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**Product Name Ethernet Routing Switch & Ethernet Switch**

> **Technical Configuration Guide  
for Link Aggregation Control Protocol  
(LACP) 802.3ad and VLACP**

Enterprise Solutions Engineering  
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## Abstract

The document provides an overview on how to configure 802.3ad Link Aggregation for the Nortel ERS and ES switches. Concepts will include 802.3ad, 802.3ad with SMLT, 802.3ad with Single Link SMLT, and VLACP.



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# 1. Overview: 802.3ad Link Aggregation

IEEE 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 802.3ad-based link aggregation and MultiLink Trunking (MLT) features provide similar services, MLT is statically defined, whereas IEEE 802.3ad-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 802.3ad was designed for point-to-point link aggregation only. However, the ERS8600 has 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 - note that for the ERS8600 in release 3.7.x, the port's STP state is disabled whereas with an ES switch, the port is removed from the LAG and put into normal STP mode. The default 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. VLACP - Virtual LACP - can be used to speed up this process if necessary. Note that VLACP will also disable the port whereas LACP just removes a port from the LAG.

## 1.2 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). When Hello packets are not received, VLACP transitions to a failure state and the port will be brought down. The benefit of this over LACP is that VLACP timers can be reduced to 400 milliseconds between a pair of ERS8600 switches. This will allow for approximately one second failure detection and switchover. Note that the lowest VLACP timer on an ES460/470 is 500ms.

VLACP can also be used with Nortel's proprietary aggregation mechanism (MLT) to complement its capabilities and provide quick failure detection. VLACP is recommended for all SMLT 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 the ERS8600.

---

**NOTE:** In the current implementation for the ERS8600, although either the CLI or JDM interface allows you to configure the short timers to less than 400ms, Nortel does not support this configuration. Changes will be made in the software to allow these short timers in a subsequent release (target release is ERS 8600 4.1).

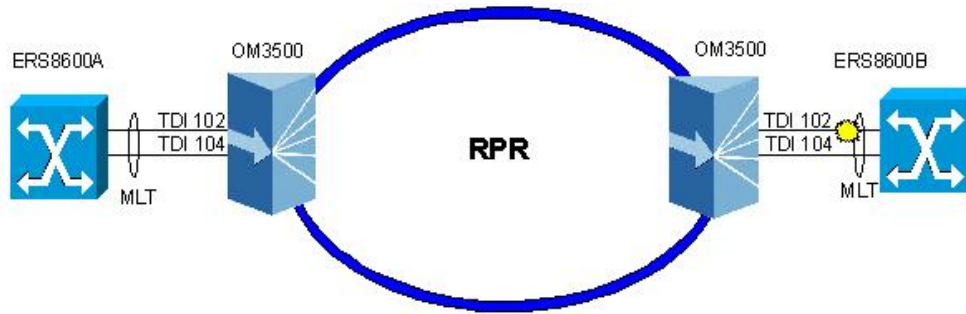
---

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. Finally, 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-to-port match. It will not work in a port-to-multi-port scenario where there is no guarantee for a point-point match.

### 1.3 Using VLACP over an RPR



As mentioned above, VLACP can be used across a LAN Extension service to provide end-to-end failure detection. In the case of using RPR, MLT is only supported on NNI links and not on UNI links. Hence, if MLT is used on a PRP ring via a UNI interface, by default, there is no mechanism to signal a remote link failure. For this application, providing Nortel switches are used at both ends, VLACP can be configured on top of MLT to provide end-to-end failure detection. If the remote switch is not a Nortel switch, LACP can be used providing the switch supports 802.1ad.

When setting up the OM3500, a separate TDI should be used for each link from the Nortel switch. If only one TDI is used, broadcasts would be flooded back to the end switch. As shown in the diagram above, two TDIs are used for this application. If you are using OEL2 mode, then configure the service type as point-to-point for more efficient use of bandwidth on RPR.



## 1.4 LACP and VLACP Support on Nortel Products

Switch	LACP Support	VLACP Support	Limitations
ERS8600	Yes	Yes	<ul style="list-style-type: none"> <li>• 32 Link Aggregation Groups                             <ul style="list-style-type: none"> <li>○ A maximum of 8 active links are supported per LAG. <sup>Note 1</sup></li> <li>○ A maximum of 8 standby links are supported per LAG. <sup>Note 1</sup></li> <li>○ Up to 16 ports can be configured in a LAG (8 active and 8 standby ports)</li> </ul> </li> <li>• 383 Single-port SMLT LAG's (all ports minus IST port(s))</li> </ul>
ERS8300	Release 2.2	Release 2.2	<ul style="list-style-type: none"> <li>• 31 Link Aggregation Groups                             <ul style="list-style-type: none"> <li>○ A maximum of 4 active links are supported per LAG</li> </ul> </li> </ul>
ERS55x0	Release 5.0	Release 5.0	<ul style="list-style-type: none"> <li>• 32 Link Aggregation Groups                             <ul style="list-style-type: none"> <li>○ A maximum of 8 active links are support per LAG.</li> </ul> </li> <li>• 128 Single-port SMLT LAG's</li> </ul>
ERS1600	Release 2.1	Release 2.1	<ul style="list-style-type: none"> <li>• 7 Link Aggregation Groups                             <ul style="list-style-type: none"> <li>○ A maximum of 4 active links are supported per LAG</li> </ul> </li> <li>• All ports for Single-port SMLT</li> </ul>
ES460/470	Yes	Yes	<ul style="list-style-type: none"> <li>• 6 Link Aggregation Groups                             <ul style="list-style-type: none"> <li>○ Maximum of 4 active links are support per LAG</li> <li>○ A fifth standby can be added to a trunk group.</li> <li>○ The first four highest priority links form a trunk group while the 5<sup>th</sup> lowest priority link remains in standby mode</li> </ul> </li> </ul>
ES325/425	Release 3/7 (Q106)	Yes	<ul style="list-style-type: none"> <li>• 6 Link Aggregation Groups                             <ul style="list-style-type: none"> <li>○ Maximum of 4 active links are support per LAG</li> </ul> </li> </ul>

**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.



## 2. Configuration Rules and Guidelines

### 2.1 Configuration Notes

- 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); STP normally should be disabled with on all SMLT ports.
- Link aggregation group(s) must be in the same STP group(s).
- If the NTSTG parameter is set to false, STP BPDU transmits only on one link. MTSTG is the default mode where ERS 8600 sends BPDUs on ALL links of an aggregation group – MLT or 802.3ad group.
- 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 order to change the VLANs membership on a LAG, or the ports membership within the VLANs, LACP must be disabled on the ports. Once the changes are completed, LACP can be enabled again on all appropriate port members.

### 2.2 SMLT Network Design Considerations

- If you use LACP in an SMLT/Square configuration, the LACP ports must have the same keys for that SMLT/LAG; otherwise, the aggregation may fail if a switch failure occurs.
- 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 CLI command:
  - ERS8610C:5# **config mlt {1..32} lacp clear-link-aggrgate**
- It is recommended to not enable LACP on the IST trunk to avoid unnecessary processing and to maintain simplicity. If a failure detection mechanism is required when there is an optical network between the SMLT core switches then use VLACP.

### 2.3 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 802.3ad-based link aggregation does not expect BPDUs to be replicated over all ports in the trunk group therefore you must enter the following command to disable the parameter on the spanning tree group for LACP-based link aggregation:

- Passport-8610:5# ***config stg x ntstg disable***

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.

## 2.4 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 802.3ad 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, ERS8600 only, 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:

$$\text{timeout} \times \text{slow-periodic-time} = 3 \times 30s = 90s$$

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



## 3.1 ERS8600

### 3.1.1 Global LACP Parameters

#### 3.1.1.1 Via CLI

LACP is configured globally by using the following command:

- Passport-8610:5# **config lacp ?**

Sub-Context:

Current Context:

```
aggr-wait-time milliseconds
disable
enable
system-priority <integer>
fast-periodic-time milliseconds
slow-periodic-time milliseconds
timeout-scale <integer>
info
```

where:

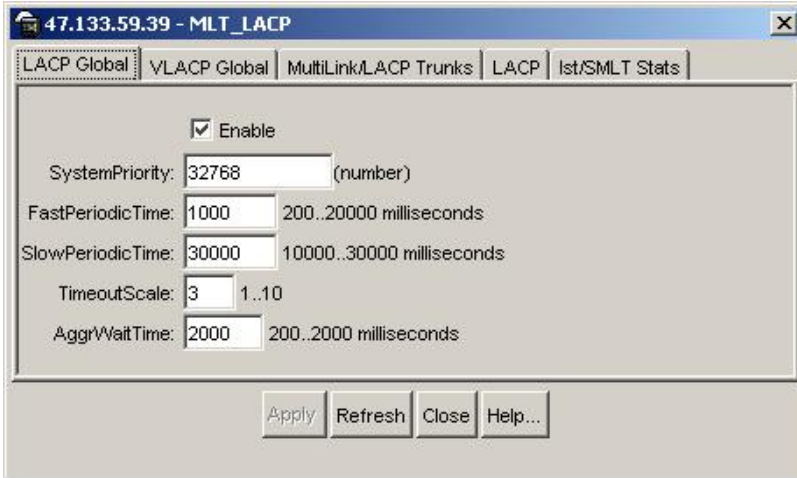
Parameter	Description
info	Displays current level parameter settings and next level directories.
enable	Enables LACP globally.
disable	Disables LACP globally.
aggr-wait-time <milliseconds>	Sets the aggregator wait-time in milliseconds. The default wait-time is 2,000 ms. The range is 200 to 2,000 ms.
system-priority <integer>	Sets LACP system priority globally. The default system-priority is 32,768. <i>integer</i> is the system priority value with range of 0..65535.
fast-periodic-time milliseconds	Sets fast periodic time globally. The default fast-periodic-time is 1,000 ms. The range is 200 to 2,000 ms, however, Nortel recommends a value no lower than 400ms. <i>milliseconds</i> are the fast periodic time value.
slow-periodic-time milliseconds	Sets slow periodic time globally. The default slow-periodic-time is 30,000 ms. The range is 10,000 to 30,000 ms <i>milliseconds</i> are the slow periodic time value.
timeout-scale <integer>	Sets a timeout scale globally. The default timeout-scale is 3. The range is 1 to 10. <i>integer</i> is the timeout scale value.



### 3.1.1.2 Via JDM

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

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



### 3.1.1.3 LACP Interface Parameters

### 3.1.1.4 Via CLI

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

- Passport-8610:5# ***config ethernet <slot/port> lacp ?***

Sub-Context :

Current Context :

```

disable
enable
aggr-wait-time <milliseconds>
fast-periodic-time <milliseconds>
info
key <integer>
aggregation <true|false>
mode <active|passive>
partner-key <int>
partner-port <int>
partner-port-priority <int>
partner-state <hex>
partner-system-id <mac>
partner-system-priority <int>
port-priority <integer>
slow-periodic-time <milliseconds>
system-priority <integer>
timeout <long|short>
timeout-scale <integer>
    
```

where :

Parameter	Description
info	Displays current level parameter settings and next level directories.



Parameter	Description
enable	Enables LACP for a specific port-type.
disable	Disables LACP for a specific port-type.
aggr-wait-time <milliseconds>	Sets the aggregation wait time (in milliseconds) for a specific port-type. <i>milliseconds</i> is the LACP aggregation wait time, an integer value in the range 200 and 2,000 ms
fast-periodic-time <milliseconds>	Sets the fast periodic time (in milliseconds) for a specific port-type. The default value is 1,000 ms. <i>milliseconds</i> is the fast periodic time value; an integer value in the range 200 and 20,000 ms. <b>Note:</b> The fast periodic time value of 200 ms is not supported for this software release 3.7.x. The minimum supported fast periodic time value is 400 ms.
key <integer>	Sets LACP aggregation key for a specific port-type. <i>integer</i> is an integer value in the range 1 and 32 for aggregatable ports. You can use a default key only for individual ports, an integer value in the range 0 and 65535.
aggregation <true false>	Sets individual port or aggregatable for a specific port type. <i>true</i> sets port as aggregatable. <i>false</i> sets port as individual.
mode <active passive>	Sets the mode as active or passive for a specific port-type. <b>Active Mode</b> – ports will initiate the aggregation process. Active mode ports will aggregate with other Active mode ports or Passive mode ports. <b>Passive Mode</b> – ports will participate in LACP but will not initiate the aggregation process. Passive mode ports must be partnered with Active Mode ports for aggregation to occur.
partner-key <int>	Sets the port partner's administration key value. <i>int</i> is the LACP partner's administrative key; an integer value in the range 0 and 65535.
partner-port <int>	Sets the port partner's administration port value. <i>int</i> is the LACP partner's administrative port; an integer value in the range 0 and 65535.
partner-port-priority <int>	Sets the port partner's administration port priority value. <i>int</i> is the LACP partner's administrative port priority; an integer value in the range 0 and 65535.
partner-state <hex>	Sets the port partner's administration state. <i>hex</i> is the LACP partner's administrative state bitmap; (Exp,Def,Dis,Col,Syn,Agg,Time,Act). <b>Example:</b> Activity = true Aggregating = true val = 00000101 (0x05) {0x0..0xff}
partner-system-id <mac>	Sets the port partner's administration system ID. <i>mac</i> is the LACP partner's administrative system ID; Mac address in the format: 0x00:0x00:0x00:0x00:0x00:0x00.
partner-system-priority <int>	Sets the port partner's administration system priority value. <i>int</i> is the LACP partner's administrative system priority; an integer value in the range 0 and 65535.

Parameter	Description
port-priority <integer>	Sets the LACP port priority to specific port type. The default value is 32768. <i>integer</i> is the port priority value; an integer value in the range 0 and 65535.
slow-periodic-time <milliseconds>	Sets the slow periodic time (in milliseconds) for a specific port-type. The default value is 1,000 ms <i>integer</i> is the slow periodic time value, an integer value in the range 10,000 and 30,000 ms.
system-priority <integer>	Sets system-priority for a specific port-type. <i>integer</i> is system-priority value with range 0..65535.
timeout <long/short>	Sets the timeout value to either long or short for a specific port-type.
timeout-scale <integer>	Sets a timeout scale for a specific port-type. The default value is 3. <i>integer</i> is the timeout scale value, an integer value in the range 1 and 10.

### 3.1.1.5 Via JDM

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



## 3.2 ES Switch

### 3.2.1 Default LACP System-Priority

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

- 470-48T(config)#**lacp system-priority ?**  
`<0-65535> priority`

### 3.2.2 LACP Interface Parameters

#### 3.2.2.1 Via CLI

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

- 470-48T-PWR(config)#**interface fastEthernet all**
- 470-48T-PWR(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. <ul style="list-style-type: none"> <li>• Value is in the range from 1 to 4095</li> </ul>
mode	Sets the LACP mode: <ul style="list-style-type: none"> <li>• Active = AdminEnabled + ActorAdminState(lacpActive)</li> <li>• Passive = AdminEnabled</li> <li>• Off = AdminDisabled</li> </ul>
priority	The priority value assigned to this aggregation port. <ul style="list-style-type: none"> <li>• Value is in the range 0 to 65535</li> </ul>
timeout-time	Set the timer for ether long or short.

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

- 470-48T-PWR(config)#**interface fastEthernet all**
- 470-48T-PWR(config-if)# **lacp aggregation port 3 enable**



### 3.2.2.2 Via JDM

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

**- Port 1/19**

Interface | VLAN | STG | EAPOL | EAPOL Advance | **LACP** | VLACP | Rate Limit | ADAC

**AdminEnabled**

OperEnabled: false

AggregateOrIndividual: Individual

ActorSystemPriority: 32768 0..65535

ActorSystemID: 00:09:97:49:a2:00

ActorAdminKey: 3 1..4095

ActorOperKey: 0

SelectedAggID: 0

AttachedAggID: 0

ActorPort: 19

ActorPortPriority: 32768 0..65535

ActorAdminState:  **lACPActive**  lACPShortTimeout  aggregation

ActorOperState:

Apply Refresh Close Help...

LACP mode: active=AdminEnabled+ActorAdminState(lACPActive),passive=AdminEnabled,off=AdminDisabled





## 4. Configuring VLACP

### 4.1 ERS Switch

#### 4.1.1 Interface Level

##### 4.1.1.1 Via CLI

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

- ERS8610C:5# **config ethernet <slot/port> vlacp ?**

Sub-Context:  
Current Context:

```

disable
enable
fast-periodic-time <milliseconds>
info
slow-periodic-time <milliseconds>
timeout <long|short>
timeout-scale <integer>
ethertype <integer>
macaddress <mac>
    
```

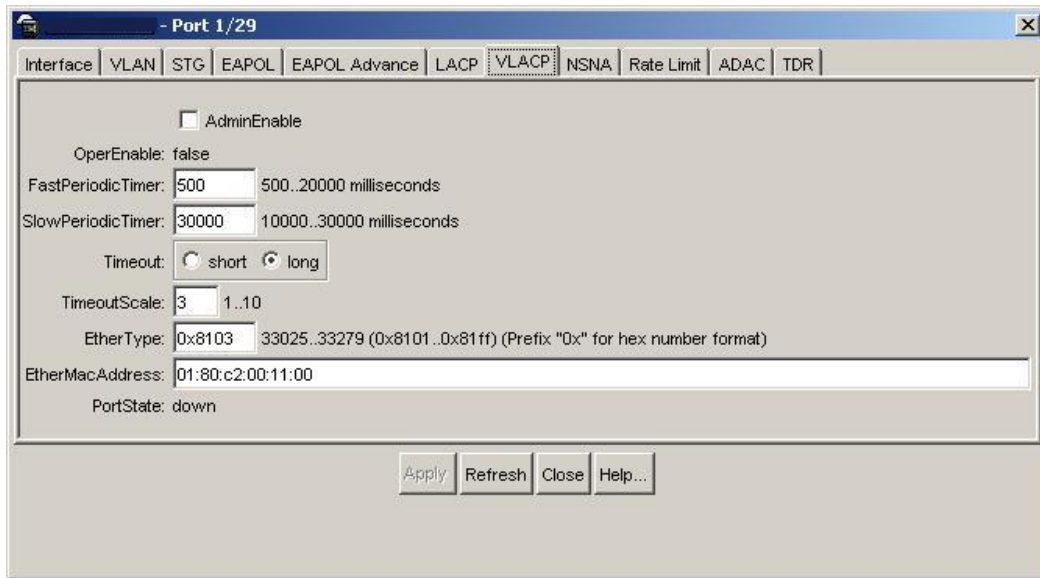
where:

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 <ul style="list-style-type: none"> <li><i>milliseconds</i> is the fast periodic time value, an integer value in the range 200 and 20,000 ms.</li> </ul> <b>Note:</b> 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 <ul style="list-style-type: none"> <li><i>milliseconds</i> is the slow periodic time value, an integer value in the range 10,000 and 30,000 ms.</li> </ul>
timeout <long short>	Sets the port to use the long or short timeout value: <ul style="list-style-type: none"> <li><i>long</i> sets the port to use the timeout-scale value * the slow-periodic-time value.</li> <li><i>short</i> sets the port to use the timeout-scale value * the fast-periodic-time value.</li> </ul> For example, if you set the timeout-scale <i>value</i> to 3, and the fast-periodic-time <i>value</i> 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. <ul style="list-style-type: none"> <li><i>integer</i> is the timeout scale value, an integer value in the range 1 and 10.</li> </ul>

Parameters and Variables	Description
ethertype <integer>	Sets the VLACP protocol identification for this port. <ul style="list-style-type: none"> <li><i>integer</i> is the ethertype value, an integer value in the range 1 and 65535.</li> </ul>
macaddress <mac>	Sets the Multicast MAC address used for the VLACPDU. Required parameters: <ul style="list-style-type: none"> <li><i>mac</i> is the MAC address in the following format: 0x00:0x00:0x00:0x00:0x00:0x00</li> </ul>

#### 4.1.1.2 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.



### 4.1.2 Global Level

#### 4.1.2.1 Via CLI

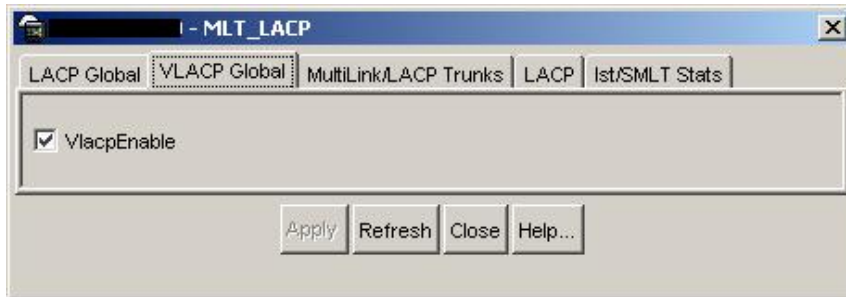
The following command enables VLACP globally:

- ERS8610C:5# **config vlacp <enable/disable/info>**



### 4.1.2.2 Via JDM

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



## 4.2 ES Switch

### 4.2.1 Interface Level

#### 4.2.1.1 Via CLI

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

- 470-48T(config)#**interface fastEthernet all**
- 470-48T(config-if)#**vlaccp 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

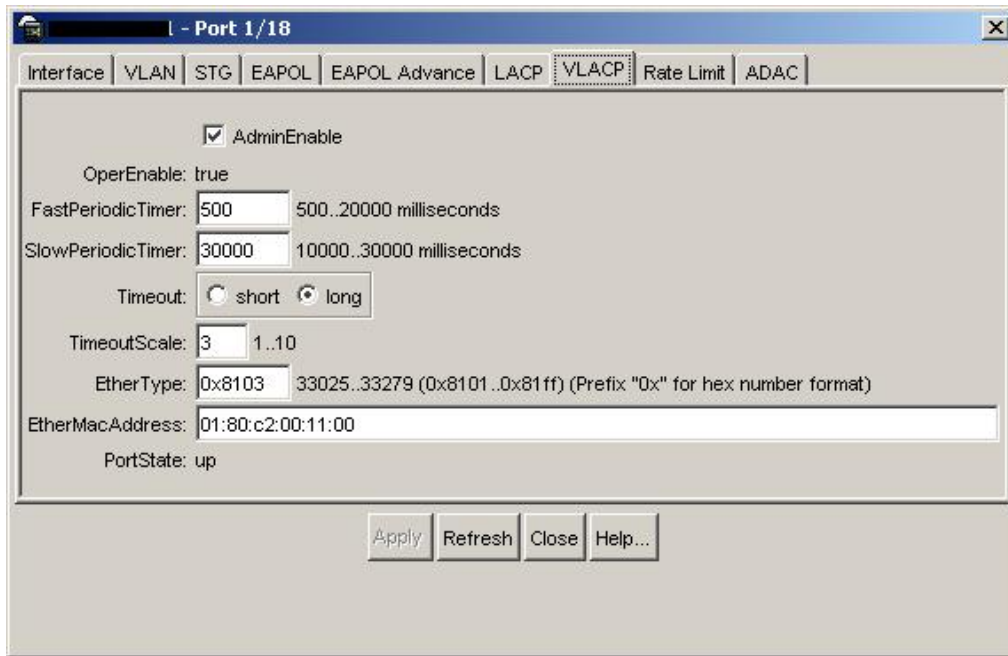
where:

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. <ul style="list-style-type: none"> <li>• <i>long</i> sets the port timeout value to: (timeout-scale value) x (slow-periodic-time value).</li> <li>• <i>short</i> sets the port's timeout value to: (timeout-scale value) x (fast-periodic-time value).</li> </ul> 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.
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.

Parameters and Variables	Description
funcmac-addr <mac>	Specifies the address of the far-end switch/stack configured to be the partner 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

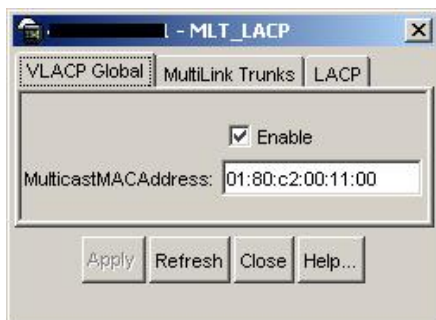
#### 4.2.2.1 Via CLI

The following command enables VLACP globally:

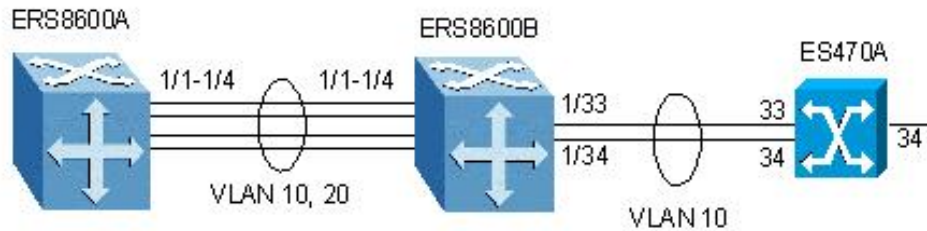
- 470-48T(config)#**vlACP enable**

#### 4.2.2.2 Via JDM

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



## 5. LACP Configuration Example: Base Scenario, Point-to-Point



For this example, we will configure the following:

- Disable Spanning Tree on all LAG ports
- A Link Aggregation Group (LAG) is configured between ERS8600A and ERS8600B with 4 link members and the following items:
  - VLANs 10 and 20 will be tagged across the LAG
  - LACP key = 1
  - MLT ID = 1
- A LAG between ERS8600B and ES470A with 2 link members and the following items:
  - VLAN 10 will be tagged across the LAG
  - LACP key = 2
  - MLT ID = 2

---

**NOTE:** In order to change the VLAN port membership or the VLAN tagged over the MLT. It is first required to disable LACP on the port, add the VLAN and associate it to the LACP ports, and then enable LACP on the ports.

---

### 5.1 Configuration Steps

#### 5.1.1 Perform the Following Steps on Switches ERS8600A

1. Create MLT 1 using key 1. Note: the key value must be the same as the port key.
  - Passport-8610:5# **conf mlt 1 create**
  - Passport-8610:5# **conf mlt 1 lacp key 1**
  - Passport-8610:5# **conf mlt 1 lacp enable**
2. Disable Spanning Tree on ports 1/1-1/4
  - Passport-8610:5# **conf ethernet 1/1-1/4 stg 1 stp disable**
3. Configure LACP on ports 1/1-1/4 using key 1. 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.
  - Passport-8610:5# **conf ethernet 1/1-1/4 perform-tagging enable**
  - Passport-8610:5# **conf ethernet 1/1-1/4 lacp key 1**
  - Passport-8610:5# **conf ethernet 1/1-1/4 lacp aggregation true**



4. Create VLANs and add port members
  - Passport-8610:5# **conf vlan 1 ports remove 1/1-1/4**
  - Passport-8610:5# **conf vlan 10 create byport 1**
  - Passport-8610:5# **conf vlan 10 ports add 1/1-1/4**
  - Passport-8610:5# **conf vlan 20 create byport 1**
  - Passport-8610:5# **conf vlan 20 ports add 1/1-1/4**
5. Enable LACP on each port and globally
  - Passport-8610:5# **conf ethernet 1/1-1/4 lacp enable**
  - Passport-8610:6# **config lacp enable**

### 5.1.2 Perform the Following Steps on Switches ERS8600B

1. Create MLT 1 using key 1. Note: the key value must be the same as the port key
  - Passport-8610:5# **conf mlt 1 create**
  - Passport-8610:5# **conf mlt 1 lacp key 1**
  - Passport-8610:5# **conf mlt 1 lacp enable**
2. Create MLT 2 using key 2
  - Passport-8610:5# **conf mlt 2 create**
  - Passport-8610:5# **conf mlt 2 lacp key 2**
  - Passport-8610:5# **conf mlt 2 lacp enable**
3. Disable Spanning Tree on ports 1/1-1/4 and 1/33-1/34
  - Passport-8610:5# **conf ethernet 1/1-1/4,1/33-1/34 stg 1 stp disable**
4. Configure LACP on ports 1/1-1/4 using key 1. 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.
  - Passport-8610:5# **conf ethernet 1/1-1/4 perform-tagging enable**
  - Passport-8610:5# **conf ethernet 1/1-1/4 lacp key 1**
  - Passport-8610:5# **conf ethernet 1/1-1/4 lacp aggregation true**
5. Configure LACP on ports 1/33-1/34 using key 2. The key used must be the same as that used in step 2 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.
  - Passport-8610:5# **conf ethernet 1/33,1/34 perform-tagging enable**
  - Passport-8610:5# **conf ethernet 1/33,1/34 lacp key 2**
  - Passport-8610:5# **conf ethernet 1/33,1/34 lacp aggregation true**
6. Create VLANs and add port members
  - Passport-8610:5# **conf vlan 1 ports remove 1/1-1/4,1/34-1/35**
  - Passport-8610:5# **conf vlan 10 create byport 1**
  - Passport-8610:5# **conf vlan 10 ports add 1/1-1/4,1/33,1/34**
  - Passport-8610:5# **conf vlan 20 create byport 1**
  - Passport-8610:5# **conf vlan 20 ports add 1/1-1/4**
7. Enable LACP on each port, enable LACP globally
  - Passport-8610:5# **conf ethernet 1/1-1/4,1/33,1/34 lacp enable**
  - Passport-8610:6# **config lacp enable**



### 5.1.3 Perform the Following Steps on Switch ES470A

1. Go to configuration mode
  - 470-48T >**enable**
  - 470-48T# **configure terminal**
2. Enable tagging on ports 33 and 34, create VLAN 10, and add port members
  - 470-48T(config)#**vlan members remove 1 ALL**
  - 470-48T(config)#**vlan ports 33,34 tagging tagall**
  - 470-48T(config)# **vlan create 10 type port**
  - 470-48T(config)# **vlan members add 10 33,34,35**
3. Configure LACP on ports 33 and 34 using key 2. 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.
  - 470-48T(config)# **interface fastEthernet all**
  - 470-48T(config-if)#**no spanning-tree port 18,19 stp 1**
  - 470-48T(config-if)# **lacp key port 33,34 2**
  - 470-48T(config-if)# **lacp mode port 33,34 active**
  - 470-48T(config-if)# **lacp aggregation port 33,34 enable**
  - 470-48T(config-if)# **exit**
  - 470-48T(config)#

## 5.2 Verification

### 5.2.1 ERS8600B LACP

- Passport-8610:6# **show mlt info**

```

=====
                                Mlt Info
=====
MLTID      IFINDEX  NAME      PORT      SVLAN    MLT      MLT      PORT      VLAN
           NAME    TYPE      TYPE      TYPE     ADMIN    CURRENT MEMBERS  IDS
-----
1          4096    MLT-1     trunk     normal   norm     norm     1/1-1/4   10 20
2          4097    MLT-2     trunk     normal   norm     norm     1/33-1/34 10

           MULTICAST
MLTID IFINDEX  DISTRIBUTION  NT-STG  DESIGNATED  LACP      LACP
           PORTS    ADMIN        OPER
-----
1      4096    disable      disable  1/1         enable    up
2      4097    disable      disable  1/33       enable    up
    
```



• **Passport-8610:6# show mlt lacp info 4097**

```

=====
                        LACP Aggrgator Information
=====
MLTID  IFINDEX      MAC                COLLECTOR      AGGR      PORT
      ADDR                MAXDELAY      ORINDI      MEMBERS
-----
2      4097          00:80:2d:36:14:30  32768          aggr      1/33-1/34
-----
MLTID  IFINDEX      OPER              OPERLAST
      STATE                CHANGE
-----
2      4097          up                10 day(s) , 01:35:06
-----
MLTID  IFINDEX      ACTOR              ACTOR          ACTOR          ACTOR
      SYSPRIO      SYSID              ADMINKEY      OPERKEY
-----
2      4097          32768  00:80:2d:36:14:00  2              2
-----
MLTID  IFINDEX      PARTNER            PARTNER        PARTNER
      SYSPRIO      SYSID              OPERKEY
-----
2      4097          32768  00:09:97:49:a2:00  8194

```

• **Passport-8610:6# show lacp info**

```

=====
                        LACP Global Information
=====
SystemId: 00:80:2d:36:14:00
LACP: enable
system-priority: 32768
timeout: 3
fast-periodic-time: 1000
slow-periodic-time: 30000
aggr-wait-time: 2000

```

**5.2.2 ES470A LACP**

• **470-48T#show mlt**

Trunk Name	Members	Bpdu	Mode	Status
1 Trunk #1	NONE	All	Basic	Disabled
2 Trunk #2	NONE	All	Basic	Disabled
3 Trunk #3	NONE	All	Basic	Disabled
4 Trunk #4	NONE	All	Basic	Disabled
5 Trunk #5	NONE	All	Basic	Disabled
6 Trunk #6	33-34	Single	DynLag	Enabled

• **470-48T#show lacp aggr**

Aggr ID	Trunk	Status	Type	Members
8193	6	Enabled	LA	33-34

• **470-48T#show lacp port 33,34**

Port	Priority	LACP	A/I	Timeout	Admin Key	Oper Key	AggrId	Trunk Id	Partner Port	Status
33	32768	Active	A	Long	2	8194	8193	6	96	Active
34	32768	Active	A	Long	2	8194	8193	6	97	Active





- **470-48T#show lacp system**

```
System Priority      : 32768
Collector Max Delay: 1
```

- **470-48T#show lacp port 33,34**

Port	Priority	Lacp	A/I	Timeout	Admin Key	Oper Key	AggrId	Trunk Id	Partner Port	Status
33	32768	Active	A	Long	2	8194	8193	6	96	Active
34	32768	Active	A	Long	2	8194	8193	6	97	Active

- **470-48T#show lacp stats 33,34**

```
Port 33 -----
LACPDUs Rx:                279
LACPDUs Tx:                334
MarkerPDUs Rx:             0
MarkerResponsePDUs Rx:    0
MarkerPDUs Tx:             0
MarkerResponsePDUs Tx:    0
UnknownPDUs Rx:           0
IllegalPDUs Rx:           0

Port 34 -----
LACPDUs Rx:                277
LACPDUs Tx:                333
MarkerPDUs Rx:             0
MarkerResponsePDUs Rx:    0
MarkerPDUs Tx:             0
MarkerResponsePDUs Tx:    0
UnknownPDUs Rx:           0
IllegalPDUs Rx:           0
```

- **470-48T#show lacp debug member 33,34**

Port	AggrId	TrunkId	Rx State	Mux State	Partner Port
33	8193	6	Current	Ready	96
34	8193	6	Current	Ready	97

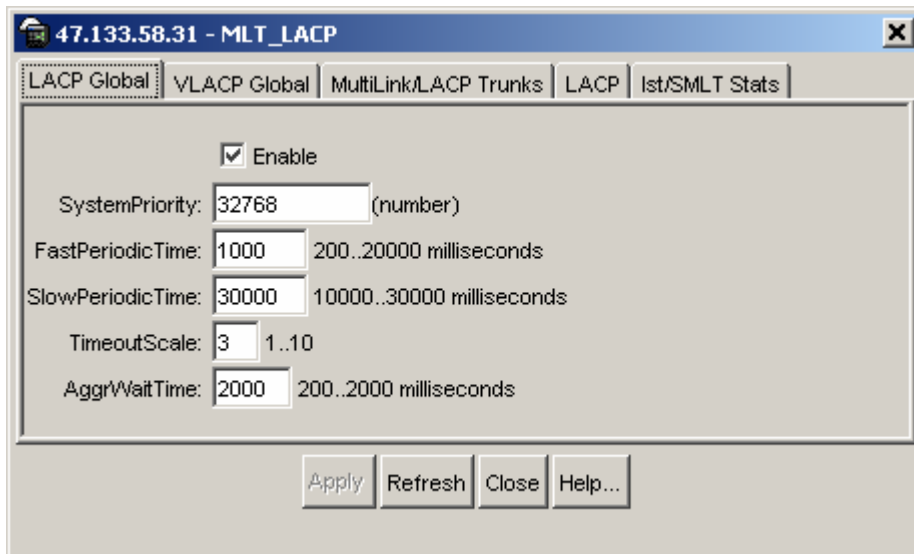


## 5.3 JDM LACP Configuration – ERS8600A

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

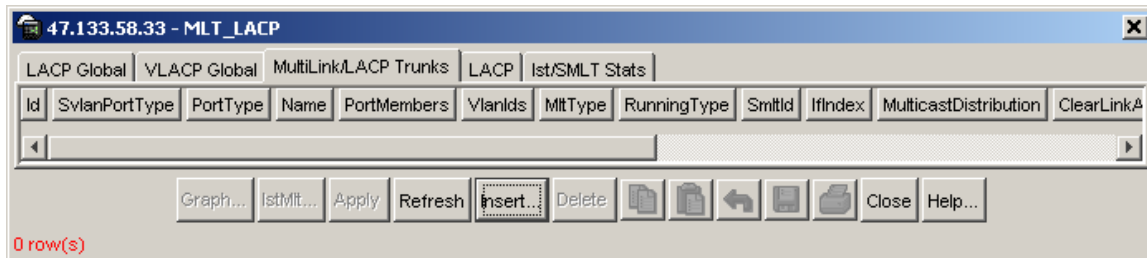
- VLAN 10 and 20 have already been created.
- Ports 1/1-1/4 are tagging enabled and are members of VLAN 10 and 20.
- Both switches are mirror images of each other so the same commands can be entered in both.

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



- Enabled by default
- Recommend keeping timers default

2 Go to VLAN -> MLT/LACP -> Multilink/LACP Trunks



- Click on *Insert* to create a new trunk group as shown below:



**47.133.58.33 - MLT\_LACP, Insert MultiLink/LAC...**

**Id:** 1 1..32

**SvlanPortType:**  normal  uni  nni

**PortType:**  access  trunk

**Name:** LACP\_MLT

**PortMembers:** ...

**Vlanids:** 10,20 ...

**MltType:**  normalMLT  istMLT  splitMLT

**SmlfId:** 1..32

**MulticastDistribution:**  enable  disable

NtStgEnable

**Aggregatable:**  enable  disable

Insert Close Help...

- Go to *VLAN -> MLT/LACP -> LACP* and change the *ActorAdminKey* for the MLT to 1. This key must match the key on ports 1/1-1/4:

**47.133.58.33 - MLT\_LACP**

LACP Global | VLACP Global | MultiLink/LACP Trunks | LACP | Ist/SMLT Stats

Index	MACAddress	ActorSystemPriority	ActorSystemID	AggregateOrIndividual	ActorAdminKey	ActorOperKey	PartnerSystemID	PartnerSystemPr
LACP_MLT	00:00:00:00:00:00	32768	00:80:2d:be:20:00	true	1	0	00:00:00:00:00:00	

Apply Refresh [Icons] Close Help...

1 row(s)



4 Next, start by clicking on each of the LAG ports (1/1 to 1/4), right-click the mouse key, and select *Edit*. 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.

- 1) ActorAdminKey = 1
- 2) ActorAdminState = aggregation
- 3) AdminEnable

**47.133.58.33 - Port 1/1**

Mroute Stream Limit | Fdb Protect | IP Address | ARP | DHCP | DVMRP | IGMP | OSPF | RIP | PIM | PGM | VRRP | Router Discovery | IPX BRouter  
 Interface | VLAN | STG | MAC Learning | Rate Limiting | Test | SMLT | PCAP | EAPOL | LACP | VLACP | Remote Mirroring

AdminEnable  
 OperEnable: true  
 FastPeriodicTime: 1000 200..20000 milliseconds  
 SlowPeriodicTime: 30000 10000..30000 milliseconds  
 AggrWaitTime: 2000 200..20000 milliseconds  
 TimeoutScale: 3 1..10

PartnerAdminSystemPriority: 0 0.65535  
 PartnerOperSystemPriority: 0  
 PartnerAdminSystemID: 00:00:00:00:00:00 (MAC Add)  
 PartnerOperSystemID: 00:00:00:00:00:00  
 PartnerAdminKey: 0 0.65535  
 PartnerOperKey: 0  
 PartnerAdminPort: 0 0.65535  
 PartnerOperPort: 0  
 PartnerAdminPortPriority: 0 0.65535  
 PartnerOperPortPriority: 0

ActorSystemPriority: 32768 0.65535  
 ActorSystemID: 00:80:2d:be:20:00  
 ActorAdminKey: 1 0.65535  
 ActorOperKey: 1

SelectedAggID: 64  
 AttachedAggID: 0  
 ActorPort: 1/1  
 ActorPortPriority: 32768 0.65535  
 ActorAdminState:  lacpActive  lacpShortTimeout  aggregation  
 ActorOperState: lacpActive,aggregation,defaulted,expired

PartnerAdminState:  lacpActive  lacpShortTimeout  aggregation  
 synchronization  collecting  distributing  
 defaulted  expired  
 PartnerOperState: lacpShortTimeout

Apply Refresh **Close** Help...

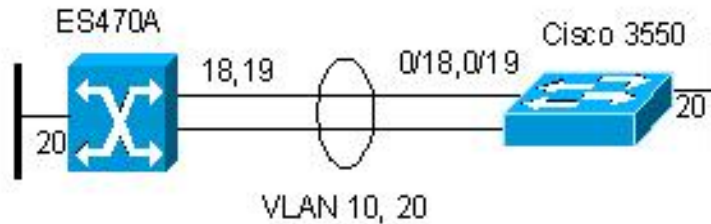


Once the ports have been configured, the MLT should look like the following, note that ports 1/3-1/4 are not enabled thus do not show up as port members:

Id	SvlanPortType	PortType	Name	PortMembers	VlanIds	MltType	RunningType	SmtId	IfIndex	MulticastDistribution	ClearLinkAggregate
1	normal	trunk	MLT-1	1/1-1/2	10,20	normalMLT	normalMLT	0	4096	disable	none

MulticastDistribution	ClearLinkAggregate	NtStgEnable	DesignatedPort	Aggregatable	AggOperState	AggTimeOfLastOperChange
disable	none	true	1/1	enable	enable	00h:35m:19s

## 6. LACP Interoperability Between a ES470 and Cisco 3550



For this example, we will configure the following:

- A Link Aggregation Group (LAG) is configured between ES470A and a Cisco 3550.
  - VLANs 10 and 20 will be tagged across the LAG
  - LACP key = 3
  - MLT ID = 2
  - LACP Timeout = Long

### 6.1.1 Perform the following steps on switch ES470A

1. Go to configuration mode.
  - 470-48T>**enable**
  - 470-48T#**config terminal**
2. Enable tagging on ports 33 and 34, create VLAN 10 and 20, and add port members
  - 470-48T(config)#**vlan members remove 1 ALL**
  - 470-48T(config)#**vlan ports 18,19 tagging tagall**
  - 470-48T(config)# **vlan create 10 type port**
  - 470-48T(config)#**vlan create 20 type port**
  - 470-48T(config)# **vlan members add 10 18-20**
  - 470-48T(config)#**vlan members add 20 18-20**
3. Configure LACP on ports 18 and 19 using key 3. 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.
  - 470-48T(config)# **interface fastEthernet all**
  - 470-48T(config-if)#**no spanning-tree port 18,19 stp 1**
  - 470-48T(config-if)# **lacp key port 18,19 3**
  - 470-48T(config-if)# **lacp mode port 18,19 active**
  - 470-48T(config-if)# **lacp aggregation port 18,19 enable**
  - 470-48T(config-if)# **exit**
  - 470-48T(config)#

### 6.1.2 Cisco C3550 Configuration

1. Add VLANs 10 and 20
  - C3550#**vlan data**
  - C3550(vlan)#**vlan 10 state active**
  - C3550(vlan)#**vlan 20 state active**
  - C3550(vlan)#**exit**



## 2. Configuration

```

!
spanning-tree mode pvst
spanning-tree extend system-id
no spanning-tree vlan 2,4,10,20
spanning-tree vlan 4,100-102 priority 8192
!
vlan dot1q tag native
!
interface Port-channel3
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 10
  switchport trunk allowed vlan 10,20
  switchport mode trunk
!
!
interface FastEthernet0/18
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 10
  switchport trunk allowed vlan 10,20
  switchport mode trunk
  channel-group 3 mode active
  channel-protocol lacp
!
interface FastEthernet0/19
  switchport trunk encapsulation dot1q
  switchport trunk native vlan 10
  switchport trunk allowed vlan 10,20
  switchport mode trunk
  channel-group 3 mode active
  channel-protocol lacp
!
interface FastEthernet0/20
  switchport access vlan 10
  switchport mode access
!

```

## 6.2 Verification

### 6.2.1 C3550

- C3550#*show etherchannel summary*

```

Flags: D - down          P - in port-channel
       I - stand-alone s - suspended
       H - Hot-standby (LACP only)
       R - Layer3        S - Layer2
       u - unsuitable for bundling
       U - in use        f - failed to allocate aggregator
       d - default port

```

```

Number of channel-groups in use: 1
Number of aggregators:          1

```

Group	Port-channel	Protocol	Ports
3	Po3 (SU)	LACP	Fa0/18 (P) Fa0/19 (P)



• **C3550#show lacp internal detail**

Flags: S - Device is requesting Slow LACPDUs  
 F - Device is requesting Fast LACPDUs  
 A - Device is in Active mode            P - Device is in Passive mode

Channel group 3

Actor (internal) information:

Port	Actor System ID	Actor Port Number	Age	Actor Flags
Fa0/18	32768,000b.5f02.f300	0x12	20s	SA
	LACP Actor Port Priority	Actor Oper Key	Actor Port State	
	32768	0x3	0x3D	

Port State Flags Decode:  
 Activity:    Timeout:    Aggregation:    Synchronization:  
 Active      Short        Yes              Yes

Collecting:    Distributing:    Defaulted:    Expired:  
 Yes            Yes              No             No

Port	Actor System ID	Actor Port Number	Age	Actor Flags
Fa0/19	32768,000b.5f02.f300	0x13	9s	SA
	LACP Actor Port Priority	Actor Oper Key	Actor Port State	
	32768	0x3	0x3D	

Port State Flags Decode:  
 Activity:    Timeout:    Aggregation:    Synchronization:  
 Active      Short        Yes              Yes

Collecting:    Distributing:    Defaulted:    Expired:  
 Yes            Yes              No             No

• **C3550#show lacp neighbor detail**

Flags: S - Device is requesting Slow LACPDUs  
 F - Device is requesting Fast LACPDUs  
 A - Device is in Active mode            P - Device is in Passive mode

Channel group 3 neighbors

Partner's information:

Port	Partner System ID	Partner Port Number	Age	Partner Flags
Fa0/18	32768,0009.9749.a200	0x12	1s	SA
	LACP Partner Port Priority	Partner Oper Key	Partner Port State	
	32768	0x2003	0x3D	

Port State Flags Decode:  
 Activity:    Timeout:    Aggregation:    Synchronization:  
 Active      Short        Yes              Yes

Collecting:    Distributing:    Defaulted:    Expired:  
 Yes            Yes              No             No

Port	Partner System ID	Partner Port Number	Age	Partner Flags
Fa0/19	32768,0009.9749.a200	0x13	20s	SA
	LACP Partner Port Priority	Partner Oper Key	Partner Port State	
	32768	0x2003	0x3D	

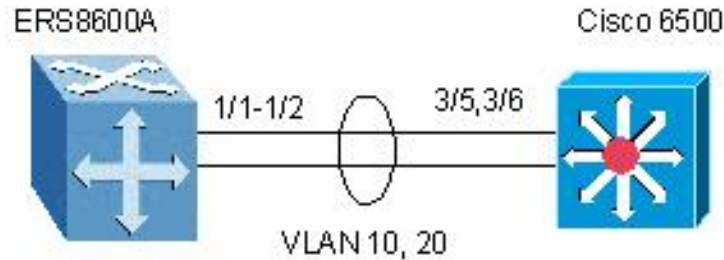




---

Port State Flags Decode:  
Activity: Timeout: Aggregation: Synchronization:  
Active Short Yes Yes  
Collecting: Distributing: Defaulted: Expired:  
Yes Yes No No

## 7. LACP Interoperability between ERS8600 and Cisco Catalyst 6500



For this example, we will configure the following

- A Link Aggregation Group (LAG) is configured between ERS8600A and Cisco Catalyst 6500.
  - VLANs 10 and 20 will be tagged across the LAG
  - LACP key = 4
  - MLT ID = 2
  - LACP Timeout = Long
  - Configure ERS8600 to force it to only use the Cisco LACP port number and system id.

### 7.1 Configuration Steps

#### 7.1.1 Perform the following steps on switches ERS8600A

1. Create MLT 1 using key 1. Note: the key value must be the same as the port key.
  - Passport-8610:5# **conf mlt 2 create**
  - Passport-8610:5# **conf mlt 2 lacp key 4**
  - Passport-8610:5# **conf mlt 2 lacp enable**
2. Disable Spanning Tree on port 1/1-1/4
  - Passport-8610:5# **conf ethernet 1/1-1/2 stg 1 stp disable**
3. Configure LACP on ports 1/1-1/4 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. Note, 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 use 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.
  - Passport-8610:5# **conf ethernet 1/1-1/2 perform-tagging enable**
  - Passport-8610:5# **conf ethernet 1/1-1/2 lacp key 4**
  - Passport-8610:5# **conf ethernet 1/1-1/2 lacp partner-key 4**
  - Passport-8610:5# **conf ethernet 1/1 lacp partner-port 773**
  - Passport-8610:5# **conf ethernet 1/2 lacp partner-port 774**
  - Passport-8610:5# **conf ethernet 1/1-1/2 lacp partner-port-priority 32768**
  - Passport-8610:5# **conf ethernet 1/1-1/2 lacp partner-system-id 00:0f :35 :3b :89 :66**
  - Passport-8610:5# **conf ethernet 1/1-1/2 lacp aggregation true**



#### 4. Create VLANs and add port members

- Passport-8610:5# **conf vlan 1 ports remove 1/1-1/2**
- Passport-8610:5# **conf vlan 10 create byport 1**
- Passport-8610:5# **conf vlan 10 ports add 1/1-1/2**
- Passport-8610:5# **conf vlan 20 create byport 1**
- Passport-8610:5# **conf vlan 20 ports add 1/1-1/2**

#### 5. Enable LACP on each port and globally

- Passport-8610:5# **conf ethernet 1/1-1/2 lacp enable**
- Passport-8610:6# **config lacp enable**

### 7.1.2 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
```



## 8. SMLT with 802.3ad and MLT with VLACP Configuration Example

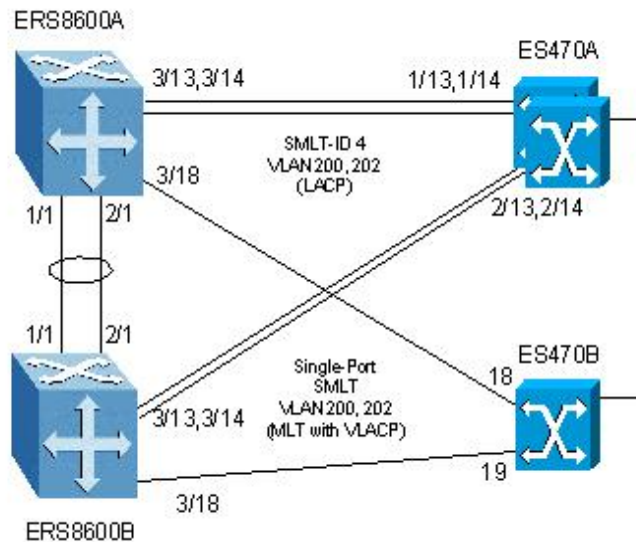
With the 3.7 release, the ERS8600 switch fully supports the IEEE 802.3ad Link aggregation control protocol; not only on MLT and DMLT links, but also extended to a pair of SMLT switches. With this extension, the ERS8600 switch now provides a standardized external link aggregation interface to third party vendor IEEE 802.3ad implementations. With previous software versions, interoperability was provided through a static configuration; now a dynamic link aggregation mechanism is provided.

In this example, ES470A and ES470B are used as the SMLT Clients. ES470A will be configured with dynamic link aggregation using LACP. ES470B will be configured with static link aggregation using MLT. 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 use as a SMLT client.

**Note:**

- It is recommended to not run 802.3ad on the IST connection.
- The LACP keys on the SMLT core switches must match (ERS8600A, ERS8600B).
- Spanning is disabled by default on a port level when SMLT is enabled
- CP Limit should be disabled on all IST interface; this is the default setting
- If the SMLT client is a Nortel switch using MLT, VLACP should be enabled to provide end-to-end protection. The default VLACP setting should be fine for all direct connections. For LAN extension applications, fast timers should be used.

### 8.1 SMLT Topology





## 8.2 Config Steps

### 8.2.1 ERS8600A Configuration

1. Create IST using VLAN 3999 using key 1. Note: the key value must be the same as the port key.
  - Passport-8610:5# **conf vlan 3999 create byport 1**
  - Passport-8610:5# **conf mlt 1 create**
  - Passport-8610:5# **conf mlt 1 perform-tagging enable**
  - Passport-8610:5# **conf mlt 1 add ports 1/1,2/1**
  - Passport-8610:5# **conf mlt 1 add vlan 3999**
  - Passport-8610:5# **conf vlan 3999 ip create 2.2.2.1/30**
  - Passport-8610:5# **conf mlt 1 ist create ip 2.2.2.2 vlan-id 3999**
2. Create SMLT group
  - Passport-8610:5# **conf mlt 4 create**
  - Passport-8610:5# **conf mlt 4 lacp key 4**
  - Passport-8610:5# **conf mlt 4 lacp enable**
  - Passport-8610:5# **conf mlt 4 smlt create smlt-id 4**
3. Enable VLAN Tagging on ports 3/13, 3/14, and 3/18 and remove VLAN 1 port membership
  - Passport-8610:5# **conf ethernet 3/13,3/14,3/18 perform-tagging enable**
  - Passport-8610:5# **conf vlan 1 ports remove 3/13-3/14,3/18**
4. Configure LACP on ports 3/13-3/14 using key 4. The key must match on all ports in a LAG. The same key must be used on both SMLT core switches.
  - Passport-8610:5# **conf ethernet 3/13,3/14 lacp key 4**
  - Passport-8610:5# **conf ethernet 3/13,3/14 lacp aggregation true**
5. Create SMLT VLAN 200 and add port members
  - Passport-8610:5# **conf vlan 200 create byport 1**
  - Passport-8610:5# **conf vlan 200 ports add 3/13-3/15,3/18,1/1,1/2**
6. Create VLAN 202 and Single-Port SMLT using SNMP ID 6
  - Passport-8610:5# **config vlan 202 create byport 1**
  - Passport-8610:5# **config vlan 202 ports add 3/13,3/14,3/18**
  - Passport-8610:5# **config ethernet 3/18 smlt 6 create**
7. Add VLAN 202 to IST (MLT 1)
  - Passport-8610:5# **config mlt 1 add vlan 202**
8. Enable VLACP on port 3/18
  - Passport-8610:5# **config ethernet 3/18 vlacp enable**
  - Passport-8610:6# **config vlacp enable**
9. Enable LACP on each port and globally
  - Passport-8610:5# **conf ethernet 3/13,3/14 lacp enable**
  - Passport-8610:6# **config lacp enable**



## 8.2.2 ERS8600B Configuration

1. Create IST using VLAN 3999 using key 1. Note: the key value must be the same as the port key.
  - Passport-8610:5# **conf vlan 3999 create byport 1**
  - Passport-8610:5# **conf mlt 1 create**
  - Passport-8610:5# **conf mlt 1 perform-tagging enable**
  - Passport-8610:5# **conf mlt 1 add ports 1/1,2/1**
  - Passport-8610:5# **conf mlt 1 add vlan 3999**
  - Passport-8610:5# **conf vlan 3999 ip create 2.2.2.2/30**
  - Passport-8610:5# **conf mlt 1 ist create ip 2.2.2.1 vlan-id 3999**
2. Create SMLT group
  - Passport-8610:5# **conf mlt 4 create**
  - Passport-8610:5# **conf mlt 4 lacp key 4**
  - Passport-8610:5# **conf mlt 4 lacp enable**
  - Passport-8610:5# **conf mlt 4 smlt create smlt-id 4**
3. Enable VLAN Tagging on ports 3/13, 3/14, and 3/18 and remove VLAN 1 port membership
  - Passport-8610:5# **conf ethernet 3/13,3/14,3/18 perform-tagging enable**
  - Passport-8610:5# **conf vlan 1 ports remove 3/13-3/14,3/18**
4. Configure LACP on ports 3/13-3/14 using key 4. The key must match on all ports in a LAG. The same key must be used on both SMLT core switches.
  - Passport-8610:5# **conf ethernet 3/13,3/14 lacp key 4**
  - Passport-8610:5# **conf Ethernet 3/13,3/14 lacp aggregation true**
5. Create SMLT VLAN 200 and add port members
  - Passport-8610:5# **conf vlan 200 create byport 1**
  - Passport-8610:5# **conf vlan 200 ports add 3/13-3/14,3/18,1/1,1/2**
6. Create VLAN 202 and Single-Port SMLT using SNMP ID 6
  - Passport-8610:5# **config vlan 202 create byport 1**
  - Passport-8610:5# **config vlan 202 ports add 3/18-3/19**
  - Passport-8610:5# **config ethernet 3/18 smlt 6 create**
7. Add VLAN 202 to IST (MLT 1)
  - Passport-8610:5# **config mlt 1 add vlan 202**
8. Enable VLACP on port 3/18 and globally
  - Passport-8610:5# **config ethernet 3/18 vlacp enable**
  - Passport-8610:6# **config vlacp enable**
9. Enable LACP on each port and globally
  - Passport-8610:5# **conf ethernet 3/13,3/14 lacp enable**
  - Passport-8610:6# **config lacp enable**



### 8.2.3 ES470A configuration

1. Go to configuration mode.
  - 470-48T>**enable**
  - 470-48T#**config terminal**
2. Enable tagging on ports 1/13, 1/14, 2/13, and 2/14, create VLAN 200 and 202, and add port members
  - 470-48T(config)# **vlan ports 1/13,1/14,2/13,2/14 tagging tagall**
  - 470-48T(config)# **vlan create 200 type port**
  - 470-48T(config)# **vlan members add 200 1/13-15,2/13-15**
  - 470-48T(config)# **vlan create 202 type port**
  - 470-48T(config)# **vlan members add 202 1/13-14,2/13-14,1/19,2/19**
3. Configure LACP on ports 1/13, 1/14, 2/13, and 2/14 using key 4.
  - 470-48T(config)# **interface fastEthernet all**
  - 470-48T(config-if)# **no spanning-tree port 1/13-14,2/13-14 stp 1**
  - 470-48T(config-if)# **lacp key port 1/13-14,2/13-14 4**
  - 470-48T(config-if)# **lacp mode port 1/13-14,2/13-14 active**
  - 470-48T(config-if)# **lacp aggregation port 1/13-14,2/13-14 enable**
  - 470-48T(config-if)# **exit**
  - 470-48T(config)#

### 8.2.4 ES470B Configuration

1. Go to configuration mode.
  - 470-48T>**enable**
  - 470-48T#**config terminal**
2. Enable tagging on ports 18 and 19, create VLAN 200 and 202, and add port members
  - 470-48T(config)# **vlan members remove 1 ALL**
  - 470-48T(config)# **vlan ports 18,19 tagging tagall**
  - 470-48T(config)# **vlan create 200 type port**
  - 470-48T(config)# **vlan create 202 type port**
  - 470-48T(config)# **vlan members add 200 18-19,22**
  - 470-48T(config)# **vlan members add 202 18-20**
3. Create MLT group for port 18 and 19.
  - 470-48T(config)# **mlt 1 learning disable**
  - 470-48T(config)# **mlt 1 member 18,19**
  - 470-48T(config)# **mlt 1 enable**
4. Enable VLACP on port 18 and 19
  - 470-48T(config)#**interface fastEthernet all**
  - 470-48T(config-if)#**vlacp port 18,19 enable**
  - 470-48T(config-if)#**exit**
5. Enable VLACP Globally
  - 470-48T(config)#**vlacp enable**



## 8.3 Verification

### 8.3.1 ERS8600A and ERS8600B – SMLT Verification

- ERS8610A:5# *show mlt info*

```

=====
                                Mlt Info
=====
MLTID  IFINDEX  NAME          PORT   SVLAN  MLT   MLT   PORT   VLAN
TYPE   TYPE    ADMIN  CURRENT MEMBERS
-----
1      4096    MLT-1        trunk  normal ist   ist   1/1-2/1      200 202 3999
4      4099    MLT-4        trunk  normal smlt  smlt  3/13-3/14    200 202

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

- ERS8610B:5# *show mlt info*

```

=====
                                Mlt Info
=====
MLTID  IFINDEX  NAME          PORT   SVLAN  MLT   MLT   PORT   VLAN
TYPE   TYPE    ADMIN  CURRENT MEMBERS
-----
1      4096    MLT-1        trunk  normal ist   ist   1/1-2/1      200 202 3999
4      4099    MLT-4        trunk  normal smlt  smlt  3/13-3/14    200 202

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

### 8.3.2 ERS8600A and ERS8600B – Single-Port SMLT Verification

- ERS8610A:5# *show port info smlt port 3/18*

```

=====
                                SMLT Info
=====
PORT   SMLT    ADMIN  CURRENT
NUM   ID      TYPE   TYPE
-----
3/18  6       smlt   smlt
    
```

- ERS8600B:6# *show port info smlt port 3/18*

```

=====
                                SMLT Info
=====
PORT   SMLT    ADMIN  CURRENT
NUM   ID      TYPE   TYPE
-----
3/18  6       smlt   smlt
    
```





### 8.3.3 ERS8600A and ERS8600B – VLACP Verification

- ERS8610C:5# *show port info vlacp port 3/18*

```

=====
                                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 long    3      8103   01:80:c2:00:11:00
    
```

- ERS8600D:6# *show port info vlacp port 3/18*

```

=====
                                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 long    3      8103   01:80:c2:00:11:00
    
```

### 8.3.4 ES470B - VLACP Verification

- 470-48T#*show vlacp interface 18,19*

```

=====
                                VLACP Information
=====
INDEX  ADMIN   OPER    FAST   SLOW   TIMEOUT TIMEOUT ETHER  MAC
      ENABLED ENABLED TIME    TIME  TYPE    SCALE  TYPE  ADDRESS
-----
0/18  true    true    500    30000 long    3      8103  01:80:c2:00:11:00
0/19  true    true    500    30000 long    3      8103  01:80:c2:00:11:00
    
```

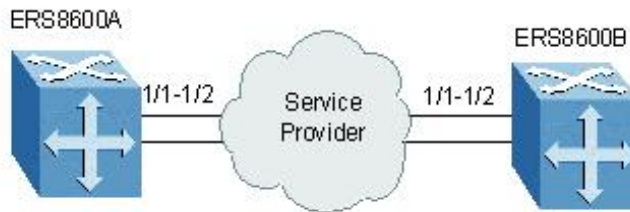


## 9. VLACP Example via LAN Extension

This example, we will configure VLACP between two ERS8600's connected together via a service providers LAN extension service. The configuration below has two links going through a service provider cloud. VLACP can be used to detect failures within the service provider that normally would not be detected by the ERS8600's using mechanisms such as RFI or Single Fiber Fault Detection (SFFD). Mechanisms such as RFI or SFFD will only work between directly connected interfaces on a pair of switches. In a LAN extension network, the switches are not directly connected; hence, a mechanism that is end-to-end such as VLACP must be deployed.

In this example, we will configure VLACP for short timeout with a fast periodic time of 400ms. Note: when using the fast-periodic-time for detecting failure on an ERS8600, the minimum supported value is 400ms. This means that with a timeout-scale of 3 then failures should be detected in 400ms x 3 = 1.2 seconds.

### 9.1 Configuration Example



1. Enable VLACP on port 1/1 and 1/2
  - Passport-8610:5# **config ethernet 1/1,1/2 vlacp fast-periodic-time 400**
  - Passport-8610:5# **config ethernet 1/1,1/2 vlacp timeout short**
  - Passport-8610:5# **config ethernet 1/1,1/2 vlacp enable**
2. Enable VLACP Globally
  - Passport-8610:6# **config vlacp enable**

### 9.2 Verification:

- Passport-8610:6# **show ports info vlacp port 1/1-1/2**

```

=====
                                VLACP Information
=====
INDEX  ADMIN   OPER    PORT   FAST   SLOW   TIMEOUT TIMEOUT ETHER   MAC
      ENABLED ENABLED STATE  TIME   TIME   TIME   SCALE  TYPE   ADDR
-----
1/1    true    true    UP     400    30000  short   3      8103  01:80:c2:00:11:00
1/1    true    true    UP     400    30000  short   3      8103  01:80:c2:00:11:00
    
```

- Passport-8610:6# **show vlacp info**

```

=====
                                Vlacp Global Information
=====
SystemId: 00:80:2d:be:20:00
Vlacp: enable
    
```



## 10. Reference Documentation

Document Title	Publication Number	Description
Configuring VLANs, Spanning Tree, and Link Aggregation	Part No. 314725-C	Passport 8000 Series Software Release 3.7
Configuring VLANs, Spanning Tree, and MultiLink Trunking	Part No. 217460-A	Nortel Ethernet Switches 460 and 470 Software Release 3.6

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