-Stackable-1(config-if)#exit
```

5.4.1.9 Enable VLACP on SMLT Cluster and ERS-Stackable-2

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#interface gigabitEthernet 3/18
8000-1(config-if)#vlacp timeout short
8000-1(config-if)#vlacp timeout-scale 5
8000-1(config-if)#vlacp fast-periodic-time 500
8000-1(config-if)#vlacp funcmac-addr 01:80:c2:00:00:0f
8000-1(config-if)#vlacp enable
8000-1(config-if)#exit
8000-1(config)#vlacp enable
```

ERS Stackable-2:

```
ERS-Stackable-2(config)#mlt 1 enable member 18,19 learning disable
ERS-Stackable-2(config)#interface ethernet 18,19
ERS-Stackable-2(config-if)#vlacp timeout short
ERS-Stackable-2(config-if)#vlacp timeout-scale 5
ERS-Stackable-2(config-if)#vlacp enable
ERS-Stackable-2(config-if)#exit
ERS-Stackable-2(config)#vlacp macaddress 0180.c200.000f
ERS-Stackable-2(config)#vlacp enable
```

5.4.1.10 CP Limit – SMLT Port Members

CP Limit will be enabled on all the SMLT Access port members. For this example, we will select the moderate recommendations for CP-Limit.

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#interface gigabitEthernet 3/13,4/13,4/26
8000-1(config-if)#cp-limit multicast 2500 broadcast 2500
8000-1(config-if)#exit
```

5.4.1.11 SLPP on SMLT Cluster and SLPP Guard on ERS Stackable switches

8000-1:

```
8000-1(config)#slpp vid 200,202
8000-1(config)#slpp enable
8000-1(config)# interface gigabitEthernet 3/13,3/14,3/18
8000-1(config-if)#slpp packet-rx-threshold 5
8000-1(config-if)# slpp packet-rx
```

8000-2:

```
8000-2(config)#slpp vid 200,202
8000-2(config)#slpp enable
8000-2(config)# interface gigabitEthernet 3/13,3/14,3/18
8000-2(config-if)#slpp packet-rx-threshold 50
8000-2(config-if)# slpp packet-rx
```

ERS Stackable-1:

```
ERS-Stackable-1(config)#interface ethernet 1/1-12,1/15-50,2/1-12,2/15-48
ERS-Stackable-1(config-if)#slpp-guard enable timeout 0
ERS-Stackable-1(config-if)#exit
```

ERS Stackable-2:

```
ERS-Stackable-2(config)#interface ethernet 1/1-17,1/19-48
ERS-Stackable-2(config-if)#slpp-guard enable timeout 0
ERS-Stackable-2(config-if)#exit
```

SLPP Guard should be enabled on all access ports. A timeout value of 0 indicates a SLPP Guard timeout of infinity where the port must be manually enabled again in case of a loop. If you wish, you can get a timeout value from 10 to 65535 seconds where the switch will bring up the port automatically after the expired time interval.

5.4.1.12 Ext-CP Limit

Enable Extended CP-Limit globally with trap set to normal. Also enable Extended CP-Limit with SoftDown option on port 1/23.

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#sys ext-cp-limit
8000-1(config)#sys ext-cp-limit max-ports-to-check 5
8000-1(config)#sys ext-cp-limit trap-level Normal
8000-1(config)#interface gigabitEthernet 3/13,3/14,3/18
8000-1(config-if)#ext-cp-limit softDown threshold-util-rate 10
8000-1(config-if)#exit
```

5.4.1.13 Discard Untagged Frames on SMLT Cluster and ERS Stackables

It is recommended to enable discard untagged frames on all IST and SMLT ports.

8000-1 & 8000-2: Same configuration on both switches

```
8000-1(config)#interface gigabitEthernet 1/1,2/1,3/13,3/14,3/18
8000-1(config-if)#untagged-frames-discard
8000-1(config-if)#exit
```

ERS-Stackable-1:

```
ERS-Stackable-1(config)#vlan ports 1/13,1/14,2/13,2/14 filter-untagged-frame enable
```

ERS-Stackable-2:

```
ERS-Stackable-2(config)#vlan ports 18,19 filter-untagged-frame enable
```

5.4.1.14 Enable STP FastStart, BPDU Filtering, and Rate Limiting on all Access Ports on ERS Stackables

Enable STP FastStart and set the broadcast/multicast rate limit to 10%.

ERS-Stackable-1:

```
ERS-Stackable-1(config)#interface ethernet 1/1-12,1/15-50,2/1-12,2/15-48
ERS-Stackable-1(config-if)#spanning-tree learning fast
ERS-Stackable-1(config-if)#spanning-tree bpdu-filtering timeout 0
ERS-Stackable-1(config-if)#spanning-tree bpdu-filtering enable
ERS-Stackable-1(config-if)#rate-limit both 10
ERS-Stackable-1(config-if)#exit
```

ERS-Stackable-2:

```
ERS-Stackable-2(config)#interface ethernet 1/1-17,1/19-48
ERS-Stackable-2(config-if)#spanning-tree learning fast
```

```
ERS-Stackable-2(config-if)#spanning-tree bpdu-filtering timeout 0
ERS-Stackable-2(config-if)#spanning-tree bpdu-filtering enable
ERS-Stackable-2(config-if)#rate-limit both 10
ERS-Stackable-2(config-if)#exit
```

5.4.2 Verification

5.4.2.1 Verify MLT/LACP Operation

Verify the MLT instance is operational

```
show mlt
show mlt <mlt #>
```

Results:

8000-1 & 8000-2:

```
================================================================================
                                    Mlt Info
================================================================================
                         PORT     SVLAN  MLT    MLT         PORT          VLAN
MLTID IFINDEX NAME       TYPE     TYPE   ADMIN  CURRENT     MEMBERS       IDS
--------------------------------------------------------------------------------
1    4096  MLT-1         trunk    normal ist    ist       1/1-2/1           200 202 1900
4    4099  MLT-4         trunk    normal smlt   smlt      3/13-3/14         200 202

                MULTICAST             DESIGNATED    LACP       LACP
MLTID IFINDEX   DISTRIBUTION  NT-STG  PORTS         ADMIN      OPER
--------------------------------------------------------------------------------
1       4096     disable      enable   2/1         disable    down
4       4099     disable      disable  3/13        enable       up
```

ERS Stackable-1:

```
ERS-Stackable-2#show mlt
Trunk Name                 Members              Bpdu   Mode   Status
----- -------------------- -------------------- ------ ------ --------
1     Trunk #1             18-19                All    basic  Enabled

ERS-Stackable-2#show mlt spanning-tree
STP Group    STP Learning
---------    ------------
1            Disabled
```

On each ERS 8000 in the switch cluster verify the following information:

Option	Verify
VLAN IDS	Verify that the VLAN ids assigned to the IST and SMLT MLT are correct: • IST MLT 1: Member of VLANs *200, 202* & *1900* with port members *1/1* and *2/1* • MLT 4: Member of VLAN *200* & *202* with port member *3/13* & 3/14
MLT Admin	Displays as *smlt* or *ist*. The value *normal* indicates that the IST or SMLT is not operational.

MLT CURRENT	
PORT TYPE	Displays as *trunk* for all IST and SMLT ports and will pass tagged frames. The value *access* indicates that the port will pass untagged frames.

On ERS-Stackable-1, verify the following information:

Option	Verify
Status	Displays as *Enabled*, indicating that the MLT instance is enabled
STP Learning	Displays as *Disabled*, indicating that STP is disabled for this MLT instance.

5.4.2.1.1 Single-Port SMLT Verification

Verify that the SLT instances is configured correctly and is functioning by issuing the following command:

show smlt gigabitethernet 3/18

Results:

8000-1 & 8000-2:

```
================================================================================
================================================
                    SMLT Info
================================================
PORT   SMLT      ADMIN     CURRENT
NUM    ID        TYPE      TYPE
------------------------------------------------
3/18   129       smlt      smlt
```

On each ERS8000 in the switch cluster verify the following information:

Option	Verify
SMLT ID	Displays as *129*. For this configuration example, the SLT id used is 129.
ADMIN TYPE CURRENT TYPE	Displays as *smlt.* The value *normal* indicates that the SLT is not operational.

5.4.2.2 VLACP Verification

Verify that the SLT instances is configured correctly and is functioning by issuing the following command:

```
ERS 8000:
show vlacp interface gigabitEthernet 3/18

ERS Stackable:
show vlacp
show vlacp
```

Results:

8000-1 & 8000-2:

```
================================================================================
                                    VLACP Information
================================================================================
INDEX ADMIN    OPER     PORT    FAST    SLOW     TIMEOUT TIMEOUT ETHER     MAC
      ENABLED ENABLED  STATE   TIME    TIME     TIME    SCALE   TYPE      ADDR

--------------------------------------------------------------------------------
3/18  true     true     UP     500     30000    short   5       0x8103    01:80:c2:00:00:0f
```

ERS Stackable-2:

```
ERS-Stackable-2#show vlacp
================================================================================
                          Vlacp Global Information
================================================================================
                  Multicast address :  01:80:c2:00:00:0f
                  Vlacp             :  enabled

ERS-Stackable-2#show vlacp interface ethernet 18-19
================================================================================
                           VLACP Information
================================================================================
PORT ADMIN    OPER     HAVE     FAST  SLOW  TIMEOUT TIMEOUT ETH  MAC
     ENABLED ENABLED  PARTNER  TIME  TIME  TYPE    SCALE   TYPE ADDRESS
--------------------------------------------------------------------------------
0/18  true     true     yes     500   30000 short   5       8103 00:00:00:00:00:00
0/19  true     true     yes     500   30000 short   5       8103 00:00:00:00:00:00
```

On each ERS 8000 in the SMLT cluster, verify the following information:

Option	Verify
ADMIN ENABLED	Displays as *true* for port *3/18*. This indicates VLACP is configured and enabled.

OPER ENABLED	
PORT STATE	Displays as *UP* for port *3/18*. This indicates that VLACP operational. If not, check the VLACP configuration, Admin state is enabled and remote ERS-Stackable-2 is configured correctly and operational.
FAST TIME	Displays as *500*. This indicates the VLACP fast-periodical-time has been configured for 500 ms.
TIMEOUT TIME	Displays as *short*. If not, go back and configure the VLACP time as short.
TIMEOUT SCALE	Displays as *5*.
MAC ADDR	Displays as *01:80:c2:00:00:0f* indicating that the default VLACP MAC has been changed to the recommended VLACP MAC for SMLT operations.

On ERS-Stackable-2, verify the following information:

Option	Verify
ADMIN ENABLED OPER ENABLED	Displays as *true* for ports *18 & 19*. This indicates VLACP is configured and enabled.
HAVE PARTNER	Displays as *yes* for ports *18 & 19*. This indicates that VLACP operational. If not, check the VLACP configuration, Admin state is enabled and remote ERS 8000 cluster is configured correctly and operational.
FAST TIME	Displays as *500*. This indicates the VLACP fast-periodical-time has been configured for 500 ms which actually is the default value when you enable VLACP short timers on the ES470.
TIMEOUT TYPE	Displays as *short*. If not, go back and configure the VLACP time as short.
TIMEOUT SCALE	Displays as *5*.

5.5 ERS5600 SMLT with LACP

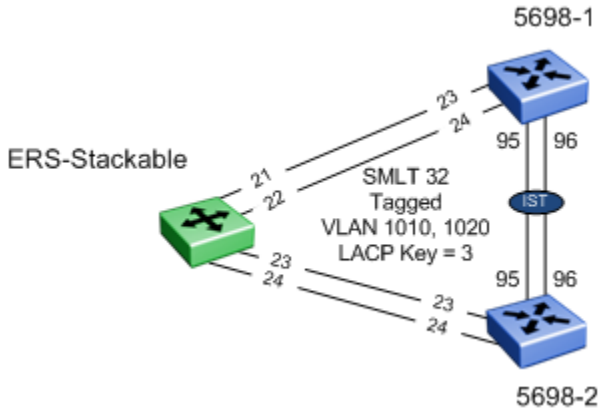


Figure 6: ERS 5600 SMLT with LACP

For this example, we will configure the following:

- A Link Aggregation Group (LAG) is configured between the ERS5600 triangle topology and an Avaya Ethernet Stackable Switch.
    - VLANs 1010 and 1020 will be tagged across the LAG
    - LACP port-mode = advance
    - LACP key = 3
    - MLT ID = 32
    - SMLT ID = 32
    - LACP Timeout = Short
- For this application to work, we will need to configure the SMLT System Identifier so that LACP global identifier is the same on both 5600-1 and 5600-2. Although you can use any MAC address, we will simple use the LACP identifier from 5600-1 to avoid any possible duplicate addresses.
- Disable Spanning Tree on all SMLT ports

For more detail on configuring SMLT, please refer to the document titled ” Switch Clustering using Split-Multilink Trunking (SMLT) Technical Configuration Guide”, document number NN48500-518.

5.5.1 Configuration

5.5.1.1 Go to configuration mode

```
config terminal
```

5.5.1.2 Create VLANs and enable discard untagged frames

The following port based VLANs will be configured on the SMLT Switch cluster

- VLAN 2 to be used by the Inter Switch Trunk (IST)
- VLAN 1010 and 1020 to be used at a Layer 2 level to ERS-Stackable

5600-1 & 5600-2: Same configuration on both switches

```
5600-1(config)#vlan create 1010,1020 type port
5600-1(config)#vlan configcontrol flexible
5600-1(config)#vlan create 1010, 1020 type port
5600-1(config)#vlan ports 23-24,95-96 tagging tagAll filter-untagged-frame
enable
5600-1(config)#vlan members remove 1 23-24,95-96
5600-1(config)#vlan members 2 95-96
5600-1(config)#vlan members 1010,1020 23-24,95-96
```

ERS Stackable:

```
ERS-Stackable(config)#vlan create 1010,1020 type port
ERS-Stackable(config)#vlan ports 21-24 tagging tagall
ERS-Stackable(config)# vlan configcontrol flexible
ERS-Stackable(config)#vlan members remove 1 3-11,21-24
ERS-Stackable(config)#vlan ports 21-24 tagging tagall
ERS-Stackable(config)#vlan members 1010,1020 21-24
ERS-Stackable(config)#vlan members 1010 3-5
ERS-Stackable(config)#vlan ports 3-5 pvid 1010
ERS-Stackable(config)#vlan members 1020 6-11
ERS-Stackable(config)#vlan ports 6-11 pvid 1020
ERS-Stackable(config)#vlan ports 21-24 filter-untagged-frame enable
```

The VLAN configuration mode is set by using the command *vlan configcontrol <automatic|autopvid|flexible|strict>*. The flexible mode has no restrictions as to number of VLANs provisioned at the same time

5.5.1.3 Enable VLACP globally and use the Reserved MAC

5600-1,5600-2 & ERS Stackable: Same configuration on all switches

```
5600-1(config)#vlacp macaddress 180.c200.f
5600-1(config)#vlacp enable
```

It is recommended to use the reserved multicast MAC address of 01:80:c2:00:00:0f for the VLACP MAC address. Via the ERS 5600, enter the hex value *180.c200.f*. VLACP will be enabled on the IST interfaces.

5.5.1.4 Create IST

Multilink Trunking 1 (MLT 1) will be used for the IST with port members 95 and 96. 802.1Q tagging will be enabled on all IST port members and Spanning Tree will be disabled on all IST port members via the MLT configuration. VLACP will be enabled on the IST trunk.

5600-1:

```
5600-1(config)#mlt 1 name ist enable member 95-96 learning disable
5600-1(config)#ip routing
5600-1(config)#interface vlan 2
5600-1(config-if)#ip address 10.1.2.1 255.255.255.252
5600-1(config-if)#exit
5600-1(config)#interface mlt 1
5600-1(config-if)#ist enable peer-ip 10.1.2.2 vlan 2
5600-1(config-if)#exit
```

5600-2:

```
5600-2(config)#mlt 1 name ist enable member 95-96 learning disable
5600-2(config)#ip routing
5600-2(config)#interface vlan 2
5600-2(config-if)#ip address 10.1.2.2 255.255.255.252
5600-2(config-if)#exit
5600-2(config)#interface mlt 1
5600-2(config-if)#ist enable peer-ip 10.1.2.1 vlan 2
5600-2(config-if)#exit
```

5.5.1.5 Enable VLACP on IST port members

5600-1 & 5600-2: Same configuration on both switches

```
5600-1(config)#interface Ethernet ALL
5600-1(config-if)#vlacp slow-periodic-time 10000
5600-1(config-if)#vlacp port 95,96 enable
5600-1(config-if)#exit
```

5.5.1.6 Enable LACP

For this example, we will use the base MAC address from switch 5600-1; use the ACLI *show sys-info* to find the base MAC address.

5600-1 & 5600-2: Same configuration on both switches

```
5600-1(config)#lacp key 3 mlt-id 32 smlt-id 32
5600-1(config)#lacp port-mode advance
5600-1(config)#lacp smlt-sys-id 80:17:7d:26:68:00
5600-1(config)#interface ethernet 23-24
5600-1(config-if)#lacp timeout-time short
5600-1(config-if)#lacp key 3
5600-1(config-if)#lacp mode active
5600-1(config-if)#lacp aggregation enable
5600-1(config-if)#exit
```

ERS Stackable:

```
ERS-Stackable(config)#interface ethernet all
ERS-Stackable(config-if)#lacp key port 21-24 3
ERS-Stackable(config-if)#lacp mode port 21-24 active
ERS-Stackable(config-if)#lacp aggregation port 21-24 enable
ERS-Stackable(config-if)#lacp timeout-time short
ERS-Stackable(config-if)#spanning-tree learning disable
ERS-Stackable(config-if)#exit
```

Prior to release 6.3 for the ERS 5000, release 5.6 for the ERS 4000, and release 10.2 for the VSP 7000, to add a new VLAN to port members where LACP is running, you must first disable LACP. It is also recommended to shutdown the port members so as to not create a loop. This can be accomplished by entering the ACLI commands assuming we wish to add VLAN 1021 to port members 23,24:

```
5600-2(config)#interface ethernet 23,24
5600-2(config-if)#shutdown
5600-2(config-if)#lacp mode off
5600-2(config-if)#vlan mem add 1021 23-24
5600-2(config-if)#lacp mode active
5600-2(config-if)#no shutdown
5600-2(config-if)#exit
```

5.5.1.7 SLPP and SLPP Guard

SLPP will be enabled globally and only on the SMLT ports 23 and 24. On the SMLT primary switch we will set the SLPP packet-rx-threshold to 5, while on the SMLT secondary switch we will set the SLPP packet-rx-threshold to 50. For this example, we will pick 5600-1 as the primary switch.

The recommended SLPP receive threshold value for the primary switch is 5 and 50 for the secondary switch in an SMLT cluster.

SLPP should only be enabled on the SMLT access ports and not on the IST port members.

5600-1:

```
5600-1(config)#slpp vid 1010,1020
5600-1(config)#slpp enable
5600-1(config)#interface ethernet 23-24
5600-1(config-if)#slpp packet-rx-threshold 5
5600-1(config-if)#slpp enable
5600-1(config-if)#exit
```

5600-2:

```
5600-2(config)#slpp vid 1000,1020
5600-2(config)#slpp enable
5600-2(config)#interface ethernet 23-24
5600-2(config-if)#slpp packet-rx-threshold 50
5600-2(config-if)#slpp enable
5600-2(config-if)#exit
```

ERS Stackable:

```
ERS-Stackable(config)#interface ethernet 3-20
ERS-Stackable(config-if)#slpp-guard enable timeout 0
ERS-Stackable(config-if)#exit
```

5.5.1.8 Enable STP FastStart, Rate Limiting, and BPDU filtering on all Access Ports

ERS Stackable:

```
ERS-Stackable(config)#interface ethernet 3-20
ERS-Stackable(config-if)#spanning-tree learning fast
ERS-Stackable(config-if)#spanning-tree bpdu-filtering timeout 0
ERS-Stackable(config-if)#spanning-tree bpdu-filtering enable
ERS-Stackable(config-if)#rate-limit both 10
ERS-Stackable(config-if)#exit
```

5.5.2 Verification

5.5.2.1 ERS 5600 SMLT Cluster

5.5.2.1.1 Verify LACP Global settings

Verify LACP key with corresponding MLT and SMLT ID

```
show lacp key
```

Results:

```
LACP Key    MLT ID    SMLT ID    Ports
--------    ------    -------    ----------------------
3           32        32         23-24
```

Verify LACP port mode provisioned – this setting must be provisioned as Advanced mode for SMLT

```
show lacp port-mode
```

Results:

```
Advanced mode
```

Verify SM LT System ID. For this example, we simply used the base MAC from 5600-1

```
show lacp system
```

Results:

```
System Priority    :  32768
Collector Max Delay:  1
SMLT System ID:  80:17:7d:26:68:00
5600-1#show sys-info
Operation Mode:         Switch
MAC Address:            80-17-7D-26-68-00
```

5.5.2.1.2 Verify LACP Operation at MLT and SMLT level

Verify LACP operation at MLT level

```
show mlt
show mlt <mlt #>
```

Results:

```
Id Name              Members                 Bpdu   Mode            Status  Type
-- ----------------- ----------------------- ------ --------------- ------- ------
1  ist               95-96                   All    Advance         Enabled Trunk
2  Trunk #2          NONE                    All    Basic           Disabled
|
32 Trunk #32         23-24                   Single DynLag/Basic    Enabled Trunk
```

Verify SMLT Operations

```
show smlt
```

Results:

```
================================================================================
                                      MLT SMLT Info
================================================================================
MLT    SMLT      ADMIN     CURRENT
ID     ID        TYPE      TYPE
--------------------------------------------------------------------------------
1                 ist       ist
32       32       smlt      smlt
```

Verify LACP Operations

show lacp aggr

Results:

```
Aggr ID Trunk Status    Type    Members
------- ----- --------- ------ -------------------
        1     Enabled   MLT    95-96
8224    32    Enabled   LA     23-24
```

On each ERS5600 switch, verify the following information:

Option	Verify
show mlt	
Members	Ports *23* and *24* should be displayed.
Mode	Displays as *DynLag* for MLT ID 32. This indicates LACP is aggregated..
Status	Displays as *Enabled*. This indicates the LACP has been enabled
Type	Displays as *Trunk.* This indicates port members are set for VLAN tagging.
show smlt	
SMLT ID	Displays as *32*. This indicates the SMLT ID provisioned for MLT 32.
show lacp aggr	
Trunk	Displays as *32*. This indicates the MLT ID used in this example.
Status	Displays as *Enabled* indicating LACP is enabled.
Type	Displays as *LA* indicating this MLT is provisioned with LACP

5.5.2.1.3 Verify LACP Operation at interface level

Verify LACP operation at port level

show lacp port 23,24

Results:

```
                                    Admin Oper          Trunk Partner
Port Priority Lacp    A/I Timeout Key   Key   AggId Id    Port    Status
---- -------- ------- --- ------- ----- ----- ----- ----- ------- -------
23   32768    Active  A   Short   3     12291 8224   32    21      Active
24   32768    Active  A   Short   3     12291 8224   32    22      Active
```

5.6 VSP 7000 SLT with LACP

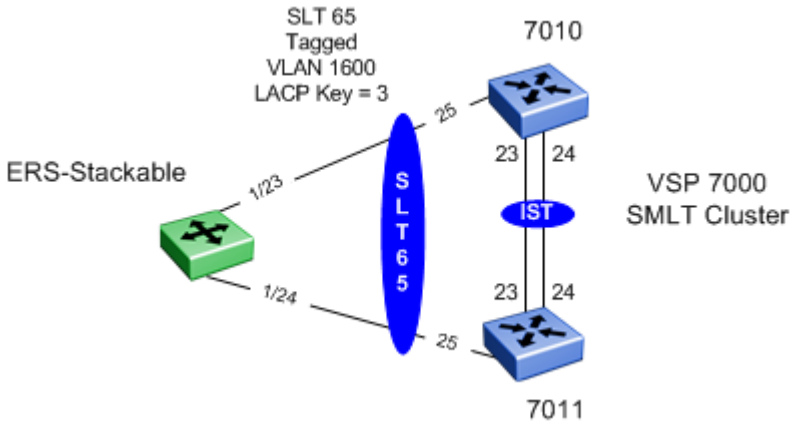


Figure 7: VSP 7000 SLT with LACP

For this example, we will configure the following:

- A Link Aggregation Group (LAG) is configured between the VSP 7000 triangle topology and an Avaya Ethernet Stackable Switch.
    - VLANs 1600 will be tagged across the LAG
    - LACP port-mode = advance
    - LACP key = 3
    - SLT ID = 65
    - LACP Timeout = Short
- For this application to work, we will need to configure the SMLT System Identifier so that the LACP global identifier is the same on both 7010 and 7011. Although you can use any MAC address, we will simple use the LACP identifier from 7010 to avoid any possible duplicate addresses.

For more details on configuring SMLT, please refer to the document titled ” Switch Clustering using Split-Multilink Trunking (SMLT) Technical Configuration Guide”, document number NN48500-518.

For the VSP 7000, if Shortest Path Bridging (SPB) is enabled, it is important to not enable VLACP and the *filter-untagged-frame* option on the IST port members. Also, the default PVID of all IST ports must be the primary B-VLAN ID. This will happened automatically providing SPB is enable first prior to enabling the IST.

5.6.1 Configuration

5.6.1.1 Go to configuration mode

```
config terminal
```

5.6.1.2 Create VLANs

The following port based VLANs will be configured on the SMLT Switch cluster

- VLAN 2 to be used by the Inter Switch Trunk (IST)
- VLAN 1600 to be used at a Layer 2 level to ERS-Stackable

7010 & 7011: Same configuration on both switches

```
7010(config)#vlan create 2 name ist type port
7010(config)#vlan create 1600 name ist type port
7010(config)#vlan configcontrol flexible
7010(config)#vlan ports 23-25 tagging tagAll
7010(config)#vlan members remove 1 23-25
7010(config)#vlan members 2 23-24
7010(config)#vlan members 1600 23-25
```

ERS Stackable:

```
ERS-Stackable(config)#vlan create 1600 type port
ERS-Stackable(config)#vlan ports 23-24 tagging tagall
ERS-Stackable(config)#vlan configcontrol automatic
ERS-Stackable(config)#vlan members remove 1 23-24
ERS-Stackable(config)#vlan ports 23-24 tagging tagall
ERS-Stackable(config)#vlan members 1600 3-11,23-24
```

The VLAN configuration mode is set by using the command *vlan configcontrol <automatic|autopvid|flexible|strict>*. The flexible mode has no restrictions as to number of VLANs provisioned at the same time

If SPB is enabled, the C-VLAN port members cannot be added to the IST.

5.6.1.3 Create IST

Multilink Trunking 1 (MLT 1) will be used for the IST with port members 23 and 24. 802.1Q tagging will be enabled on all IST port members via the MLT configuration. VLACP will be enabled on the IST trunk.

7010:

```
7010(config)#mlt 1 name IST enable member 23-24 learning disable
7010(config)#interface vlan 2
7010(config-if)#ip address 10.70.2.1 255.255.255.252
7010(config-if)#exit
7010(config)#interface mlt 1
7010(config-if)#ist enable peer-ip 10.70.2.2 vlan 2
7010(config-if)#exit
```

7011:

```
7011(config)#mlt 1 name IST enable member 23-24 learning disable
7011(config)#interface vlan 2
7011(config-if)#ip address 10.70.2.2 255.255.255.252
7011(config-if)#exit
7011(config)#interface mlt 1
7011(config-if)#ist enable peer-ip 10.70.2.1 vlan 2
7011(config-if)#exit
```

5.6.1.4 Enable LACP and SLT on VSP 7000 SMLT Cluster

Use the *show sys-info* command to get the base MAC address from switch 7010 which will be used for the SMLT sys-id on the both SMLT cluster switches.

7010 & 7011: Same configuration on both switches

```
7010(config)#lacp port-mode advance
7010(config)#lacp smlt-sys-id 70:30:18:23:a8:00
7010(config)#interface ethernet 25
7010(config-if)#lacp key 3
7010(config-if)#lacp mode active
7010(config-if)#lacp timeout-time short
7010(config-if)#lacp aggregation enable
7010(config-if)#exit
7010(config)#interface ethernet 25
7010(config-if)#smlt 65
7010(config-if)#exit
```

ERS Stackable:

```
ERS-Stackable(config)#interface ethernet 23-24
ERS-Stackable(config-if)#lacp key 3
ERS-Stackable(config-if)#lacp mode active
ERS-Stackable(config-if)#lacp aggregation enable
ERS-Stackable(config-if)#spanning-tree learning disable
ERS-Stackable(config-if)#exit
```

5.6.1.5 SLPP on SMLT Cluster and SLPP Guard on ERS Stackable

SLPP will be enabled globally and only on the SLT ports 25 for VLAN 1600. On the SMLT primary switch we will set the SLPP packet-rx-threshold to 5, while on the SMLT secondary switch we will set the SLPP packet-rx-threshold to 50. For this example, we will pick 7010 as the primary switch.

The recommended SLPP receive threshold value for the primary switch is 5 and 50 for the secondary switch in an SMLT cluster.

SLPP should only be enabled on the SMLT access ports and not on the IST port members.

7010:

```
7010(config)#slpp vid 1600
7010(config)#slpp enable
7010(config)#interface ethernet 25
7010(config-if)#slpp packet-rx-threshold 5
7010(config-if)#slpp enable
7010(config-if)#exit
```

7011:

```
7011(config)#slpp vid 1600
7011(config)#slpp enable
7011(config)#interface ethernet 25
7011(config-if)#slpp packet-rx-threshold 50
7011(config-if)# slpp enable
7011(config-if)#exit
```

ERS Stackable:

```
ERS-Stackable(config)#interface ethernet 1-22
ERS-Stackable(config-if)#slpp-guard enable timeout 0
ERS-Stackable(config-if)#exit
```

5.6.1.6 Enable STP FastStart, Rate Limiting, and BPDU filtering on all Access Ports

ERS Stackable:

```
ERS-Stackable(config)#interface ethernet 1-22
ERS-Stackable(config-if)#spanning-tree learning fast
ERS-Stackable(config-if)#spanning-tree bpdu-filtering timeout 0
ERS-Stackable(config-if)#spanning-tree bpdu-filtering enable
ERS-Stackable(config-if)#rate-limit both 10
ERS-Stackable(config-if)#exit
```

5.6.1.7 Discard Untagged Frames

ERS Stackable:

```
ERS-Stackable(config)#vlan ports 21-24 filter-untagged-frame enable
```

5.6.2 Verification

5.6.2.1 VSP 7000 SMLT Cluster

5.6.2.1.1 Verify LACP Global settings

Verify LACP key

```
show lacp port 25
```

Results:

```
LACP Key    MLT ID    SMLT ID    Ports
--------    ------    -------    ----------------------
3           32        32         23-24
Port Priority Lacp    A/I Timeout Key    Key    AggId Id     Port     Status
---- -------- ------- --- ------- ----- ----- ----- ----- -------- -------
25   32768    Active  A   Short   3     32833 0             23       Active
```

Verify LACP port mode provisioned – this setting must be provisioned as Advanced mode for SMLT

show lacp port-mode

Results:

```
Advanced mode
```

Verify SM LT System ID. For this example, we simply used the base MAC from 7010

show lacp system

Results:

```
System Priority    :  32768
Collector Max Delay:  1
SMLT System ID:  70:30:18:23:a8:00

7010#show sys-info
Operation Mode:         Switch
MAC Address:            70-30-18-23-A8-00
```

5.6.2.1.2 Verify LACP Operation at Interface Level

Verify SMLT operation

```
show smlt
```

Results:

```
================================================================================
                                      MLT SMLT Info
================================================================================
MLT    SMLT      ADMIN     CURRENT
ID     ID        TYPE      TYPE
--------------------------------------------------------------------------------
1                 ist       ist
================================================================================
                                      SLT Info
================================================================================
PORT   SMLT      ADMIN     CURRENT
NUM    ID        TYPE      TYPE
--------------------------------------------------------------------------------
25       65       slt       slt
```

Verify LACP statuc

```
show lacp port 25
```

Results:

7010:

```
                                    Admin Oper        Trunk Partner
Port Priority Lacp    A/I Timeout Key   Key   AggId Id    Port    Status
---- -------- ------- --- ------- ----- ----- ----- ----- ------- -------
25   32768    Active  A   Short   3     32833 0           23      Active
```

7011:

```
                                    Admin Oper        Trunk Partner
Port Priority Lacp    A/I Timeout Key   Key   AggId Id    Port    Status
---- -------- ------- --- ------- ----- ----- ----- ----- ------- -------
25   32768    Active  A   Short   3     32833 0           24      Active
```

Edge Switch:

```
                                        Admin Oper         Trunk Partner
Unit/Port Priority Lacp    A/I Timeout Key   Key   AggId Id    Port    Status
--------- -------- ------- --- ------- ----- ----- ----- ----- ------- -------
1/23      32768    Active  A   Short   3     12291 8224  32    2025    Active
1/24      32768    Active  A   Short   3     12291 8224  32    25      Active
```

On each VSP 7000 switch, verify the following information:

Option	Verify
Lacp	Displays as *Active*. This indicates LACP is aggregated.
A/I	
Timeout	Displays as *Enabled*. This indicates the LACP has been enabled
Key	Displays as *3*. This indicates LACP key used in this configuration example.
SMLT ID	Displays as *32*. This indicates the SMLT ID provisioned for MLT 32.
Partner Port	Displays as 23 on switch 7010 and 24 on switch 7011 indicating the remote port member. Note that since both 7010 and 7011 both use port 25, the remote Avaya Ethernet Routing Switch will add 2,000 to one of the LAG port members as the same port in a normal LAG is not a valid configuration.
Status	Displays as *Active* indicating LACP is operational.

6. Reference Documentation

Document Title	Publication Number	Description
Configuration — Link Aggregation, MLT, and SMLT Avaya Ethernet Routing Switch 8800/8600	NN46205-518	
Configuration — Link Aggregation, MLT, and SMLT Avaya Virtual Services Platform 9000	NN46250-503	
Configuration — VLANs, Spanning Tree, and Link Aggregation Avaya Ethernet Routing Switch 5000 Series	NN47200-502	
Configuration — VLANs, Spanning Tree, 3 and Multi-Link Trunking 4 Avaya Ethernet Routing Switch 4000 Series	NN47205-501	
Configuration — VLANs, Spanning Tree, and Multi-Link Trunking	NN47215-501	
Configuration — Link Aggregation, MLT, and SMLT Avaya Ethernet Routing Switch 8300	NN46200-517	
Switch Clustering using Split Multi-Link Trunking (SMLT) with VSP 9000, ERS 8600/8800, 8300, and 5000 Technical Configuration Guide	NN48500-518	
Switch Clustering Supported Topologies and Interoperability with Virtual Services Platform 9000 & Ethernet Routing Switches	NN48500-555	
Configuring Link Aggregation, MLT, SMLT and vIST on VSP Operating System Software	NN47227-503	VSP Operating System (VOSS) for the VSP 4000/7200/8000

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