EtherChannel and Redundant Interfaces

This chapter tells how to configure EtherChannels and redundant interfaces.

Note

For multiple context mode, complete all tasks in this section in the system execution space. If you are not already in the system execution space, in the Configuration > Device List pane, double-click System under the active device IP address.

For ASA cluster interfaces, which have special requirements, see ASA Cluster.

Note

For the ASA on the Firepower 2100 and Firepower 4100/9300 chassis, EtherChannel interfaces are configured in the FXOS operating system. Redundant interfaces are not supported. See the configuration or getting started guide for your chassis for more information.

• About EtherChannels and Redundant Interfaces, on page 1
• Guidelines for EtherChannels and Redundant Interfaces, on page 4
• Default Settings for EtherChannels and Redundant Interfaces, on page 6
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• Configure an EtherChannel, on page 9
• Examples for EtherChannel and Redundant Interfaces, on page 12
• History for EtherChannels and Redundant Interfaces, on page 13

About EtherChannels and Redundant Interfaces

This section describes EtherChannels and Redundant Interfaces.

Redundant Interfaces

A logical redundant interface consists of a pair of physical interfaces: an active and a standby interface. When the active interface fails, the standby interface becomes active and starts passing traffic. You can configure a redundant interface to increase the ASA reliability. This feature is separate from device-level failover, but you can configure redundant interfaces as well as device-level failover if desired.

You can configure up to 8 redundant interface pairs.
Redundant Interface MAC Address

The redundant interface uses the MAC address of the first physical interface that you add. If you change the order of the member interfaces in the configuration, then the MAC address changes to match the MAC address of the interface that is now listed first. Alternatively, you can assign a manual MAC address to the redundant interface, which is used regardless of the member interface MAC addresses. When the active interface fails over to the standby, the same MAC address is maintained so that traffic is not disrupted.

Related Topics
- Configure the Manual MAC Address, MTU, and TCP MSS
- Configure Multiple Contexts

EtherChannels

An 802.3ad EtherChannel is a logical interface (called a port-channel interface) consisting of a bundle of individual Ethernet links (a channel group) so that you increase the bandwidth for a single network. A port channel interface is used in the same way as a physical interface when you configure interface-related features.

You can configure up to 48 EtherChannels.

Channel Group Interfaces

Each channel group can have up to 16 active interfaces. For switches that support only 8 active interfaces, you can assign up to 16 interfaces to a channel group; while only 8 interfaces can be active, the remaining interfaces can act as standby links in case of interface failure. For 16 active interfaces, be sure that your switch supports the feature (for example, the Cisco Nexus 7000 with F2-Series 10 Gigabit Ethernet Module).

All interfaces in the channel group must be the same type and speed. The first interface added to the channel group determines the correct type and speed. Note that for interfaces that you can configure to use either the RJ-45 or SFP connector, you can include both RJ-45 and SFP interfaces in the same EtherChannel.

The EtherChannel aggregates the traffic across all the available active interfaces in the channel. The interface is selected using a proprietary hash algorithm, based on source or destination MAC addresses, IP addresses, TCP and UDP port numbers and VLAN numbers.

Connecting to an EtherChannel on Another Device

The device to which you connect the ASA EtherChannel must also support 802.3ad EtherChannels; for example, you can connect to the Catalyst 6500 switch or the Cisco Nexus 7000.

When the switch is part of a Virtual Switching System (VSS) or Virtual Port Channel (vPC), then you can connect ASA interfaces within the same EtherChannel to separate switches in the VSS/vPC. The switch interfaces are members of the same EtherChannel port-channel interface, because the separate switches act like a single switch.
If you use the ASA in an Active/Standby failover deployment, then you need to create separate EtherChannels on the switches in the VSS/vPC, one for each ASA. On each ASA, a single EtherChannel connects to both switches. Even if you could group all switch interfaces into a single EtherChannel connecting to both ASA (in this case, the EtherChannel will not be established because of the separate ASA system IDs), a single EtherChannel would not be desirable because you do not want traffic sent to the standby ASA.

**Figure 2: Active/Standby Failover and VSS/vPC**

**Link Aggregation Control Protocol**

The Link Aggregation Control Protocol (LACP) aggregates interfaces by exchanging the Link Aggregation Control Protocol Data Units (LACPDUs) between two network devices.

You can configure each physical interface in an EtherChannel to be:

- **Active**—Sends and receives LACP updates. An active EtherChannel can establish connectivity with either an active or a passive EtherChannel. You should use the active mode unless you need to minimize the amount of LACP traffic.

- **Passive**—Receives LACP updates. A passive EtherChannel can only establish connectivity with an active EtherChannel.

- **On**—The EtherChannel is always on, and LACP is not used. An “on” EtherChannel can only establish a connection with another “on” EtherChannel.
LACP coordinates the automatic addition and deletion of links to the EtherChannel without user intervention. It also handles misconfigurations and checks that both ends of member interfaces are connected to the correct channel group. “On” mode cannot use standby interfaces in the channel group when an interface goes down, and the connectivity and configurations are not checked.

**Load Balancing**

The ASA distributes packets to the interfaces in the EtherChannel by hashing the source and destination IP address of the packet (this criteria is configurable). The resulting hash is divided by the number of active links in a modulo operation where the resulting remainder determines which interface owns the flow. All packets with a hash_value mod active_links result of 0 go to the first interface in the EtherChannel, packets with a result of 1 go to the second interface, packets with a result of 2 go to the third interface, and so on. For example, if you have 15 active links, then the modulo operation provides values from 0 to 14. For 6 active links, the values are 0 to 5, and so on.

For a spanned EtherChannel in clustering, load balancing occurs on a per ASA basis. For example, if you have 32 active interfaces in the spanned EtherChannel across 8 ASAs, with 4 interfaces per ASA in the EtherChannel, then load balancing only occurs across the 4 interfaces on the ASA.

If an active interface goes down and is not replaced by a standby interface, then traffic is rebalanced between the remaining links. The failure is masked from both Spanning Tree at Layer 2 and the routing table at Layer 3, so the switchover is transparent to other network devices.

**Related Topics**

- Customize the EtherChannel, on page 10

**EtherChannel MAC Address**

All interfaces that are part of the channel group share the same MAC address. This feature makes the EtherChannel transparent to network applications and users, because they only see the one logical connection; they have no knowledge of the individual links.

The port-channel interface uses the lowest numbered channel group interface MAC address as the port-channel MAC address. Alternatively you can manually configure a MAC address for the port-channel interface. In multiple context mode, you can automatically assign unique MAC addresses to shared interfaces, including an EtherChannel port interface. We recommend manually, or in multiple context mode for shared interfaces, automatically configuring a unique MAC address in case the group channel interface membership changes. If you remove the interface that was providing the port-channel MAC address, then the port-channel MAC address changes to the next lowest numbered interface, thus causing traffic disruption.

**Guidelines for EtherChannels and Redundant Interfaces**

**Bridge Group**

In routed mode, EtherChannels are not supported as bridge group members.

**Failover**

- When you use a redundant or EtherChannel interface as a Failover link, it must be pre-configured on both units in the Failover pair; you cannot configure it on the primary unit and expect it to replicate to the secondary unit because the Failover link itself is required for replication.
• If you use a redundant or EtherChannel interface for the state link, no special configuration is required; the configuration can replicate from the primary unit as normal.

• You can monitor redundant or EtherChannel interfaces for Failover. When an active member interface fails over to a standby interface, this activity does not cause the redundant or EtherChannel interface to appear to be failed when being monitored for device-level Failover. Only when all physical interfaces fail does the redundant or EtherChannel interface appear to be failed (for an EtherChannel interface, the number of member interfaces allowed to fail is configurable).

• If you use an EtherChannel interface for a Failover or state link, then to prevent out-of-order packets, only one interface in the EtherChannel is used. If that interface fails, then the next interface in the EtherChannel is used. You cannot alter the EtherChannel configuration while it is in use as a Failover link. To alter the configuration, you need to either shut down the EtherChannel while you make changes, or temporarily disable Failover; either action prevents Failover from occurring for the duration.

Model Support

• EtherChannels are supported on ASA appliances only; they are not supported on the ASAv or the ASASM.

• For the Firepower 2100 and Firepower 4100/9300 chassis, you configure EtherChannels in FXOS, not in the ASA OS.

• Redundant interfaces are not supported on the Firepower 2100, Firepower 4100/9300 chassis and ASASM.

Clustering

• To configure a spanned EtherChannel or an individual cluster interface, see the clustering chapter.

Redundant Interfaces

• You can configure up to 8 redundant interface pairs.

• All ASA configuration refers to the logical redundant interface instead of the member physical interfaces.

• You cannot use a redundant interface as part of an EtherChannel, nor can you use an EtherChannel as part of a redundant interface. You cannot use the same physical interfaces in a redundant interface and an EtherChannel interface. You can, however, configure both types on the ASA if they do not use the same physical interfaces.

• If you shut down the active interface, then the standby interface becomes active.

• Redundant interfaces do not support Management slot/port interfaces as members. You can, however, set a redundant interface comprised of non-Management interfaces as management-only.

EtherChannels

• EtherChannels are supported on ASA appliances only; they are not supported on the ASAv or the ASASM.

• You can configure up to 48 EtherChannels.

• Each channel group can have up to 16 active interfaces. For switches that support only 8 active interfaces, you can assign up to 16 interfaces to a channel group: while only eight interfaces can be active, the remaining interfaces can act as standby links in case of interface failure.
• All interfaces in the channel group must be the same type and speed. The first interface added to the channel group determines the correct type and speed. Note that for interfaces that you can configure to use either the RJ-45 or SFP connector, you can include both RJ-45 and SFP interfaces on the same network module in the same EtherChannel.

• The device to which you connect the ASA EtherChannel must also support 802.3ad EtherChannels; for example, you can connect to the Catalyst 6500 switch or Cisco Nexus 7000 switch.

• The ASA does not support LACPDUs that are VLAN-tagged. If you enable native VLAN tagging on the neighboring switch using the Cisco IOS `vlan dot1Q tag native` command, then the ASA will drop the tagged LACPDUs. Be sure to disable native VLAN tagging on the neighboring switch. In multiple context mode, these messages are not included in a packet capture, so that you cannot diagnose the issue easily.

• In Cisco IOS software versions earlier than 15.1(1)S2, the ASA did not support connecting an EtherChannel to a switch stack. With default switch settings, if the ASA EtherChannel is connected cross stack, and if the master switch is powered down, then the EtherChannel connected to the remaining switch will not come up. To improve compatibility, set the `stack-mac persistent timer` command to a large enough value to account for reload time; for example, 8 minutes or 0 for indefinite. Or, you can upgrade to more a more stable switch software version, such as 15.1(1)S2.

• All ASA configuration refers to the logical EtherChannel interface instead of the member physical interfaces.

• You cannot use a redundant interface as part of an EtherChannel, nor can you use an EtherChannel as part of a redundant interface. You cannot use the same physical interfaces in a redundant interface and an EtherChannel interface. You can, however, configure both types on the ASA if they do not use the same physical interfaces.

**Default Settings for EtherChannels and Redundant Interfaces**

This section lists default settings for interfaces if you do not have a factory default configuration.

**Default State of Interfaces**

The default state of an interface depends on the type and the context mode.

In multiple context mode, all allocated interfaces are enabled by default, no matter what the state of the interface is in the system execution space. However, for traffic to pass through the interface, the interface also has to be enabled in the system execution space. If you shut down an interface in the system execution space, then that interface is down in all contexts that share it.

In single mode or in the system execution space, interfaces have the following default states:

• Physical interfaces—Disabled.

• Redundant Interfaces—Enabled. However, for traffic to pass through the redundant interface, the member physical interfaces must also be enabled.

• EtherChannel port-channel interfaces—Enabled. However, for traffic to pass through the EtherChannel, the channel group physical interfaces must also be enabled.
**Configure a Redundant Interface**

A logical redundant interface consists of a pair of physical interfaces: an active and a standby interface. When the active interface fails, the standby interface becomes active and starts passing traffic. You can configure a redundant interface to increase the ASA reliability. This feature is separate from device-level failover, but you can configure redundant interfaces as well as failover if desired.

This section describes how to configure redundant interfaces.

**Before you begin**

- You can configure up to 8 redundant interface pairs.
- Redundant interface delay values are configurable, but by default the ASA inherits the default delay values based on the physical type of its member interfaces.
- Both member interfaces must be of the same physical type. For example, both must be GigabitEthernet.
- You cannot add a physical interface to the redundant interface if you configured a name for it. You must first remove the name in the Configuration > Device Setup > Interface Settings > Interfaces pane.
- For multiple context mode, complete this procedure in the system execution space. If you are not already in the System configuration mode, in the Configuration > Device List pane, double-click System under the active device IP address.

**Caution**

If you are using a physical interface already in your configuration, removing the name will clear any configuration that refers to the interface.

**Procedure**

**Step 1** Depending on your context mode:

- For single mode, choose the Configuration > Device Setup > Interface Settings > Interfaces pane.
- For multiple mode in the System execution space, choose the Configuration > Context Management > Interfaces pane.

**Step 2** Choose **Add > Redundant Interface**.

The Add Redundant Interface dialog box appears.

**Note** In single mode, this procedure only covers a subset of the parameters on the Edit Redundant Interface dialog box. Note that in multiple context mode, before you complete your interface configuration, you need to allocate interfaces to contexts. See Configure Multiple Contexts.

**Step 3** In the **Redundant ID** field, enter an integer between 1 and 8.
Step 4 From the **Primary Interface** drop-down list, choose the physical interface you want to be primary.

Be sure to pick an interface that does not have a subinterface and that has not already been allocated to a context. Redundant interfaces do not support Management slot/port interfaces as members.

Step 5 From the **Secondary Interface** drop-down list, choose the physical interface you want to be secondary.

Step 6 If the interface is not already enabled, check the **Enable Interface** check box.

The interface is enabled by default.

Step 7 To add a description, enter text in the **Description** field.

The description can be up to 240 characters on a single line, without carriage returns. For multiple context mode, the system description is independent of the context description. In the case of a failover or state link, the description is fixed as “LAN Failover Interface,” “STATE Failover Interface,” or “LAN/STATE Failover Interface,” for example. You cannot edit this description. The fixed description overwrites any description you enter here if you make this interface a failover or state link.

Step 8 Click **OK**.

You return to the **Interfaces** pane. The member interfaces now show a lock to the left of the interface ID showing that only basic parameters can be configured for it. The redundant interface is added to the table.

---

### Change the Active Interface

By default, the active interface is the first interface listed in the configuration, if it is available.

**Procedure**

Step 1 To view which interface is active, enter the following command in the **Tools > Command Line Interface** tool:

```
show interface redundant number detail | grep Member
```

Example:

```
show interface redundant1 detail | grep Member
Members GigabitEthernet0/3 (Active), GigabitEthernet0/2
```

Step 2 Change the active interface:

```
redundant-interface redundant number active-member physical_interface
```

The `redundant` `number` argument is the redundant interface ID, such as `redundant1`.

---

**Note:**

Changes to the Active Interface can only be made through the CLI tool, not through the Web Interface.
Configure an EtherChannel

This section describes how to create an EtherChannel port-channel interface, assign interfaces to the EtherChannel, and customize the EtherChannel.

Add Interfaces to the EtherChannel

This section describes how to create an EtherChannel port-channel interface and assign interfaces to the EtherChannel. By default, port-channel interfaces are enabled.

Before you begin

- You can configure up to 48 EtherChannels.
- Each channel group can have up to 16 active interfaces. For switches that support only 8 active interfaces, you can assign up to 16 interfaces to a channel group: while only eight interfaces can be active, the remaining interfaces can act as standby links in case of interface failure.
- To configure a spanned EtherChannel for clustering, see the clustering chapter instead of this procedure.
- All interfaces in the channel group must be the same type, speed, and duplex. Half duplex is not supported. Note that for interfaces that you can configure to use either the RJ-45 or SFP connector, you can include both RJ-45 and SFP interfaces in the same EtherChannel.
- You cannot add a physical interface to the channel group if you configured a name for it. You must first remove the name in the Configuration > Device Setup > Interface Settings > Interfaces pane.
- For multiple context mode, complete this procedure in the system execution space. If you are not already in the System configuration mode, in the Configuration > Device List pane, double-click System under the active device IP address.

Caution

If you are using a physical interface already in your configuration, removing the name will clear any configuration that refers to the interface.

Procedure

Step 1

Depending on your context mode:
- For single mode, choose the Configuration > Device Setup > Interface Settings > Interfaces pane.
- For multiple mode in the System execution space, choose the Configuration > Context Management > Interfaces pane.

Step 2

Choose Add > EtherChannel Interface.

The Add EtherChannel Interface dialog box appears.
In single mode, this procedure only covers a subset of the parameters on the Edit EtherChannel Interface dialog box. Note that in multiple context mode, before you complete your interface configuration, you need to allocate interfaces to contexts. See Configure Multiple Contexts.

**Step 3** In the Port Channel ID field, enter a number between 1 and 48.

**Step 4** In the Available Physical Interface area, click an interface and then click Add to move it to the Members in Group area.

In transparent mode, if you create a channel group with multiple Management interfaces, then you can use this EtherChannel as the management-only interface.

**Note** If you want to set the EtherChannel mode to On, then you must include only one interface initially. After you complete this procedure, edit the member interface, and set the mode to On. Apply your changes, then edit the EtherChannel to add more member interfaces.

**Step 5** Repeat for each interface you want to add to the channel group.

Make sure all interfaces are the same type and speed. The first interface you add determines the type and speed of the EtherChannel. Any non-matching interfaces you add will be put into a suspended state. ASDM does not prevent you from adding non-matching interfaces.

**Step 6** Click OK.

You return to the Interfaces pane. The member interfaces now show a lock to the left of the interface ID showing that only basic parameters can be configured for it. The EtherChannel interface is added to the table.

**Step 7** Click Apply. All member interfaces are enabled automatically.

---

**Related Topics**
- Link Aggregation Control Protocol, on page 3
- Customize the EtherChannel, on page 10

### Customize the EtherChannel

This section describes how to set the maximum number of interfaces in the EtherChannel, the minimum number of operating interfaces for the EtherChannel to be active, the load balancing algorithm, and other optional parameters.

**Procedure**

**Step 1** Depending on your context mode:

- For single mode, choose the Configuration > Device Setup > Interface Settings > Interfaces pane.
- For multiple mode in the System execution space, choose the Configuration > Context Management > Interfaces pane.

**Step 2** Click the port-channel interface you want to customize, and click Edit.
The **Edit Interface** dialog box appears.

**Step 3**
To override the media type, duplex, speed, and pause frames for flow control for all member interfaces, click **Configure Hardware Properties**. This method provides a shortcut to set these parameters because these parameters must match for all interfaces in the channel group.

**Step 4**
To customize the EtherChannel, click the **Advanced** tab.

a) In the **EtherChannel** area, from the **Minimum** drop-down list, choose the minimum number of active interfaces required for the EtherChannel to be active, between 1 and 16. The default is 1.

b) From the **Maximum** drop-down list, choose the maximum number of active interfaces allowed in the EtherChannel, between 1 and 16. The default is 16. If your switch does not support 16 active interfaces, be sure to set this command to 8 or fewer.

c) From the **Load Balance** drop-down list, select the criteria used to load balance the packets across the group channel interfaces. By default, the ASA balances the packet load on interfaces according to the source and destination IP address of the packet. If you want to change the properties on which the packet is categorized, choose a different set of criteria. For example, if your traffic is biased heavily towards the same source and destination IP addresses, then the traffic assignment to interfaces in the EtherChannel will be unbalanced. Changing to a different algorithm can result in more evenly distributed traffic. For more information about load balancing, see **Load Balancing**, on page 4.

d) For **Secure Group Tagging** settings, see the firewall configuration guide.

e) For **ASA Cluster** settings, see *(Recommended; Required in Multiple Context Mode) Configure Interfaces on the Master Unit.*

**Step 5**
Click **OK**.

You return to the **Interfaces** pane.

**Step 6**
To set the mode and priority for a physical interface in the channel group:

a) Click the physical interface in the **Interfaces** table, and click **Edit**.

The **Edit Interface** dialog box appears.

b) Click the **Advanced** tab.

c) In the **EtherChannel** area, from the **Mode** drop-down list, choose **Active**, **Passive**, or **On**. We recommend using **Active** mode (the default).

d) In the **LACP Port Priority** field, set the port priority between 1 and 65535. The default is 32768. The higher the number, the lower the priority. The ASA uses this setting to decide which interfaces are active and which are standby if you assign more interfaces than can be used. If the port priority setting is the same for all interfaces, then the priority is determined by the interface ID (slot/port). The lowest interface ID is the highest priority. For example, GigabitEthernet 0/0 is a higher priority than GigabitEthernet 0/1.

If you want to prioritize an interface to be active even though it has a higher interface ID, then set this command to have a lower value. For example, to make GigabitEthernet 1/3 active before GigabitEthernet 0/7, then make the priority value be 12345 on the 1/3 interface vs. the default 32768 on the 0/7 interface.

If the device at the other end of the EtherChannel has conflicting port priorities, the system priority is used to determine which port priorities to use. See **Step 9** to set the system priority.

**Step 7**
Click **OK**.

You return to the **Interfaces** pane.

**Step 8**
Click **Apply**.
Step 9  To set the LACP system priority, perform the following steps. If the device at the other end of the EtherChannel has conflicting port priorities, the system priority is used to determine which port priorities to use. See Step 6d for more information.

a)  Depending on your context mode:

   • For single mode, choose the Configuration > Device Setup > EtherChannel pane.

   • For multiple mode in the System execution space, choose the Configuration > Context Management > EtherChannel pane.

b)  In the LACP System Priority field, enter a priority between 1 and 65535.

   The default is 32768.

Related Topics

- Load Balancing, on page 4
- Add Interfaces to the EtherChannel, on page 9

Examples for EtherChannel and Redundant Interfaces

The following example configures three interfaces as part of an EtherChannel. It also sets the system priority to be a higher priority, and GigabitEthernet 0/2 to be a higher priority than the other interfaces in case more than eight interfaces are assigned to the EtherChannel.

```
lacp system-priority 1234
interface GigabitEthernet0/0
  channel-group 1 mode active
interface GigabitEthernet0/1
  channel-group 1 mode active
interface GigabitEthernet0/2
  lacp port-priority 1234
  channel-group 1 mode passive
interface Port-channel1
  lacp max-bundle 4
  port-channel min-bundle 2
  port-channel load-balance dst-ip
```
## History for EtherChannels and Redundant Interfaces

**Table 1: History for EtherChannels and Redundant Interfaces**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redundant interfaces</td>
<td>8.0(2)</td>
<td>A logical redundant interface pairs an active and a standby physical interface. When the active interface fails, the standby interface becomes active and starts passing traffic. You can configure a redundant interface to increase the ASA reliability. This feature is separate from device-level failover, but you can configure redundant interfaces as well as failover if desired. You can configure up to eight redundant interface pairs.</td>
</tr>
<tr>
<td>EtherChannel support</td>
<td>8.4(1)</td>
<td>You can configure up to 48 802.3ad EtherChannels of eight active interfaces each. We modified or introduced the following screens: Configuration &gt; Device Setup &gt; Interface Settings &gt; Interfaces Configuration &gt; Device Setup &gt; Interface Settings &gt; Interfaces &gt; Add/Edit EtherChannel Interface Configuration &gt; Device Setup &gt; Interface Settings &gt; Interfaces &gt; Add/Edit Interface Configuration &gt; Device Setup &gt; EtherChannel Note EtherChannel is not supported on the ASA 5505.</td>
</tr>
<tr>
<td>Feature Name</td>
<td>Releases</td>
<td>Feature Information</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>----------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Support for 16 active links in an EtherChannel</td>
<td>9.2(1)</td>
<td>You can now configure up to 16 active links in an EtherChannel. Previously, you could have 8 active links and 8 standby links. Be sure that your switch can support 16 active links (for example the Cisco Nexus 7000 with F2-Series 10 Gigabit Ethernet Module).</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note</strong> If you upgrade from an earlier ASA version, the maximum active interfaces is set to 8 for compatibility purposes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We modified the following screen: Configuration &gt; Device Setup &gt; Interface Settings &gt; Interfaces &gt; Add/Edit EtherChannel Interface &gt; Advanced.</td>
</tr>
</tbody>
</table>