Ethernet Switch
325, 425, 460, 470
Ethernet Routing Switch
1600, 2500, 4500, 5500, 8300, 8600
Engineering

Link Aggregation Control Protocol (LACP) 802.3ad and VLACP for ES and ERS Technical Configuration Guide

Enterprise Solutions Engineering
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Abstract

The technical configuration guide (TCG) provides an overview on how to configure 802.3ad Link Aggregation for the Nortel Ethernet Routing Switch (ERS) and Ethernet Switch (ES) switches. Concepts will include 802.3ad, 802.3ad with SMLT, 802.3ad with Single Link SMLT, and VLACP.
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Document Updates

Included ERS2500 and ERS4500 series of switches.

September 2008: Added additional information pertaining to LACP key range in sections 3.1.3 and 3.1.4.

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 Nortel devices are displayed in a Lucida Console font:

ERS5520-48T# show running-config

! Embedded ASCII Configuration Generator Script
! Model = Ethernet Routing Switch 5520-24T-PWR
! Software version = v5.0.0.011
  enable
  configure terminal
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.

When there is multiple links active in a LAG and you fall back to just a single link, a LAG is no longer formed and by default you are left with just a single link. If Spanning Tree, i.e. STP or RSTP, is implement, typically you will see a re-convergence in such a situation with standards based 802.3ad implementations. With the ES470, ERS5500 and on the ERS4500 (v5.1.1 for the ERS4500), the switch will operate in a slightly different way. That is, once a port is a member of a LAG, it will always remain a LAG member even if there is just a single link active in the LAG. This has the benefit of improving resiliency when interoparating in situations where Spanning Tree is being used.

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 802.3ad Link aggregation control protocol can also be 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.

1.3 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 ES470 is 500ms.

In regards to 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 unless the ERS8600 is equipped with the SuperMezz daughter module for the 8692SF.
The SuperMezz allows for very quick sub 100ms failure detection.

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 that 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 Nortel’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 a Nortel switch.

VLACP can also be used as a loop prevention mechanism in SMLT configurations and should be used when setting up the IST. 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 Technical Configuration Guide for Switch Clustering using Split-Multilink Trunking (SMLT) with ERS8600 for more details.

Please note that VLACP does not perform link aggregation. It is 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 ES and ERS switches are the same with the exception of the FastPeriodicTimer which is set to 200ms on the ERS8600 and 500ms on all other switches. When connecting, for example, an ERS8600 to an ERS4500 or ERS5500, the recommendation is to use 500ms FastPeriodicTimers with ShortTimeout in order to achieve fast failover. Also, when using the ES470 in the 3.6.x software release, the VLACP EtherType must be configured with a different value on each MLT link – please note, this has been resolved in the 3.7 software release. The EtherType must match the EtherType value at the far end of the MLT link.

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. Although you can enable VLACP with LACP, there is no practical reason why you would do so.

When you enable VLACP globally on a switch/stack consisting of an ES470, ERS4500, or ERS5500, the VLACP configured port on the switch/stack is able to still send/receive traffic until it receives the first VLACPPDU from the far end switch; on reception of the first VLACPPDU on the link, the forwarding status of the link is thereafter managed by VLACP. The same occurs if you disable and re-enable VLACP globally again. The
reason for this is to avoid cutting traffic when the user is configuring VLACP on both sides of an active link which is already setup to forward traffic. Once VLACP is configured properly on both sides, you can expect VLACP to function as expected. In the case of the ERS8600, when you enable VLACP, the link is immediately put into non-forwarding state until a VLACPPDU is received; thus if you are configuring VLACP between stackable switches and the ERS8600, it is recommended to always configure VLACP on the edge switch first, otherwise management connectivity to those switches may be lost.

1.4 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 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 TDI's 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.
## 1.5 LACP and VLACP Support on Nortel Products

<table>
<thead>
<tr>
<th>Switch</th>
<th>LACP Support (software release)</th>
<th>VLACP Support (software release)</th>
<th>Limitations</th>
</tr>
</thead>
</table>
| ERS8600       | Yes (3.7 & 3.7.x)               | Yes (3.7 & 3.7.x)                | • 32 Link Aggregation Groups  
|               | (4.1 & 4.1.x)                   | (4.1 & 4.1.x)                    |   ○ A maximum of 8 active links are supported per LAG.  
|               |                                 |                                  |   ○ A maximum of 8 standby links are supported per LAG.  
|               |                                 |                                  |   ○ Up to 16 ports can be configured in a LAG (8 active and 8 standby ports)  
|               |                                 |                                  |   • Up to 383 VLACP’s  |
| ERS8600 – R-modules | Yes (4.1 & 4.1.x)                     | Yes (4.1 & 4.1.x)                        | • 128 Link Aggregation Groups  
|               |                                 |                                  |   ○ A maximum of 8 active links are supported per LAG.  
|               |                                 |                                  |   ○ A maximum of 8 standby links are supported per LAG.  
|               |                                 |                                  |   ○ Up to 16 ports can be configured in a LAG (8 active and 8 standby ports)  
|               |                                 |                                  |   • Up to 383 VLACP’s  |
| ERS8300       | Future                          | Future                           |                                                                             |
| ERS1600       | Future                          | Future                           |                                                                             |
| ERS4500       | Yes (5.0.0)                     | Yes (5.1.0)                      | • 6 Link Aggregation Groups  
|               |                                 |                                  |   ○ Maximum of 4 active links are support per LAG.  
| ERS2500       | Yes (4.0.0)                     | No                               | • 6 Link Aggregation Groups  
|               |                                 |                                  |   ○ Maximum of 4 active links are support per LAG.  
| ERS55x0       | Yes (4.1.0)                     | Yes (5.0.0)                      | • 32 Link Aggregation Groups  
|               |                                 |                                  |   ○ A maximum of 8 active links are support per LAG.  
|               |                                 |                                  |   • 128 Single-port SMLT LAG’s  |
| ES325/425     | Yes (3.5.0)                     | No                               | • 6 Link Aggregation Groups  
|               |                                 |                                  |   ○ Maximum of 4 active links are support per LAG.  
| ES460/470     | Yes (3.1.0)                     | Yes (3.6)                        | • 6 Link Aggregation Groups  
|               |                                 |                                  |   ○ Maximum of 4 active links are support per LAG.  

**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 normally should be disabled with on all SMLT ports.
- Link aggregation group(s) must be in the same STP group(s).
- On the ERS8600, if the NTSTG parameter is set to false (disable), STP BPDUs are transmitted only on one link. If NTSTG is set for true (enable), the ERS 8600 sends BPDUs on ALL links of an aggregation group. For interoperability with Cisco, NTSTG should be set to false.
- 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. ERS4500, ERS55xx, ES425 and ES470 in stack mode, ports in a link aggregation group can be on different units to form a distributed LAG (DLAG)
- 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.
- In regards to the ERS8600, the following applies:
  - A maximum of 32 link aggregation groups are supported in non R mode (both Classic and R modules).
  - A maximum of 128 link aggregation groups are supported in R mode (R modules only).
  - A maximum of 8 active links are supported per LAG.
  - When using VLACP with software release 4.1 and using the SuperMezz module, Nortel recommends that you stay within the following guidelines based on a combination of basic L2 and L3 with OSPF:
    - 384 ports, fast periodic timer never lower than 50ms
    - 96 ports, fast periodic timer never lower than 10ms. In this case, please expect a constant CPU usage around 20%.
2.2 SMLT Network Design Considerations

- 802.3ad should never be enabled on the IST ports.
- 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 ERS8600, the MLT NT-STG option is automatically set to false (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.
- 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 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 CLI command:
  ```
  ERS8610C:5# config mlt {1..32} lacp clear-link-aggrate
  ```

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. By default if Spanning Tree is enabled, the ERS and ES switches will send and transmit STP BPDUs only one the first link in the LAG. On the ERS8600, you can enable STP BPDUs across all ports if you like by enabling the NTSTG option to true (enabled) by using the command “config mlt <x> ntstg <enable|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.

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.
2.4 Routing Considerations

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

2.5 VLACP with the ES470

When using VLACP with the ES470 in software release 3.6.x, the VLACP EtherType must be configured with a different value for each MLT link. The EtherType must match the EtherType value at the far end of the MLT link. Please note that this issue has been resolved in software release 3.7.

Please note that if you are using software release 4.1.0 for the ERS8600, you cannot change the VLACP EtherType. You must use software release 4.1.1 or higher in order to modify the VLACP EtherType. In addition, if you are using SMLT with SLPP, you cannot configure use a VLACP EtherType value of 0x8104 as this is used by SLPP.
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.

```plaintext
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 ERS8600

#### 3.1.1 Global LACP Parameters

##### 3.1.1.1 Via CLI

LACP is configured globally by using the following command:

- **ERS8600:5# config lacp ?**

Sub-Context:
Current Context:

```
aggr-wait-time milliseconds
disable
enable
smlt-sys-id <BaseMac>
system-priority <integer>
fast-periodic-time milliseconds
slow-periodic-time milliseconds
timeout-scale <integer>
```

where:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>info</td>
<td>Displays current level parameter settings and next level directories.</td>
</tr>
<tr>
<td>enable</td>
<td>Enables LACP globally.</td>
</tr>
<tr>
<td>disable</td>
<td>Disables LACP globally.</td>
</tr>
<tr>
<td>aggr-wait-time &lt;milliseconds&gt;</td>
<td>Sets the aggregator wait-time in milliseconds. The default wait-time is 2,000 ms. The range is 200 to 2,000 ms.</td>
</tr>
<tr>
<td>smlt-sys-id &lt;BaseMac&gt;</td>
<td>Sets the LACP SMLT system ID globally.</td>
</tr>
<tr>
<td></td>
<td>• &lt;BaseMac&gt; is the MAC address in the format {0x00:0x00:0x00:0x00:0x00:0x00:0x00}.</td>
</tr>
<tr>
<td>system-priority &lt;integer&gt;</td>
<td>Sets LACP system priority globally. The default system-priority is 32,768.</td>
</tr>
<tr>
<td></td>
<td>integer is the system priority value with range of 0..65535.</td>
</tr>
<tr>
<td>fast-periodic-time milliseconds</td>
<td>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.</td>
</tr>
<tr>
<td>slow-periodic-time milliseconds</td>
<td>Sets slow periodic time globally. The default slow-periodic-time is 30,000 ms. The range is 10,000 to 30,000 ms.</td>
</tr>
<tr>
<td>timeout-scale &lt;integer&gt;</td>
<td>Sets a timeout scale globally. The default timeout-scale is 3. The range is 1 to 10.</td>
</tr>
<tr>
<td></td>
<td>integer is the timeout scale value.</td>
</tr>
</tbody>
</table>
3.1.1.2 Via JDM

Go to VLAN>MLT/LACP>LACP Global

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

3.1.2 LACP Interface Parameters

3.1.2.1 Via CLI

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

- ERS8600:5# 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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>info</td>
<td>Displays current level parameter settings and next level directories.</td>
</tr>
<tr>
<td>enable</td>
<td>Enables LACP for a specific port-type.</td>
</tr>
<tr>
<td>disable</td>
<td>Disables LACP for a specific port-type.</td>
</tr>
</tbody>
</table>
| aggr-wait-time <milliseconds> | Sets the aggregation wait time (in milliseconds) for a specific port-type.:
|                             | milliseconds 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.:
|                             | 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 3.7.x. The minimum supported fast periodic           |
|                             | time value is 400 ms                                                     |
| key <integer>               | Sets LACP aggregation key for a specific port-type. You can use a        |
|                             | default key only for individual ports                                    |
| aggregation <true|false> | Sets individual port or aggregatable for a specific port type.:
|                             | • true sets port as aggregatable.                                        |
|                             | • false sets port as individual.                                         |
| mode <active|passive> | Sets the mode as active or passive for a specific port-type.:
|                             | Active Mode – ports will initiate the aggregation process. Active         |
|                             | mode ports will aggregate with other Active mode ports or Passive         |
|                             | mode ports.                                                               |
|                             | Passive Mode – 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.:
|                             | int 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.:
|                             | int 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.:
|                             | int 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.:
|                             | hex is the LACP partner’s administrative state bitmap; (Exp,Def,Dis,Col,Syn,Agg,Time,Act). |
|                             | **Example:** Activity = true                                               |
|                             | Aggregating = true                                                        |
|                             | val = 00000101 (0x05) (0x0..0xff)                                         |
| partner-system-id <mac>     | Sets the port partner’s administration system ID.:
|                             | mac is the LACP partner’s administrative system ID; Mac address in the    |
|                             | format: 0x00:0x00:0x00:0x00:0x00:0x00:0x00.                               |
| partner-system-priority <int> | Sets the port partner’s administration system priority value.:
|                             | int is the LACP partner’s administrative system priority; an integer value |
|                             | in the range 0 and 65535.                                                |
Parameter Description

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

3.1.2.2 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.
3.1.3 LACP MLT Parameters

3.1.3.1 Via CLI

LACP is configured under MLT by using the following command:

- ERS8600:5# config mlt <mlt id> lacp

Sub-Context:
Current Context:

clear-link-aggrgate
disable
enable
key <integer>

system-priority <integer>

info

where:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>disable</td>
<td>Disables LACP for a specific multilink trunk</td>
</tr>
<tr>
<td>clear-link-aggregate</td>
<td>Clears link aggregation information for a specific multilink trunk.</td>
</tr>
<tr>
<td>key &lt;integer&gt;</td>
<td>Sets LACP aggregator key for a specific multilink trunk</td>
</tr>
<tr>
<td></td>
<td>• &lt;integer&gt; is the LACP actor admin key</td>
</tr>
<tr>
<td>System-priority &lt;integer&gt;</td>
<td>Sets LACP system priority for a specific multilink trunk</td>
</tr>
<tr>
<td></td>
<td>• &lt;integer&gt; is the system priority within the range 0 to 65,535</td>
</tr>
</tbody>
</table>
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>
<thead>
<tr>
<th>Type</th>
<th>Upper 6 Bits</th>
<th>Lower 10 Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>000000</td>
<td>1 to Max number of MLTs</td>
<td>Keys for aggregators that are capable of aggregation. These aggregators will be associated with physical aggregation hardwares.</td>
</tr>
<tr>
<td>Individual</td>
<td>000001</td>
<td>Valid Port Number</td>
<td>Keys for aggregators that are NOT capable of aggregation. These aggregators will only have individual links.(default)</td>
</tr>
<tr>
<td>SLT</td>
<td>000010</td>
<td>Valid Port Number</td>
<td>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 hardwares.</td>
</tr>
</tbody>
</table>

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.
3.1.5 ES and ERS Switch - NNCLI

3.1.6 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

3.1.7 LACP Interface Parameters

3.1.7.1 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
  
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aggregation</td>
<td>Enable or disable aggregation on this port</td>
</tr>
<tr>
<td>clear-stats</td>
<td>Clears the LACP statistics</td>
</tr>
<tr>
<td>key</td>
<td>Sets LACP aggregation key for a specific port-type.</td>
</tr>
<tr>
<td></td>
<td>• Value is in the range from 1 to 4095</td>
</tr>
<tr>
<td>mode</td>
<td>Sets the LACP mode:</td>
</tr>
<tr>
<td></td>
<td>• Active = AdminEnabled + ActorAdminState(lacpActive)</td>
</tr>
<tr>
<td></td>
<td>• Passive = AdminEnabled</td>
</tr>
<tr>
<td></td>
<td>• Off = AdminDisabled</td>
</tr>
<tr>
<td>priority</td>
<td>The priority value assigned to this aggregation port.</td>
</tr>
<tr>
<td></td>
<td>• Value is in the range 0 to 65535</td>
</tr>
<tr>
<td>timeout-time</td>
<td>Set the timer for ether long or short.</td>
</tr>
</tbody>
</table>

where:

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
3.1.7.2 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.
4. Configuring VLACP

4.1 ERS8600

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:

<table>
<thead>
<tr>
<th>Parameters and Variables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>info</td>
<td>Displays current level parameter settings and next level directories.</td>
</tr>
<tr>
<td>enable</td>
<td>Enables VLACP for a specific port-type.</td>
</tr>
<tr>
<td>disable</td>
<td>Disables VLACP for a specific port-type.</td>
</tr>
<tr>
<td>fast-periodic-time</td>
<td>Sets the fast periodic time value (in milliseconds) for a specific port-type. The default value is 200 ms</td>
</tr>
<tr>
<td>slow-periodic-time</td>
<td>Sets the slow periodic time value (in milliseconds) for a specific port-type. The default value is 30,000 ms</td>
</tr>
<tr>
<td>timeout &lt;long</td>
<td>short&gt;</td>
</tr>
<tr>
<td>timeout-scale &lt;integer&gt;</td>
<td>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 1440 ms.</td>
</tr>
</tbody>
</table>

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.
Parameters and Variables | Description
--- | ---
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: 0x00:00:00:00:00:00:00:00

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 and ERS Switch - NNCLI

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)#vlacp port <port #> ?

<table>
<thead>
<tr>
<th>Parameters and Variables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;port-type&gt;</td>
<td>Specifies the port type. In the current software release, port type must be Ethernet.</td>
</tr>
<tr>
<td>&lt;slot/port&gt; enable</td>
<td>disable</td>
</tr>
<tr>
<td>timeout &lt;long/short&gt;</td>
<td>Specifies whether the timeout control value for the port is a long or short timeout.</td>
</tr>
<tr>
<td>fast-periodic-time &lt;integer&gt;</td>
<td>Specifies the number of milliseconds between periodic VLACPDU transmissions using short timeouts.</td>
</tr>
<tr>
<td>slow-periodic-time &lt;integer&gt;</td>
<td>Specifies the number of milliseconds between periodic VLACPDU transmissions using long timeouts.</td>
</tr>
<tr>
<td>timeout-scale &lt;integer&gt;</td>
<td>Sets a timeout scale for the port, where timeout = (periodic time) x (timeout scale).</td>
</tr>
</tbody>
</table>

where:

<table>
<thead>
<tr>
<th>Parameters and Variables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>enable</td>
<td>Enable VLACP for the port(s)</td>
</tr>
<tr>
<td>ethertype</td>
<td>Set the ethertype value of VLACP</td>
</tr>
<tr>
<td>fast-periodic-time</td>
<td>Set the fast-periodic time interval</td>
</tr>
<tr>
<td>funcmac-addr</td>
<td>Set the mac-addr to exchange VLACPDU from end-to-end perspective</td>
</tr>
<tr>
<td>slow-periodic-time</td>
<td>Set the slow periodic time interval</td>
</tr>
<tr>
<td>timeout</td>
<td>Set the timeout type</td>
</tr>
<tr>
<td>timeout-scale</td>
<td>Set the timeout scale</td>
</tr>
</tbody>
</table>

Examples:

- Enable VLACP for the port(s): 470-48T(config)#vlacp enable
- Set the ethertype value of VLACP: 470-48T(config)#vlacp ethertype ethernet
- Set the fast-periodic time interval: 470-48T(config)#vlacp fast-periodic-time 2000
- Set the mac-addr to exchange VLACPDU from end-to-end perspective: 470-48T(config)#vlacp funcmac-addr 00:00:00:00:00:00
- Set the slow periodic time interval: 470-48T(config)#vlacp slow-periodic-time 30000
- Set the timeout type: 470-48T(config)#vlacp timeout short
- Set the timeout scale: 470-48T(config)#vlacp timeout-scale 3

Note:

- "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>:
  - The range is 500-20000 milliseconds. Default is 500.

- slow-periodic-time <integer>:
  - The range is 10000-30000 milliseconds. Default is 30000.

- timeout-scale <integer>:
  - The range is 1-10. Default is 3.
### Parameters and Variables

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>funcmac-addr &lt;mac&gt;</strong> 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.</td>
</tr>
<tr>
<td><strong>ethertype &lt;integer&gt;</strong> Sets the VLACP protocol identification for this port. Defines the ethtype value of the VLACP frame. The range is 1 to 65535. Default is 8103.</td>
</tr>
</tbody>
</table>

### 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:

- Enable Spanning Tree – default setting
- 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
  - 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 ERS8600B and ES470B 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 Configuration

5.1.1 ERS8600

5.1.1.1 Create MLT

Create MLT 1 using key 1. On ERS8600B, also create MLT 2 using key 2 for ES470B.

On the ERS8600, 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. Do not create an MLT for the ES470. By default, the first LACP group will be added to last MLT group (MLT group 6 on the ES470 switch).
ERS8600A# config mlt 1 create  
ERS8600A# config mlt 1 name 8600b  
ERS8600A# config mlt 1 lacp key 1  
ERS8600A# config mlt 1 lacp enable  

ERS8600B Step 1 – Create MLT 1 using LACP key 1

ERS8600B# config mlt 1 create  
ERS8600B# config mlt 1 name 8600a  
ERS8600B# config mlt 1 lacp key 1  
ERS8600B# config mlt 1 lacp enable  

ERS8600B Step 2 – Create MLT 2 using LACP key 2

ERS8600B# config mlt 2 create  
ERS8600B# config mlt 2 name 470b  
ERS8600B# config mlt 2 lacp key 2  
ERS8600B# config mlt 2 lacp enable  

5.1.1.2 Create VLANs

ERS8600A Step 1 – Enable port tagging on ports 1/1-1/4 and configure VLANs 10 and 20

ERS8600A# config ethernet 1/1-1/4 perform-tagging enable  
ERS8600A# config vlan 1 ports remove 1/1-1/4  
ERS8600A# config vlan 10 create byport 1  
ERS8600A# config vlan 10 ports add 1/1-1/4  
ERS8600A# config vlan 20 create byport 1  
ERS8600A# config vlan 20 ports add 1/1-1/4  

ERS8600B Step 1 – Enable port tagging on ports 1/1-1/4 and 1/7-1/8 and configure VLANs 10 and 20

ERS8600B# config ethernet 1/1-1/4,1/7-1/8 perform-tagging enable  
ERS8600B# config vlan 1 ports remove 1/1-1/4,1/7-1/8  
ERS8600B# config vlan 10 create byport 1  
ERS8600B# config vlan 10 ports add 1/1-1/4,1/7-1/8  
ERS8600B# config vlan 20 create byport 1  
ERS8600B# config vlan 20 ports add 1/1-1/4  

5.1.1.3 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.

ERS8600A Step 1 – Configure LACP on ports 1/1-1/4 using key 1
ERS8600A# config ethernet 1/1-1/4 lACP key 1
ERS8600A# config ethernet 1/1-1/4 lACP timeout short
ERS8600A# config ethernet 1/1-1/4 lACP aggregation true

**ERS8600B Step 1 – Configure LACP on ports 1/1-1/4 using key 1**

ERS8600B# config ethernet 1/1-1/4 lACP key 1
ERS8600B# config ethernet 1/1-1/4 lACP timeout short
ERS8600B# config ethernet 1/1-1/4 lACP aggregation true

**ERS8600B Step 2 – Configure LACP on ports 1/7-1/8 using key 2 and also disable auto-negotiate**

ERS8600B# config ethernet 1/7,1/8 perform-tagging enable
ERS8600B# config ethernet 1/7,1/8 lACP key 2
ERS8600B# config ethernet 1/7,1/8 lACP timeout short
ERS8600B# config ethernet 1/7,1/8 lACP aggregation true

5.1.1.4 Disable Auto-Negotiation

Depending on if ES470B is a POE version or not, you may have to disable auto-negotiation on the GigE uplinks. If it is a non-POE version, enter the following command on ERS8600B. The ES470-PWR version does support auto-negotiation so this step is not required.

**ERS8600B Step 1 – Disable auto-negotiation if remote ES470 does not support POE**

ERS8600B# config ethernet 1/7,1/8 auto-negotiate disable

5.1.1.5 Enable LACP Globally and at Interface Level

**ERS8600A Step 1 – Enable LACP at interface and global levels**

ERS8600A# config ethernet 1/1-1/4 lACP enable
ERS8600A# config lACP enable

**ERS8600B Step 1 – Enable LACP at interface and global levels**

ERS8600B# config ethernet 1/1-1/4,1/7,1/8 lACP enable
ERS8600B# config lACP enable

5.1.2 ES470

5.1.2.1 Go to Configuration Mode

**ES470-1 Step 1 - Enter configuration mode**

470B-48T>enable
470B-48T#configure terminal
5.1.2.2 Create VLANs

**ES470B Step 1 – Enable port tagging on ports 47 and 48 and configure VLAN 10**

```
470B-48T(config)# vlan members remove 1 all
470B-48T(config)# vlan ports 47,48 tagging tagall
470B-48T(config)# vlan create 10 type port
470B-48T(config)# vlan members add 10 35,47-48
```

5.1.2.3 Configure LACP on Aggregation Ports

**ES470B Step 1 – Configure LACP on ports 47 and 48 using key 2**

```
470B-48T(config)# interface fastEthernet 47-48
470B-48T(config-if)# lACP key 2
470B-48T(config-if)# lACP mode active
470B-48T(config-if)# lACP timeout-time short
470B-48T(config-if)# lACP aggregation enable
470B-48T(config-if)# exit
```

In software release v3.7, smart auto-negotiation mode for the ES470-PWR models enables the switch to automatically detect the far end auto-negotiation settings and setup the port appropriately when using GigE MDA's.

This is only available on the ES470-PWR models due to hardware limitation on the ES470 SFP MDA.

5.2 Verification

5.2.1 ERS8600

5.2.1.1 Verify MLT

**Step 1 – Verify that the MLT instance is operating**

```
ERS8600B# show mlt info
```

Result:
On each ERS8600, verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VLAN IDS</strong></td>
<td>Verify that the VLAN ids assigned to the IST and SMLT MLT are correct:</td>
</tr>
<tr>
<td></td>
<td>• IMLT 1: Member of VLANs 10 &amp; 20 with port members 1/1-1/4 3/1</td>
</tr>
<tr>
<td></td>
<td>• MLT 2: Member of VLAN 10 with port member 1/7 and 1/8 on ERS8600B only</td>
</tr>
<tr>
<td><strong>LACP ADMIN</strong></td>
<td>Displays as enabled for MLT ID 1 and 2. The value enabled indicates that the LACP have been enabled.</td>
</tr>
<tr>
<td><strong>LACP OPER</strong></td>
<td>Displays as up for MLT ID 1 and 2. The value up indicates that LACP is operational.</td>
</tr>
<tr>
<td><strong>IFINDEX</strong></td>
<td>This value indicated is the index number which is used to view individual state for an LACP instance. Please see next step below.</td>
</tr>
</tbody>
</table>

### 5.2.1.2 Verify LACP Operations

**Step 1** – Verify LACP operation, i.e. for MLT 2 on ERS8600B, use MLT index 4097 verified above via the ‘show mlt info’ command.

ERS8600B# *show mlt lACP info 4097*

**Result:**

<table>
<thead>
<tr>
<th>LACP Aggregator Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLTID IFINDEX</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>2 4097</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPER</th>
<th>OPERLAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 4097</td>
<td>up 122 day(s), 03:03:05</td>
</tr>
</tbody>
</table>
On ERS8600B in the switch cluster verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGGR ORINDI</td>
<td>Displays as <code>aggr</code> with port members 1/7 and 1/8. This indicates that</td>
</tr>
<tr>
<td>PORT MEMBERS</td>
<td>the LACP aggregation is operation with port members 1/7-1/8 as shown</td>
</tr>
<tr>
<td></td>
<td>for the MLT IFINDEX 4097 (MLT 2).</td>
</tr>
<tr>
<td>OPER STATE</td>
<td>Displays as <code>up</code>. The value <code>up</code> indicates that LACP is operational.</td>
</tr>
<tr>
<td>ACTOR ADMINKEY</td>
<td>Displays as 2. This value indicated the LACP key configured and used.</td>
</tr>
<tr>
<td>ACTOR OPERKEY</td>
<td>Please note that the keys need not match between two LACP peers. In</td>
</tr>
<tr>
<td></td>
<td>this example we used the same key for ease of configuration.</td>
</tr>
</tbody>
</table>

### 5.2.1.3 Verify LACP Interface Operation

**Step 1 – Verify LACP interface operation, i.e. for ports 1/7 and 1/8**

ERS8600B# `show port info lacp all port 1/7,1/8`

**Result:**

```plaintext
Actor Admin

<table>
<thead>
<tr>
<th>INDEX</th>
<th>SYS PRIO</th>
<th>SYS ID</th>
<th>KEY</th>
<th>PORT PRIO</th>
<th>PORT ID</th>
<th>STATE</th>
<th>AGGR</th>
<th>STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/7</td>
<td>32768</td>
<td>00:09:97:07:e0:00</td>
<td>2</td>
<td>0x46</td>
<td>32768 act</td>
<td>short aggr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/8</td>
<td>32768</td>
<td>00:09:97:07:e0:00</td>
<td>2</td>
<td>0x47</td>
<td>32768 act</td>
<td>short aggr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Actor Oper

<table>
<thead>
<tr>
<th>INDEX</th>
<th>KEY</th>
<th>SELECTED ATTACHED AGGR</th>
<th>AGGR ID</th>
<th>STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/7</td>
<td>2</td>
<td>4097</td>
<td>4097</td>
<td>true act</td>
</tr>
<tr>
<td>1/8</td>
<td>2</td>
<td>4097</td>
<td>4097</td>
<td>true act</td>
</tr>
</tbody>
</table>

Partner Admin

<table>
<thead>
<tr>
<th>INDEX</th>
<th>SYS PRIO</th>
<th>SYS ID</th>
<th>KEY</th>
<th>PORT PRIO</th>
<th>PORT ID</th>
<th>STATE</th>
<th>AGGR</th>
<th>STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/7</td>
<td>0</td>
<td>00:00:00:00:00:00:00</td>
<td>0</td>
<td>0x0</td>
<td>0 pas</td>
<td>long indi</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

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External Distribution
On ERS8600B in the switch cluster verify the following information:

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

5.2.2 ES470

5.2.2.1 Verify MLT and LACP Operation

**Step 1** – Verify that the MLT instance is operating

470B-48T# `show mlt`

**Result:**
Step 2 – Verify that the MLT instance is operating

470B-48T# show lacp aggr

Result:

<table>
<thead>
<tr>
<th>Aggr ID</th>
<th>Trunk Status</th>
<th>Type</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>8193</td>
<td>Enabled</td>
<td>LA</td>
<td>47-48</td>
</tr>
</tbody>
</table>

On ES470B, verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>Displays as <strong>47-48</strong> for MLT ID <strong>6</strong>. The value <strong>enabled</strong> indicates that the LACP port members</td>
</tr>
<tr>
<td>Bpdu</td>
<td>Displays as <strong>Single</strong> for MLT ID <strong>6</strong>. The value indicates Spanning Tree is operational which can also be observed using the command ‘show spanning-tree port 47-48’.</td>
</tr>
<tr>
<td>Mode</td>
<td>Displays as <strong>DynLag</strong> for MLT ID <strong>6</strong>. This indicates LACP is aggregated.</td>
</tr>
<tr>
<td>Status</td>
<td>Displays as <strong>enabled</strong> indicating that LACP is enabled on ports 47 and 48.</td>
</tr>
</tbody>
</table>

5.2.2.2 Verify LACP Interface Operation

Step 1 – Verify LACP interface operation for ports 47 and 48

470B-48T# show lacp port 47, 48

Result:

<table>
<thead>
<tr>
<th>Port</th>
<th>Priority</th>
<th>Oper</th>
<th>A/I Timeout</th>
<th>Key</th>
<th>AggrId</th>
<th>Id</th>
<th>Port</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>32768</td>
<td>Active</td>
<td>Short</td>
<td>2</td>
<td>16386</td>
<td>8193</td>
<td>70</td>
<td>Active</td>
</tr>
<tr>
<td>48</td>
<td>32768</td>
<td>Active</td>
<td>Short</td>
<td>2</td>
<td>16386</td>
<td>8193</td>
<td>71</td>
<td>Active</td>
</tr>
</tbody>
</table>

Step 2 – Verify LACP debug state for ports 47 and 48

470B-48T# show lacp debug member 47, 48

Result:

<table>
<thead>
<tr>
<th>Port</th>
<th>AggrId</th>
<th>TrunkId</th>
<th>Rx State</th>
<th>Mux State</th>
<th>Partner Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>8193</td>
<td>6</td>
<td>Current</td>
<td>Ready</td>
<td>70</td>
</tr>
<tr>
<td>48</td>
<td>8193</td>
<td>6</td>
<td>Current</td>
<td>Ready</td>
<td>71</td>
</tr>
</tbody>
</table>

On ES470b, verify the following information:
<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>LACP Status</td>
<td>Displays as <strong>Active</strong> for MLT ID 6. This indicates LACP is configured, enabled, and operation with partner.</td>
</tr>
<tr>
<td>Timeout</td>
<td>Displays as <strong>Short</strong> for MLT ID 6. This indicates that LACP Short Timer has been configured.</td>
</tr>
<tr>
<td>Admin Key</td>
<td>Displays as 2. This indicates the LACP configured on this interface.</td>
</tr>
<tr>
<td>Rx State</td>
<td>Displays as <strong>Current</strong> if LACP is Rx information is valid. Otherwise, the value displayed could be Expired, Defaulted, Initialized, LACPDisabled, or PortDisabled.</td>
</tr>
<tr>
<td>Mux State</td>
<td>Displays as <strong>Ready</strong> indicating that ports 47 and 48 are ready to transmit and receive. Otherwise, the value displayed could be Detached, Waiting, or Attached.</td>
</tr>
</tbody>
</table>

### 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:

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:

3 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:
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** = lacpActive, lacpShortTimeout, and aggregation

3) **AdminEnable**

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:
6. LACP Interoperability between a ERS8600 and Cisco 3750 via SMLT Triangle Topology

For this example, we will configure the following:

- A Link Aggregation Group (LAG) is configured between the ERS8600 triangle topology and a Cisco 3750.
  - VLANs 10 and 20 will be tagged across the LAG
  - LACP key = 4
  - MLT ID = 4
  - SMLT ID = 4
  - LACP Timeout = Long
    - **NOTE**: Cisco does not support LACP short timer
- For this application to work, we will need to configure the SMLT System Identifier so that LACP global identifier is the same on both ERS8600A and ERS8600B. Although you can use any MAC address, we will simply use the LACP identifier from ERS8600A to avoid any possible duplicate addresses.
- Assuming both ERS8600A and ERS8600B are running 4.1.4 software loads, 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 ERS8600 switches in the SMLT cluster are operating at the same speed. For example, if port 3/23 on ERS8600A is using a legacy module 8648TX and port 3/23 on ERS8600B is using an R-module 8648GTR, by default port 1/23 on ERS8600A will connect at 100Mbps and port 3/23 on ERS8600B will connect at 1000Mbps. To solve this issue, either set the speed to a fixed rate or set the auto-negotiation advertisements on the edge switch.
6.1 Configuration Steps

6.1.1 SMLT Cluster Configuration

6.1.1.1 Create IST VLAN

Create VLAN 1900 to be used by the Inter Switch Trunk (IST)

<table>
<thead>
<tr>
<th>ERS8600A: Step 1 – VLAN 1900</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600A# config vlan 1900 create byport 1 name IST</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERS8600B: Step 1 – Create 1900</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600B# config vlan 1900 create byport 1 name IST</td>
</tr>
</tbody>
</table>

6.1.1.2 Create IST

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.

<table>
<thead>
<tr>
<th>ERS8600A: Step 1 – Create MLT 1 for IST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600A# config mlt 1 create</td>
</tr>
<tr>
<td>ERS8600A# config mlt 1 name IST</td>
</tr>
<tr>
<td>ERS8600A# config mlt 1 add port 1/1,2/1</td>
</tr>
<tr>
<td>ERS8600A# config vlan 1900 add-mlt 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERS8600B: Step 1 – Create MLT 1 for IST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600B# config mlt 1 create</td>
</tr>
<tr>
<td>ERS8600B# config mlt 1 name IST</td>
</tr>
<tr>
<td>ERS8600B# config mlt 1 add port 1/1,2/1</td>
</tr>
<tr>
<td>ERS8600B# config vlan 1900 add-mlt 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERS8600A: Step 2 – Create IST</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600A# config vlan 1900 ip create 2.1.1.1/30</td>
</tr>
<tr>
<td>ERS8600A# config mlt 1 ist create ip 2.1.1.2 vlan-id 1900</td>
</tr>
<tr>
<td>ERS8600A# config mlt 1 ist enable</td>
</tr>
</tbody>
</table>
### ERS8600B: Step 2 – Create IST

ERS8600B# `config vlan 1900 ip create 2.1.1.2/30`
ERS8600B# `config mlt 1 ist create ip 2.1.1.1 vlan-id 1900`
ERS8600B# `config mlt 1 ist enable`

### ERS8600A: Step 3 – Enable VLACP

ERS8600A# `config ethernet 1/1,2/1 vlacp macaddress 01:80:c2:00:00:0f`
ERS8600A# `config ethernet 1/1,2/1 vlacp enable`
ERS8600A# `config vlacp enable`

### ERS8600B: Step 3 – Enable VLACP

ERS8600B# `config ethernet 1/1,2/1 vlacp macaddress 01:80:c2:00:00:0f`
ERS8600B# `config ethernet 1/1,2/1 vlacp enable`
ERS8600B# `config vlacp enable`

#### 6.1.1.3 Create MLT with LACP Key

Create MLT 4 using key 4.

### ERS8600A: Step 1 – Create MLT 4 using LACP key 4

ERS8600A# `config mlt 4 create`
ERS8600A# `config mlt 4 name c3750_lacp`
ERS8600A# `config mlt 4 lacp key 4`
ERS8600A# `config mlt 4 lacp enable`

### ERS8600B: Step 1 – Create MLT 4 using LACP key 4

ERS8600B# `config mlt 4 create`
ERS8600B# `config mlt 4 name c3750_lacp`
ERS8600B# `config mlt 4 lacp key 4`
ERS8600B# `config mlt 4 lacp enable`

#### 6.1.1.4 Create Access VLANs

ERS8600A Step 1 – Configure VLANs 10 and 20

ERS8600A# `config ethernet 3/23 perform-tagging enable`
ERS8600A# `config vlan 1 ports remove 3/23`
ERS8600A# `config vlan 10 create byport 1`
ERS8600A# `config vlan 10 ports add 3/23`
ERS8600A# `config vlan 20 create byport 1`
ERS8600A# `config vlan 20 ports add 3/23`
ERS8600B Step 1 – Configure VLANs 10 and 20

ERS8600B# config ethernet 3/23 perform-tagging enable
ERS8600B# config vlan 1 ports remove 3/23
ERS8600B# config vlan 10 create byport 1
ERS8600B# config vlan 10 ports add 3/23
ERS8600B# config vlan 20 create byport 1
ERS8600B# config vlan 20 ports add 3/23

6.1.1.5 Configure LACP on Aggregation Ports

ERS8600A Step 1 – Enable LACP on each port and globally and add SMLT System ID of ERS8600A

ERS8600A# config ethernet 3/23 lacp enable
ERS8600A# config ethernet 3/23 lacp key 4
ERS8600A# config ethernet 3/23 lacp aggregation true
ERS8600A# config lacp smlt-sys-id 00:01:81:28:84:00
ERS8600A# config lacp enable

ERS8600B Step 1 – Enable LACP on each port and globally and add SMLT System ID of ERS8600B

ERS8600B# config ethernet 3/23 lacp enable
ERS8600B# config ethernet 3/23 lacp key 4
ERS8600B# config ethernet 3/23 lacp aggregation true
ERS8600B# config lacp smlt-sys-id 00:01:81:28:84:00
ERS8600B# config lacp enable

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

- ERS8600-A# show lacp info

```
Lacp Global Information
SystemId: 00:01:81:28:84:00
SmltSystemId: 00:01:81:28:84:00
LACP: enabled
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
```
6.1.1.6 Create SMLT-4 to C3750

ERS8600A: Step 1 – Create SMLT-4 and add VLANs 10 and 20 to the IST MLT 1

ERS8600A# config mlt 4 smlt create smlt-id 4
ERS8600A# config vlan 10 add-mlt 1
ERS8600A# config vlan 20 add-mlt 1

ERS8600B: Step 1 – Create SMLT-4 and add VLANs 10 and 20 to the IST MLT 1

ERS8600B# config mlt 4 smlt create smlt-id 4
ERS8600B# config vlan 10 add-mlt 1
ERS8600B# config vlan 20 add-mlt 1

6.1.1.7 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.

ERS8600A: Step 1 – CP Limit

ERS8600A# config ethernet 3/23 cp-limit enable multicast-limit 2500 broadcast-limit 2500

ERS8600B: Step 1 – CP Limit

ERS8600B# config ethernet 3/23 cp-limit enable multicast-limit 2500 broadcast-limit 2500

6.1.1.8 SLPP

SLPP will be enabled globally and only on the SMLT access port 3/23 for VLAN 10 and 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. For this example, we will pick ERS8600A 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.

ERS8600A: Step 1 – Enable SLPP

ERS8600A# config slpp add 10,20
ERS8600A# config slpp operation enable
ERS8600A# config ethernet 3/23 slpp packet-rx-threshold 5
ERS8600A# config ethernet 3/23 slpp packet-rx enable
**ERS8600B: Step 1 – Enable SLPP**

ERS8600B# `config slpp add 10,20`
ERS8600B# `config slpp operation enable`
ERS8600B# `config ethernet 3/23 slpp packet-rx-threshold 50`
ERS8600B# `config ethernet 3/23 slpp packet-rx enable`

### 6.1.1.9 Ext-CP Limit

Enable Extended CP-Limit globally with trap set to normal. Also enable Extended CP-Limit with SoftDown option on port 3/23. Since the port is a 100Mbps Ethernet interface, we will set the threshold to 80%.

**ERS8600A: Step 1 – Enable EXT-CP-Limit**

ERS8600A# `config sys ext-cp-limit extcplimit enable`
ERS8600A# `config sys ext-cp-limit max-ports-to-check 5`
ERS8600A# `config sys ext-cp-limit trap-level Normal`
ERS8600A# `config ethernet 3/23 ext-cp-limit SoftDown threshold-util-rate 80`

**ERS8600B: Step 1 – Enable EXT-CP-Limit**

ERS8600B# `config sys ext-cp-limit extcplimit enable`
ERS8600B# `config sys ext-cp-limit max-ports-to-check 5`
ERS8600B# `config sys ext-cp-limit trap-level Normal`
ERS8600B# `config ethernet 3/23 ext-cp-limit SoftDown threshold-util-rate 80`

### 6.1.1.10 Discard Untagged Frames

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

**ERS8600A: Step 1 – Enable Discard Untagged Frames**

ERS8600A# `config ethernet 3/23,1/1,2/1 untagged-frames-discard enable`

**ERS8600B: Step 1 – Enable Discard Untagged Frames**

ERS8600B# `config ethernet 3/23,1/1,2/1 untagged-frames-discard enable`

### 6.1.2 Cisco C3750 Configuration

The configuration configures port-channel 4 with the port-channel load-balance set for src-dst-mac. Note, when configuring port-channel on Cisco, you must configure this item first under the interface level prior to configuring the switchport settings. Also, all the access ports are configured for Spanning Tree portfast and multicast/broadcast rate limiting set to a limit of 10%.

1. Add VLANs 10 and 20
2. Configuration

```snippet
c3550#vlan data
C3550(vlan)#vlan 10 state active
C3550(vlan)#vlan 20 state active
C3550(vlan)#exit

interface Port-channel4
  switchport trunk encapsulation dot1q
  switchport trunk allowed vlan 10,20
  switchport mode trunk

interface GigabitEthernet7/0/3
  switchport access vlan 10
  switchport mode access
  storm-control broadcast level 10.00
  storm-control multicast level 10.00
  storm-control action trap
  spanning-tree portfast

interface GigabitEthernet7/0/4
  switchport access vlan 10
  switchport mode access
  storm-control broadcast level 10.00
  storm-control multicast level 10.00
  storm-control action trap
  spanning-tree portfast

interface GigabitEthernet7/0/5
  switchport access vlan 10
  switchport mode access
  storm-control broadcast level 10.00
  storm-control multicast level 10.00
  storm-control action trap
  spanning-tree portfast

interface GigabitEthernet7/0/6

interface GigabitEthernet7/0/7
  switchport access vlan 20
  switchport mode access
  storm-control broadcast level 10.00
  storm-control multicast level 10.00
  storm-control action trap
  spanning-tree portfast

interface GigabitEthernet7/0/8
  switchport access vlan 20
  switchport mode access
  storm-control broadcast level 10.00
  storm-control multicast level 10.00
  storm-control action trap
  spanning-tree portfast

interface GigabitEthernet7/0/9

```
switchport access vlan 20
switchport mode access
storm-control broadcast level 10.00
storm-control multicast level 10.00
storm-control action trap
spanning-tree portfast
!
interface GigabitEthernet7/0/23
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 10,20
switchport mode trunk
no cdp enable
channel-group 4 mode active
!
interface GigabitEthernet7/0/24
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 10,20
switchport mode trunk
speed 100
duplex full
no cdp enable
channel-group 4 mode active
!

6.2 Verification

6.2.1 SMLT Cluster

6.2.1.1 Verify MLT Configuration

**Step 1** – Verify that the MLT instances is configured correctly and is functioning by issuing the following command:

ERS8600A# show mlt info

**Result:**

<table>
<thead>
<tr>
<th>MLTID</th>
<th>IFINDEX</th>
<th>NAME</th>
<th>SVLAN</th>
<th>MLT</th>
<th>MLT TYPE</th>
<th>PORT</th>
<th>MLT ADMIN</th>
<th>CURRENT</th>
<th>MLT TYPE</th>
<th>ADMIN CURRENT</th>
<th>MLT TYPE</th>
<th>VLAN</th>
<th>IDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4096</td>
<td>IST</td>
<td>trunk</td>
<td>normal</td>
<td>ist</td>
<td>1/1</td>
<td>2/1</td>
<td>ist</td>
<td>10</td>
<td>20</td>
<td>1900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4099</td>
<td>c3750_lacp</td>
<td>trunk</td>
<td>normal</td>
<td>smlt</td>
<td>3/23</td>
<td></td>
<td>smlt</td>
<td>10</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On each ERS8600 in the switch cluster verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORT MEMBERS</td>
<td>Verify that the VLAN ids assigned to the IST and SMLT MLT are correct:</td>
</tr>
<tr>
<td>VLAN IDS</td>
<td>• IST MLT 1: Member of VLANs 10, 20 &amp; 1900 with port members 1/1 and 2/1</td>
</tr>
<tr>
<td></td>
<td>• MLT 4: Member of VLAN 10 &amp; 20 with port member 3/23</td>
</tr>
<tr>
<td>MLT Admin</td>
<td>Displays as smlt or ist. The value normal under MLT CURRENT indicates</td>
</tr>
<tr>
<td>MLT CURRENT</td>
<td>that the IST or SMLT is not operational.</td>
</tr>
</tbody>
</table>
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.

### 6.2.1.2 Verify LACP Operations

**Step 1** – The following command is used to verify the global VLACP System ID

ERS8600A# `show lacp info`

**Result:**

```
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
```

**Step 2** – Verify LACP operation, i.e. for MLT 2; use MLT index 4097 verified above via the ‘show mlt info’ command.

ERS8600A# `show port info lacp actor-admin port 3/23`

**Result:**

```
Actor Admin
INDEX SYS   SYS               KEY   PORT  PORT  STATE
PRIO  ID                            PRIO
-----------------------------------------------------------------------
3/23  32768 00:01:81:28:84:00 4 0x56    32768 act  long aggr
```

**Step 3** – Verify LACP operation, i.e. for MLT 2; use MLT index 4097 verified above via the ‘show mlt info’ command.

ERS8600A# `show port info lacp partner-oper port 3/23`

**Result:**

```
Partner Operational
INDEX SYS   SYS               KEY   PORT  PORT  STATE
PRIO  ID                            PRIO
-----------------------------------------------------------------------
3/23  32768 00:0d:65:cc:09:00 4 0x14f   32768 act  long aggr sync col
```

On ERS8600B in the switch cluster verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>SystemId</td>
<td>In an SMLT configuration, both switches in an SMLT cluster must use</td>
</tr>
</tbody>
</table>
the same System ID. You can use the System ID from either switch. This is to ensure proper LACP operation at the edge switch in case of a SMLT cluster switch failure. This will ensure the edge always sees the same ID from the LACP packets from both switch in the cluster in case if one of the switches should fail.

| SYS ID | For this example, the value of **00:01:81:28:84:00** should be displayed when using the LACP actor-admin command via either switch in the SMLT cluster and also via the Cisco switch. The LACP partner value will be the value send by the Cisco switch and verified by using the command “*show lacp sys-id*” on the C3750. For this example, the value is **00:0d:65:cc:09:00**. |

### 6.2.2 C3750

#### 6.2.2.1 Verify LACP Operations

**Step 1** – The following command is used to view the global LACP System ID

*C3750*# `show lacp sys-id`

**Result:**

32768, **00d.65cc.0900**

**Step 2** – The following command is used to verify the interface level LACP operation

*C3750*# `show interfaces port-channel 4 etherchannel`

**Result:**

```plaintext
Port-channel4   (Primary aggregator)
Age of the Port-channel   = 00d:02h:11m:03s
Logical slot/port   = 10/4   Number of ports = 2
HotStandBy port = null
Port state   = Port-channel Ag-Inuse
Protocol   =   LACP

Ports in the Port-channel:

<table>
<thead>
<tr>
<th>Index</th>
<th>Load</th>
<th>Port</th>
<th>EC state</th>
<th>No of bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00</td>
<td>Gi7/0/23</td>
<td>Active</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>00</td>
<td>Gi7/0/24</td>
<td>Active</td>
<td>0</td>
</tr>
</tbody>
</table>

Time since last port bundled:   00d:00h:23m:40s   Gi7/0/24
Time since last port Un-bundled: 00d:00h:25m:53s   Gi7/0/24
```

**Step 3** – The following command is used to verify local LACP operation and key

*C3750*# `show lacp 4 internal`

**Result:**

```plaintext
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 4

<table>
<thead>
<tr>
<th>Port</th>
<th>Flags</th>
<th>State</th>
<th>Priority</th>
<th>Admin</th>
<th>Oper</th>
<th>Port</th>
<th>Port</th>
</tr>
</thead>
</table>
```
Step 4 – The following command is used to view the LACP partner values

C3750# `show lacp 4 neighbor`

Result:

<table>
<thead>
<tr>
<th>Port</th>
<th>Flags</th>
<th>Priority</th>
<th>Dev ID</th>
<th>Age</th>
<th>Key</th>
<th>Number</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi7/0/23</td>
<td>SA</td>
<td>bndl</td>
<td>32768</td>
<td>0x4</td>
<td>0x4</td>
<td>0x14F</td>
<td>0x3D</td>
</tr>
<tr>
<td>Gi7/0/24</td>
<td>SA</td>
<td>bndl</td>
<td>32768</td>
<td>0x4</td>
<td>0x4</td>
<td>0x150</td>
<td>0x3D</td>
</tr>
</tbody>
</table>

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
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

7.1.1.1 Create MLT

ERS8600A Step 1 – Create MLT 1 using LACP key 1; the key value must be the same as the port key.

ERS8600A# config mlt 2 create
ERS8600A# config mlt 2 name C6500
ERS8600A# config mlt 2 lacp key 4
ERS8600A# config mlt 2 lacp enable

7.1.1.2 Disable Spanning Tree

ERS8600A Step 1 – Disable Spanning Tree on ports 1/1-1/2

ERS8600A# config ethernet 1/1-1/2 stg 1 stp disable

7.1.1.3 Create VLANs

ERS8600A Step 1 – Enable port tagging on ports 1/1-1/2 and configure VLANs 10 and 20

ERS8600A# config ethernet 1/1-1/2 perform-tagging enable
ERS8600A# config vlan 1 ports remove 1/1-1/2
ERS8600A# config vlan 10 create byport 1
ERS8600A# config vlan 10 ports add 1/1-1/2
7.1.1.4 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.

ERS8600A Step 1 – Configure LACP on ports 1/1-1/2 using key 4

ERS8600A# config ethernet 1/1-1/2 lacp key 4
ERS8600A# config ethernet 1/1-1/2 lacp partner-key 4
ERS8600B# config ethernet 1/1 lacp partner-port 773
ERS8600B# config ethernet 1/2 lacp partner-port 774
ERS8600A# config ethernet 1/1-1/2 lacp partner-port-priority 32768
ERS8600A# config ethernet 1/1-1/2 lacp partner-system-id 00:0f:35:3b:89:66
ERS8600A# config ethernet 1/1-1/2 lacp aggregation true

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.

7.1.1.5 Enable LACP Globally and at Interface Level

ERS8600A Step 1 – Enable LACP at interface and global levels

ERS8600A# config ethernet 1/1-1/2 lacp enable
ERS8600A# 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 LACP and SLT with VLACP Configuration Example

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 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 use as a SMLT client, but without VLACP. For this example, we will assume the SMLT cluster is running software release 4.1.4 so the recommended SMLT parameters will be set which includes SLPP and Ext CP-Limit. As both ES470A and ES470B are SMLT access switches, we will enable STP FastStart and broadcast/multicast rate limiting on the user ports. We will also assume the ES470 switches are using software release 3.7 – please see note below.

In the 3.6.x software release for the ES470, the VLACP EtherType must be configured with a different value on each MLT link. The EtherType must match the EtherType value at the far end of the MLT link. This issue has been resolved in the 3.7 software release.

If you are required to change the VLACP EtherType on the ERS8600 SMLT cluster, i.e. the edge switch is a ES470 with software release 3.6, you must use software release 4.1.1 or higher. Also, you cannot use EtherType 0x8104 as this value is used by SLPP.

If you have both SLPP and LACP enabled on the ERS8600 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 ES470B should be configured first. This is in regards to the VLACP operation as pointed out in section 1.3 where the ES470 will start forwarding prior to receiving any VLACPPDU from the far end switch.
8.1 Configuration Steps

8.1.1 SMLT Cluster Configuration

8.1.1.1 Create IST VLAN

Create VLAN 1900 to be used by the Inter Switch Trunk (IST)

ERS8600A: Step 1 – VLAN 1900

ERS8600A# config vlan 1900 create byport 1

ERS8600B: Step 1 – Create 1900

ERS8600B# config vlan 1900 create byport 1

8.1.1.2 Create IST

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.

ERS8600A: Step 1 – Create MLT 1 for IST

ERS8600A# config mlt 1 create
ERS8600A# config mlt 1 name IST
ERS8600A# config mlt 1 add port 1/1,2/1
ERS8600A# config vlan 1900 add-mlt 1

ERS8600B: Step 1 – Create MLT 1 for IST

ERS8600B# config mlt 1 create
ERS8600B# config mlt 1 name IST
ERS8600B# config mlt 1 add port 1/1,2/1
ERS8600B# config vlan 1900 add-mlt 1

ERS8600A: Step 2 – Create IST

ERS8600A# config vlan 1900 ip create 2.1.1.1/30
ERS8600A# config mlt 1 ist create ip 2.1.1.2 vlan-id 1900
ERS8600A# config mlt 1 ist enable
ERS8600B: Step 2 – Create IST

ERS8600B# config vlan 1900 ip create 2.1.1.2/30
ERS8600B# config mlt 1 ist create ip 2.1.1.1 vlan-id 1900
ERS8600B# config mlt 1 ist enable

ERS8600A: Step 3 – Enable VLACP

ERS8600A# config ethernet 1/1,2/1 vlacp macaddress 01:80:c2:00:00:0f
ERS8600A# config ethernet 1/1,2/1 vlacp enable
ERS8600A# config vlacp enable

ERS8600B: Step 3 – Enable VLACP

ERS8600B# ethernet 1/1,2/1 vlacp macaddress 01:80:c2:00:00:0f
ERS8600B# ethernet 1/1,2/1 vlacp enable
ERS8600B# config vlacp enable

8.1.1.3 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.

ERS8600A: Step 1 – Create MLT 4 using LACP key 4 and SMLT ID 4

ERS8600A# config mlt 4 create
ERS8600A# config mlt 4 name 470a
ERS8600A# config mlt 4 lacp key 4
ERS8600A# config mlt 4 lacp enable
ERS8600A# config mlt 4 smlt create smlt-id 4

ERS8600B: Step 1 – Create MLT 4 using LACP key 4 and SMLT ID 4

ERS8600B# config mlt 4 create
ERS8600B# config mlt 4 name 470a
ERS8600B# config mlt 4 lacp key 4
ERS8600B# config mlt 4 lacp enable
ERS8600B# config mlt 4 smlt create smlt-id 4

8.1.1.4 Create Access VLANs

ERS8600A Step 1 – Configure VLANs 200 and 202

ERS8600A# config ethernet 3/13,3/14,3/18 perform-tagging enable
ERS8600A# config vlan 1 ports remove 3/13,3/14,3/18
ERS8600A# config vlan 200 create byport 1
ERS8600A# config vlan 200 ports add 3/13-3/14,3/18
ERS8600A# config vlan 202 create byport 1
ERS8600A# config vlan 202 ports add 3/13-3/14,3/18

ERS8600B Step 1 – Configure VLANs 200 and 202

ERS8600B# config ethernet 3/13,3/14,3/18 perform-tagging enable
ERS8600B# config vlan 1 ports remove 3/13,3/14,3/18
ERS8600B# config vlan 200 create byport 1
ERS8600B# config vlan 200 ports add 3/13-3/14,3/18
ERS8600B# config vlan 202 create byport 1
ERS8600B# config vlan 202 ports add 3/13,3/14,3/18

8.1.1.5 SLT-129 to ES470B

ERS8600A: Step 1 – Create SLT-129
ERS8600A# config ethernet 3/18 smlt 129 create

ERS8600B: Step 1 – Create SLT-129
ERS8600B# config ethernet 3/18 smlt 129 create

8.1.1.6 Add Access VLANs to IST MLT 1

ERS8600A: Step 1 – Add VLANs 200 and 202 to the IST MLT 1
ERS8600A# config vlan 200 add-mlt 1
ERS8600A# config vlan 202 add-mlt 1

ERS8600B: Step 1 – Add VLANs 200 and 202 to the IST MLT 1
ERS8600B# config vlan 200 add-mlt 1
ERS8600B# config vlan 202 add-mlt 1

8.1.1.7 Configure LACP on aggregation ports

ERS8600A Step 1 – Configure LACP on ports 3/13 and 3/14 using key 4
ERS8600A# config ethernet 3/13,3/14 lacp key 4
ERS8600A# config ethernet 3/13,3/14 lacp timeout short
ERS8600A# config ethernet 3/13,3/14 lacp aggregation true

ERS8600B Step 1 – Configure LACP on ports 3/13 and 3/14 using key 4
ERS8600B# config ethernet 3/13,3/14 lacp key 4
ERS8600B# config ethernet 3/13,3/14 lacp timeout short
ERS8600B# config ethernet 3/13,3/14 lacp aggregation true

8.1.1.8 Enable VLACP on Access Port 3/18 and Enable VLACP Globally

ERS8600A: Step 1 – Enable VLACP on port 3/18 and set the timeout to short with a fast-
periodic-time of 500ms

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
</tbody>
</table>

ERS8600B: Step 1 – Enable VLACP on port 3/18 and set the timeout to short with a fast-periodic-time of 500ms

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
</tbody>
</table>

8.1.1.9 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.

ERS8600A: Step 1 – CP Limit

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
</tbody>
</table>

ERS8600B: Step 1 – CP Limit

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
</tbody>
</table>

8.1.1.10 SLPP

ERS8600A: Step 1 – Enable SLPP, assuming this is the primary switch, we will set the SLPP packet receive threshold to 5

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>config slpp add</td>
<td>Configure SLPP settings</td>
</tr>
<tr>
<td>config slpp</td>
<td>Configure SLPP settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
</tbody>
</table>

ERS8600B: Step 1 – Enable SLPP, assuming this is the secondary switch, we will set the SLPP packet receive threshold to 50

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>config slpp add</td>
<td>Configure SLPP settings</td>
</tr>
<tr>
<td>config slpp</td>
<td>Configure SLPP settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
<tr>
<td>config ethernet</td>
<td>Configure Ethernet settings</td>
</tr>
</tbody>
</table>

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8.1.1.11 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. Since the port is a 100Mbps Ethernet interface, we will set the threshold to 80%.

ERS8600A: Step 1 – Enable EXT-CP-Limit

<table>
<thead>
<tr>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600A# config sys ext-cp-limit extcplimit enable</td>
</tr>
<tr>
<td>ERS8600A# config sys ext-cp-limit max-ports-to-check 5</td>
</tr>
<tr>
<td>ERS8600A# config sys ext-cp-limit trap-level Normal</td>
</tr>
<tr>
<td>ERS8600A# config ethernet 3/13,3/14,3/18 ext-cp-limit SoftDown threshold-util-rate 80</td>
</tr>
</tbody>
</table>

ERS8600B: Step 1 – Enable EXT-CP-Limit

<table>
<thead>
<tr>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600B# config sys ext-cp-limit extcplimit enable</td>
</tr>
<tr>
<td>ERS8600B# config sys ext-cp-limit max-ports-to-check 5</td>
</tr>
<tr>
<td>ERS8600B# config sys ext-cp-limit trap-level Normal</td>
</tr>
<tr>
<td>ERS8600B# config ethernet 3/13,3/14,3/18 ext-cp-limit SoftDown threshold-util-rate 80</td>
</tr>
</tbody>
</table>

8.1.2 Enable LACP Globally and at Interface Level

For this example we will use the SMLT System ID from ERS8600A. Since this is a SMLT cluster configuration, both ERS8600A and ERS8600B must be configure with the same SMLT System ID.

ERS8600A Step 1  – Enable LACP at interface and global levels

<table>
<thead>
<tr>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600A# config ethernet 3/13,3/14 lacp enable</td>
</tr>
<tr>
<td>ERS8600A# config lacp smlt-sys-id 00:01:81:28:84:00</td>
</tr>
<tr>
<td>ERS8600A# config lacp enable</td>
</tr>
</tbody>
</table>

ERS8600B Step 1  – Enable LACP at interface and global levels

<table>
<thead>
<tr>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS8600B# config ethernet 3/13,3/14 lacp enable</td>
</tr>
<tr>
<td>ERS8600B# config lacp smlt-sys-id 00:01:81:28:84:00</td>
</tr>
<tr>
<td>ERS8600B# config lacp enable</td>
</tr>
</tbody>
</table>

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

- ERS8600-A:6# 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

8.1.2.1 Discard Untagged Frames

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

ERS8600A: Step 1 – Enable Discard Untagged Frames
ERS8600A# config ethernet 1/1,2/1,3/13,3/14,3/18 untagged-frames-discard enable

ERS8600B: Step 1 – Enable Discard Untagged Frames
ERS8600B# config ethernet 1/1,2/1,3/13,3/14,3/18 untagged-frames-discard enable

8.1.3 Configuration - Edge Switch

8.1.3.1 Create VLANs

ES470A: Step 1 – Create VLANs 200 and 202

470A(config)#vlan ports 1/13,1/14,2/13,2/14 tagging tagall
470A(config)#vlan members remove 1 1/13-14,2/13-14,1/19,2/19
470A(config)#vlan create 200 type port
470A(config)# vlan members add 200 1/13-15,2/13-15
470A(config)# vlan create 202 type port
470A(config)# vlan members add 202 1/13-14,2/13-14,1/19,2/19

ES470B: Step 1 – Create VLANs 200 and 202

470B(config)#vlan ports 18,19 tagging tagall
470B(config)#vlan members remove 1 18-20,22
470B(config)#vlan create 200 type port
470B(config)#vlan members add 200 18-19,22
470B(config)#vlan create 202 type port
470B(config)#vlan members add 202 18-20

8.1.3.2 Configure LACP – ES470A Only

Although the LACP key must be same on all ports on the switch, they can be different on the remote switch.

ES470A Step 1 – Configure LACP using key 4 and disable Spanning Tree on all trunk ports

470A(config)#interface fastEthernet all
470A(config-if)# `lacp key port 1/13-14,2/13-14 4`
470A(config-if)# `lacp mode port 1/13-14,2/13-14 active`
470A(config-if)# `lacp aggregation port 1/13-14,2/13-14 enable`
470A(config-if)# `no spanning-tree port 1/13-14,2/13-14 stp 1`
470A(config-if)# `exit`

8.1.3.3 Create MLT – ES470B Only

ES470B: Step 1 – Create MLT 1 and disable STP

470B(config)# `mlt 1 enable member 18,19 learning disable`

8.1.3.4 Enable VLACP – ES470B Only

ES470B: Step 1 – Enable VLACP on port

470B(config)# `interface fastEthernet 18,19`
470B(config-if)# `vlacp timeout short`
470B(config-if)# `vlacp enable`
470B(config-if)# `exit`

ES470B: Step 2 – Enable VLACP globally

470B(config)# `vlacp macaddress 0180.c200.000f`
470B(config)# `vlacp enable`

8.1.3.5 Enable STP FastStart and Rate Limiting on all Access Ports

ES470A: Step 1 – Enable STP FastStart and set the broadcast/multicast rate limit to 10%

470A(config)# `interface fastEthernet 1/15,2/15,1/19,2/19`
470A(config-if)# `spanning-tree learning fast`
470A(config-if)# `rate-limit both 10`
470A(config-if)# `exit`

ES470B: Step 1 – Create VLANs 200 and 202

470B(config)# `interface fastEthernet 20,22`
470B(config-if)# `spanning-tree learning fast`
470B(config-if)# `rate-limit both 10`
470B(config-if)# `exit`
8.2 Verification

8.2.1 SMLT Cluster

8.2.1.1 Verify SMLT Configuration

**Step 1 – Verify that the SMLT instances is configured correctly and is functioning by issuing the following command:**

ERS8600A# `show mlt info`

**Result:**

<table>
<thead>
<tr>
<th>MLTID</th>
<th>IFINDEX</th>
<th>NAME</th>
<th>TYPE</th>
<th>MLT</th>
<th>CURRENT</th>
<th>LEN</th>
<th>MEMBERS</th>
<th>IDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4096</td>
<td>MLT-1</td>
<td>trunk</td>
<td>normal</td>
<td>ist</td>
<td>0</td>
<td>1/1-2/1</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4099</td>
<td>MLT-4</td>
<td>trunk</td>
<td>normal</td>
<td>smlt</td>
<td>0</td>
<td>3/13-3/14</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On each ERS8600 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 | Displays as `smlt` or `ist`. The value `normal` indicates that the IST or SMLT is not operational.
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.

8.2.1.2 Single-Port SMLT Verification

**Step 1 – Verify that the SLT instances is configured correctly and is functioning by issuing the following command:**

ERS8600A# `show port info smlt port 3/18`

**Result:**
On each ERS8600 in the switch cluster verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMLT ID</td>
<td>Displays as <strong>129</strong>. For this configuration example, the SLT id used is 129.</td>
</tr>
<tr>
<td>ADMIN TYPE CURRENT</td>
<td>Displays as <strong>smlt</strong>. The value <strong>normal</strong> indicates that the SLT is not operational.</td>
</tr>
</tbody>
</table>

You also use the command "show smlt info" to display all the SMLT and SLT instances. The above command was used to illustrate showing the SLT instance on a single interface.

### 8.2.1.3 VLACP Verification

**8.2.1.4 Verify VLACP Interface Operation – ERS8600 Cluster**

**Step 1 – Verify VLACP interface operation for port 3/18**

ERS8600A# `show port info vlacp port 3/18`

**Result:**

<table>
<thead>
<tr>
<th>INDEX</th>
<th>ADMIN</th>
<th>OPER</th>
<th>PORT</th>
<th>FAST</th>
<th>SLOW</th>
<th>TIMEOUT</th>
<th>TIMEOUT</th>
<th>ETHER</th>
<th>MAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>true</td>
<td>true</td>
<td>UP</td>
<td>500</td>
<td>30000</td>
<td>short</td>
<td>3</td>
<td>0x8103</td>
<td>01:80:c2:00:00:0f</td>
</tr>
</tbody>
</table>

On each ERS8600 in the SMLT cluster, verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMIN ENABLED OPER ENABLED</td>
<td>Displays as <strong>true</strong> for port <strong>3/18</strong>. This indicates VLACP is configured and enabled.</td>
</tr>
<tr>
<td>PORT STATE</td>
<td>Displays as <strong>UP</strong> for port <strong>3/18</strong>. This indicates that VLACP operational. If not, check the VLACP configuration, Admin state is enabled and remote ES470B is configured correctly and operational.</td>
</tr>
<tr>
<td>FAST TIME</td>
<td>Displays as <strong>500</strong>. This indicates the VLACP fast-periodical-time has been configured for 500 ms.</td>
</tr>
</tbody>
</table>
8.2.2 ES470

8.2.2.1 Verify MLT Configuration

Using ES470B as an example, verify the MLT instance.

Step 1 – Verify that the MLT instances is configured correctly and is functioning by issuing the following command:

```
470B# show mlt
```

<table>
<thead>
<tr>
<th>Trunk Name</th>
<th>Members</th>
<th>Bpdu</th>
<th>Mode</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trunk #1</td>
<td>18-19</td>
<td>All</td>
<td>basic</td>
</tr>
<tr>
<td>2</td>
<td>Trunk #2</td>
<td>NONE</td>
<td>All</td>
<td>basic</td>
</tr>
<tr>
<td>3</td>
<td>Trunk #3</td>
<td>NONE</td>
<td>All</td>
<td>basic</td>
</tr>
<tr>
<td>4</td>
<td>Trunk #4</td>
<td>NONE</td>
<td>All</td>
<td>basic</td>
</tr>
<tr>
<td>5</td>
<td>Trunk #5</td>
<td>NONE</td>
<td>All</td>
<td>basic</td>
</tr>
<tr>
<td>6</td>
<td>Trunk #6</td>
<td>NONE</td>
<td>All</td>
<td>basic</td>
</tr>
</tbody>
</table>

Step 2 – Verify that the MLT Spanning Tree is disabled:

```
470B# show mlt spanning-tree 1
```

<table>
<thead>
<tr>
<th>STP Group</th>
<th>STP Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

On ES470B, verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>STP Learning</td>
<td>Displays as Disabled, indicating that STP is disabled for this MLT instance.</td>
</tr>
</tbody>
</table>

8.2.2.2 Verify VLACP Operation

In reference to ES470B, check the VLACP operation by using the following command

Step 1 – Verify VLACP globally

```
470B# show vlacp
```

Result:
Vlacp Global Information

Multicast address : 01:80:c2:00:00:0f
Vlacp : enabled

Step 2 – Verify VLACP interface operation

470B# show vlacp interface fastEthernet 47-48

Result:

<table>
<thead>
<tr>
<th>PORT</th>
<th>ADMIN</th>
<th>OPER</th>
<th>HAVE</th>
<th>FAST</th>
<th>SLOW</th>
<th>TIMEOUT TYPE</th>
<th>ETH</th>
<th>MAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/18</td>
<td>true</td>
<td>true</td>
<td>yes</td>
<td>500</td>
<td>30000</td>
<td>short</td>
<td>3</td>
<td>8103 00:00:00:00:00:00:00</td>
</tr>
<tr>
<td>0/19</td>
<td>true</td>
<td>true</td>
<td>yes</td>
<td>500</td>
<td>30000</td>
<td>short</td>
<td>3</td>
<td>8103 00:00:00:00:00:00:00</td>
</tr>
</tbody>
</table>

On ES470B, verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMIN ENABLED</td>
<td>Displays as true for ports 18 &amp; 19. This indicates VLACP is configured and enabled.</td>
</tr>
<tr>
<td>OPER ENABLED</td>
<td>Displays as true for ports 18 &amp; 19. This indicates VLACP is configured and enabled.</td>
</tr>
<tr>
<td>HAVE PARTNER</td>
<td>Displays as yes for ports 18 &amp; 19. This indicates that VLACP is operational. If not, check the VLACP configuration, Admin state is enabled and remote ERS8600 cluster is configured correctly and operational.</td>
</tr>
<tr>
<td>FAST TIME</td>
<td>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.</td>
</tr>
<tr>
<td>TIMEOUT TYPE</td>
<td>Displays as short. If not, go back and configure the VLACP time as short.</td>
</tr>
</tbody>
</table>
9. VLACP Example via LAN Extension

In this example, we will configure VLACP between two ERS8600s connected together via a service provider's 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 500ms. When using the fast-periodic-time for detecting failure on an ERS8600, the minimum supported value is 500ms without using the SuperMezz module. This means that with a timeout-scale of 3 then failures should be detected in 500ms x 3 = 1.5 seconds.

9.1 Configuration Example

9.1.1 Configuration

9.1.1.1 VLACP Configuration

9.1.1.2 Enable VLACP – ES470B Only

ERS8600: Step 1 – Enable VLACP on port

ERS8600:5# config ethernet 1/1,1/2 vlacp fast-periodic-time 500
ERS8600:5# config ethernet 1/1,1/2 vlacp timeout short
ERS8600:5# config ethernet 1/1,1/2 vlacp enable

ERS8600: Step 2 – Enable VLACP globally

ERS8600:5# config vlacp enable

9.2 Verification

9.2.1 ERS8600

9.2.1.1 Verify VLACP Operation

Step 1 – Verify VLACP at port level

ERS8600:5# show ports info vlacp port 1/1-1/2

Result:
### VLACP Information

<table>
<thead>
<tr>
<th>INDEX</th>
<th>ADMIN</th>
<th>OPER</th>
<th>PORT</th>
<th>FAST</th>
<th>SLOW</th>
<th>TIMEOUT</th>
<th>TIMEOUT</th>
<th>ETHER</th>
<th>MAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ENABLED</td>
<td>ENABLED</td>
<td>STATE</td>
<td>TIME</td>
</tr>
<tr>
<td>1/1</td>
<td>true</td>
<td>true</td>
<td>UP</td>
<td>500</td>
<td>30000</td>
<td>short</td>
<td>3</td>
<td>8103</td>
<td>01:80:c2:00:11:00</td>
</tr>
<tr>
<td>1/2</td>
<td>true</td>
<td>true</td>
<td>UP</td>
<td>500</td>
<td>30000</td>
<td>short</td>
<td>3</td>
<td>8103</td>
<td>01:80:c2:00:11:00</td>
</tr>
</tbody>
</table>

**Step 2 – Verify VLACP at global level**

ERS8600:5# `show vlacp info`

**Result:**

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

On each ERS8600, verify the following information:

<table>
<thead>
<tr>
<th>Option</th>
<th>Verify</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPER ENABLED</td>
<td>Displays as <code>true</code> for ports 1/1 and 1/2. If not, ensure that VLACP is enabled and set with the correct VLACP timeout values.</td>
</tr>
<tr>
<td>PORT STATE</td>
<td>Displays as <code>up</code> for ports 1/1 and 1/2. The value <code>up</code> indicates that the VLACP have been enabled and is operating normally with the remote peer.</td>
</tr>
<tr>
<td>FAST TIME</td>
<td>Displays as <code>500</code>. This indicates the VLACP fast-periodical-time has been configured for 500 ms.</td>
</tr>
<tr>
<td>TIMEOUT TYPE</td>
<td>Displays as <code>short</code>. If not, go back and configure the VLACP time as short.</td>
</tr>
</tbody>
</table>
## 10. Reference Documentation

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Publication Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch Clustering using Split-Multilink Trunking (SMLT) Technical Configuration Guide</td>
<td>NN48500-518</td>
<td></td>
</tr>
<tr>
<td>Converged Campus Technical Solution Guide</td>
<td>NN48500-516</td>
<td></td>
</tr>
</tbody>
</table>
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