

# Split Dial Shelf for the Cisco AS5800

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## Feature Overview

This feature provides for doubling the throughput of the AS5800 by splitting the dial shelf slots between two router shelves, each router connected to one Dial Shelf Controller (DSC), two of which must be installed in the system. Each router shelf is configured to control a certain set from the range of the dial shelf slots. Each router shelf will operate as though any other slots in the dial shelf contained no cards, even if there is a card in them, because they are controlled by the other router shelf.

Thus the configuration on each router shelf would affect only the “owned” slots. The new configuration command, **dial-shelf split slots**, is used to configure which set of the dial shelf slots is owned, as shown in the following example:

```
router# conf t
router(config)# dial-shelf split slots 0 1 2 6 7 8
```

This example would config the router shelf to own slots 0 through 2 and 6 through 8. In this example, the other router shelf could be configured to own the other slots: 3 4 5 9 10 11.

Each router shelf should own modem cards and trunk cards. Calls received on a trunk card belonging to one router shelf cannot be serviced by a modem card belonging to the other router shelf. Each router shelf operates like a single Cisco AS5800 system, as if some slots are unavailable.

The set of slots owned can be changed by re-entering the above configuration command, but if a slot is to be removed from the slot set, the **dial-shelf split remove** command is used to do that as shown in the following example:

```
router(config)# dial-shelf split remove 1 2 3 ...
```

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**Note** This document is in development. Portions of this document are not complete or developed according to the current standard. This document is subject to revision when the content is available and developed according to the standard in the near future. Please check the online version periodically until the document is completed according to the standard.

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## Commands for Split Dial Shelf Systems

The split mode is intended to support two router shelves connected to a single dial shelf. To use this arrangement as intended, both router shelves should have split dial shelf configured. However, a second router is not required; a single router can run in split mode with all slots owned by that router.

### Split Dial Shelf Configuration

Split dial shelf configuration is implemented by connecting two router shelves to a single dial shelf. You allocate the slots in the dial shelf between the two router shelves to achieve the desired configuration. The two router shelves are both configured to run in split mode by means of a new top level router configuration command:

**dial-shelf split slots** {*slot-numbers*}

where *slot-numbers* is a list of the dial shelf slot numbers (from 0 through 11) that the router owns, with the slot numbers separated by spaces. Slot ownership for each of the two router shelves is configured individually using the **dial-shelf split slots** command.

- While a router is in split mode, additional slots can be added to the set that the router owns by re-entering the **dial-shelf split slots** command listing the new slots. The effect of entering two (or more) **dial-shelf split slots** commands with different slot numbers is cumulative.
- Slots must be explicitly removed from a router's list of owned slots with the remove command: **dial-shelf split slots remove** {*slot-numbers*}.
- A single router can also be configured in split mode, but with no slots owned, by using the keyword **none** instead of slot numbers in the command (**dial-shelf split slots none**).

When you configure a Cisco AS5800 system to operate in split mode, it is the same as having two Cisco AS5800 systems with each having a separate set of feature boards assigned to its router; they just happen to be sharing a single dial shelf. Modem pooling, for example, is the same as if you had two separate Cisco AS5800 systems. Router shelf 1 has a modem pool that consists of all the modem cards that reside in slots owned by router shelf 1. The same situation applies to router shelf 2.

### Changing to Split Mode

This section describes the procedure required to transition a router from normal mode to split mode, and changing the set of slots a router owns while it is in split mode. Since the process of switching the ownership of a slot from one router to the other is potentially disruptive (when a feature board is restarted, all calls through that card are lost), a router shelf cannot take over a slot until ownership is relinquished by the router that currently claims ownership, either by reconfiguring the router or disconnecting that router or its associated DSC.

The dial shelf is split by dividing the ownership of the feature boards between the two router shelves. You must configure the division of the dial shelf slots between the two router shelves so that each router controls an appropriate mix of trunk and modem cards. Each router shelf controls its set of feature boards as if those were the only boards present. There is no interaction between feature boards owned by one router and feature boards owned by the other router.

Split mode is entered when the **dial-shelf split slots** command is parsed on the router shelf. This can occur when the router is starting up and parsing the stored configuration, or when the command is entered when the router is already up. On parsing the **dial-shelf split slots** command, the router frees any resources associated with cards in the slots that it no longer owns, as specified by exclusion of slot numbers from the *slot-numbers* argument. The router should be in the same state as if the card had been removed from the slot; all calls through that card will be terminated. The configured router then informs its connected DSC that it is in split mode, and which slots it claims to own.

In split mode, a router shelf uses only half of the 1,792 available TDM timeslots. If a **dial-shelf split slots** command is entered when the total calls using timeslots exceeds the number that would normally be available to the router in split mode, the command is rejected. This should occur only when a change to split mode is attempted where the dial shelf has more than 896 calls in progress (more than half of the 1,792 available timeslots). Otherwise, a transition from normal mode to split mode can be made without disturbing the cards in the slots that remain owned, and calls going through those cards will stay up.

### Transition Procedure

To transition from normal mode to split mode, complete the following steps:

- Step 1** Ensure that both DSCs and both router shelves are running the same IOS image.
- Having the same version of IOS running on both DSCs and both router shelves is not mandatory; however, it is a good idea. There is no automatic checking that the versions are the same.
- Step 2** Schedule a time when the Cisco AS5800 can be taken out of service without unnecessarily terminating calls in progress.
- The entire procedure for transitioning from normal mode to split mode should require approximately one hour if all the hardware is already installed.
- Step 3** Busy out all feature boards and wait for your customers to log off.
- Step 4** Reconfigure the existing router shelf to operate in split mode.
- Enter the **dial-shelf split slots** *{slot-numbers}* command, specifying the slot numbers that are to be owned by the existing router shelf.
- Step 5** Configure the new router shelf to operate in split mode on other feature boards.
- Enter the **dial-shelf split slots** *{slot-numbers}* command, specifying the slot numbers that are to be owned by the new router shelf. Do not specify any of the slot numbers that you specified in Step 4. The range of valid slot numbers is 0 through 11.
- Step 6** Install the second DSC, if it has not already been installed.
- Step 7** Connect the DSIC cable from the second DSC to the new router shelf.
- Step 8** Ensure that split mode is operating properly.
- Enter the **show dial-shelf** command for each router. This command has been extended so that the response indicates that the router shelf is running in split mode and which slots the router shelf owns. The status of any cards in any owned slots is shown, just as they are in the present **show dial-shelf** command.
- Step 9** Enable all feature boards to accept calls once again.

### Changing Slot Sets

You can change the sets of slots owned by the two router shelves while they are in split mode by first removing slot(s) from the set owned by one router, then adding them to the slot set of the other router. The changed slot set information is sent to the respective DSCs, and the DSCs determine which slots have been removed and which added from the new slot set information. It should be clear that moving a slot in this manner will disconnect all calls that were going through the card in that slot.

To move a slot from one router shelf's control to the others, the router releasing the slot should be modified first by entering the **dial-shelf split slots remove** command, specifying the slot numbers to be released. The released slot(s) can then be added to the slot set of the other router by re-entering the **dial-shelf split slots** command including the new slot number(s).

- **When a slot is removed**

The router shelf that is losing the slot frees any resources and clears any state associated with the card in the slot it is relinquishing. The DSC reconfigures its hub to ignore traffic from that slot, and if there is a card in the slot it will be reset. This ensures that the card frees up any TDM resource it might be using, and allows it to restart under control of the router shelf that is subsequently configured to own the slot.

- **When a slot is added**

If there are no configuration conflicts, and there is a card present in the added slot, a dial-shelf OIR insertion event is sent to the router shelf, which processes the event the same as it always does. The card in the added slot is reset by the DSC to ensure a clean state, and the card downloads its image from the router shelf that now owns it.

If the other router shelf (and the other DSC) claim ownership of the same slot, the command adding the slot should be rejected. However, should a configuration conflict exist, error messages are sent to both routers and the card is not reset until one of the other router shelves and its DSC stop claiming ownership of the slot. Normally, this will not happen until you issue a **dial-shelf split slots remove** command surrendering the ownership claim on the slot by one of the routers.

## Leaving Split Mode

Split mode is exited when the dial shelf configuration is changed by a **no dial-shelf split slots** command. When the split dial shelf line is removed, the router shelf will start using all of the TDM timeslots. Feature boards that were not owned in split mode, and are not owned by the other router, will be reset. Cards in slots that are owned by the other router will be reset, but only after the other DSC has been removed or is no longer claiming the slots. The split dial shelf configuration should not be removed while the second router shelf is still connected to the dial shelf.

When a router configured in split mode fails, all calls associated with the failed router are lost. Users cannot connect back in until the failed router recovers and is available to accept new incoming calls; however, the other split mode router shelf will continue to operate normally.

## Potential Problems

The system will behave as configured as soon as the configuration is changed. The exception is when there is a misconfiguration, such as one router is configured in split mode and the other router is configured in normal mode, or both routers are configured in split mode and both claim ownership of the same slot(s).

Problems can arise if one of the two routers connected to a dial shelf is not configured in split mode, or if both are configured in split mode and both claim ownership of the same slot(s). If the state of the second router is known when the **dial-shelf split slots** command is entered and the command would result in a conflict, the command is rejected.

If a conflict in slot ownership does arise, both routers will receive warning messages until the conflict is resolved. Any card in a slot which is claimed by both routers remains under the control of the router that claimed it first, until you can resolve the conflict by correcting the configuration of one or both routers.

It should be noted that there can also be slots that are not owned by either router (orphan slots). Cards in orphan slots cannot boot up until one of the two routers claims ownership of the slot because neither DSC will download bootstrap images to cards in unowned orphan slots.

## Show Commands

In normal mode, all **show** commands will look and behave as they do in the current system. In split mode, most **show** commands will look and behave as they would in the current system *if there were no cards in the slots for which the other router has configured ownership*. This is consistent with the view of a split dial shelf configuration being basically two separate Cisco AS5800 systems. A router shelf cannot manage, or even know the state of, any cards in slots that it does not own. For example, DSIP console and **execute-on** commands work only on owned slots.

There are, however, a few exceptions:

- The **show dial-shelf clocks** command still shows all configured clock sources, even those from non-owned trunk cards. This is because there can be only one DSC providing the master clock, and it may need to have backup clock sources configured from all trunk cards present (regardless of which DSC owns them).
- To avoid confusion, the **show dial-shelf** command is extended so that when the router is in split mode, **show dial-shelf** indicates that the router shelf is running in split mode and which slots the router shelf owns. The status of any cards in any owned slots is shown, just as it is in the present command. Thus, when in normal mode, **show dial-shelf** is unchanged from the current version.

When in split mode, the **show dial-shelf** output is extended as in the following example:

```
pinetopRS# sh dial-shelf
System is in split dial shelf mode.
Slots owned: 0 2 3 4 5 6 (connected to DSC in slot 13)
Slot   Board      CPU      DRAM      I/O Memory  State  Elapsed
      Type      Util    Total (free)  Total (free)
0      CE1         0%/0%   21341728( 87%) 8388608( 45%) Up     01:11:37
2      CE1         0%/0%   21341728( 87%) 8388608( 45%) Up     01:11:37
4 Modem(HMM) 20%/20% 6661664( 47%) 6291456( 33%) Up     01:11:37
5 Modem(DMM) 0%/0%   6661664( 31%) 6291456( 32%) Up     01:11:37
6 Modem(DMM) 0%/0%   6661664( 31%) 6291456( 32%) Up     01:11:37
13     DSC        0%/0%   20451808( 91%) 8388608( 66%) Up     01:16:31
Dial shelf set for auto boot
```

Note only the first two lines of output are new, the remaining information is exactly the same as in the existing system if there were no cards in the slots that are not owned (1 and 7 through 12).

- A new command, **show dial-shelf split**, has been added to provide some minimal information about the types of cards in non-owned slots. For example:

```
pinetopRS# sh dial-shelf split
System is in split dial shelf mode, connected to DSC in slot 13.
Slots owned: 0 2 3 4 5 6
Non owned slots:
Slot   Board Type
1      CE1
7      Modem(DMM)
8      Modem(DMM)
9      Modem(DMM)
10     Slot Empty
11     Slot Empty
12     DSC
```

Note that the **show dial-shelf split** command also shows the slots and corresponding feature boards for orphan slots (those slots not owned by either router shelf). This means that OIR events on all slots in the dial shelf are detected by both DSCs and the feature boards are added to or deleted from the list of boards physically present in the dial shelf. When a feature board is inserted into an orphan slot, a message is sent to both router shelves indicating that a feature board was just inserted. This message is different than an OIR event message—OIR event processing is done only for owned slots.

- The **show context** command works only for owned slots. However, **show context all** displays all the information available about any slot. This is intended to cover the case where ownership of a feature board is moved from one router shelf to the other after a crash.

## Managing a Split Dial Shelf

If you are installing split dial shelf systems, a system controller is available that provides a single system view of multiple POPs. The system controller for the Cisco AS5800 Universal Access Server includes the Cisco 3640 router running Cisco IOS software. The system controller can be installed at a remote facility so that you can access multiple systems through a console port or Web interface.

There are no new Management Information Bases (MIBs) or MIB variables required for the split dial shelf configuration. A split dial shelf appears to Simple Network Management Protocol (SNMP) management applications as two separate Cisco AS5800 systems. One console to manage the whole system is not supported—you must have a console session per router shelf (two console sessions) to configure each split of the Cisco AS5800. The system controller must manage a split dial shelf configuration as two separate Cisco AS5800 systems.

The normal mode configuration of the Cisco AS5800 requires the dial shelf and router shelf IDs to be different. In a split system, four unique shelf IDs are desirable; one for each router shelf and one for each of the slot sets; however, a split system will function satisfactorily if the router shelf IDs are the same. If a system controller is used to manage a split dial shelf configuration, then the two routers must have distinct shelf IDs, just as they must when each router has its own dial shelf.

You can download software configurations to any Cisco AS5800 using SNMP or a Telnet connection. The system controller also provides performance monitoring and accounting data collection and logging.

In addition to the system controller, a network management system with a graphical user interface (GUI) runs on a UNIX SPARC station and includes a database management system, polling engine, trap management, and map integration.

## Configuring the Routers

To configure a router for split dial shelf operation, complete the following steps:

Step	Command	Description
1	Router> <b>enable</b> Password: <password> Router#	Enter the <b>enable</b> command. Enter your password. You are in privileged EXEC mode when the prompt changes to Router#.
2	Router# <b>configure terminal</b> Enter configuration commands, one per line. End with Ctrl-Z. Router(config)#	Enter global configuration mode by typing the <b>configure</b> command. The example is using the terminal configuration option. You are in global configuration mode when the prompt changes to Router(config)#
3	Router(config)# <b>dial-shelf split slots</b> {slot_numbers}	<b>Normal mode:</b> This command changes the router shelf to split mode with ownership of the slots listed.  In case of conflicting slot assignments, the command is rejected and a warning message is issued. Issue a <b>show dial-shelf split slots</b> command to the other router shelf to display its list of owned dial shelf slots.  OIR events on all slots are detected by both DSCs and added to the list of feature boards physically present in the dial shelf; however, OIR event processing is done only for assigned slots.  <b>Split mode:</b> This command adds the dial shelf slot(s) listed to the router shelf's list of owned dial shelf slots.

The following additional commands have been added to support split dial shelf systems:

Level	Command	Description
Global	Router (config) # <b>show dial-shelf split</b>	<p><b>Normal Mode:</b> This command is invalid.</p> <p><b>Split Mode:</b> This command displays the slots assigned to each of the router shelves and the corresponding feature boards in 'orphan' slots (slots not currently assigned to either router).</p>
	Router (config) # <b>dial-shelf split slots none</b>	<p><b>Normal mode:</b> This command puts the router shelf in split mode; however, it does not assign ownership of any dial shelf slots.</p> <ul style="list-style-type: none"> <li>To prevent accidentally entering the <b>dial-shelf split slots</b> command, at least one valid dial shelf slot number (0–11) or the keyword <b>none</b> must be specified.</li> <li>If the <b>dial-shelf split slots</b> command is entered in normal mode without valid slot numbers or the keyword <b>none</b>, the command is rejected.</li> </ul> <p><b>Split mode:</b> This command will change dial shelf slot ownership. The router will no longer have ownership of any dial shelf slots.</p>
	Router (config) # <b>no dial-shelf split slots</b>	<p><b>Normal mode:</b> This command has no effect. If the router shelf is in normal mode, it stays that way.</p> <p><b>Split mode:</b> This command changes the router shelf to normal mode if it is in split mode and the other router shelf has already relinquished control of all dial shelf slots or is switched off.</p>
	<b>Router (config) # dial-shelf split slots {slot_numbers}</b>	<p><b>Normal mode:</b> This command changes the router shelf to split mode with ownership of the slots listed. Valid slot numbers are 0 through 11.</p> <ul style="list-style-type: none"> <li>In case of conflicting slot assignments, the command is rejected and a warning message is issued.</li> <li>OIR events on all slots are detected by both DSCs and added to the list of feature boards physically present in the dial shelf; however, OIR event processing is done only for assigned slots.</li> </ul> <p><b>Split mode:</b> This command adds the dial shelf slot(s) listed to the router shelf's list of owned dial shelf slots. The effect of multiple commands is cumulative.</p>
	<b>Router (config) # dial-shelf split slots remove {slot_numbers}</b>	<p><b>Normal mode:</b> This command has no effect.</p> <p><b>Split mode:</b> This command removes the dial shelf slot(s) listed from the router shelf's list of owned dial shelf slots. The effect of multiple commands is cumulative.</p>

## Error Messages

New error messages for various split dial shelf conditions include:

**Error Message** Duplicate priority clock source configured on other router shelf.

**Explanation** The configuration commands for the master clock specify the clock sources and a priority for each source. Together these commands define a prioritized list of the clock sources used to generate the master clock. This list, configured on the router shelf, is passed to and stored by the DSC providing the active clock. In the event of failure of the highest priority clock source, the DSC switches to the source with the next highest priority.

With a split dial shelf, clock sources can be configured on either of the router shelves from the slots that each shelf owns. On the dial shelf, all valid clock source configurations are known to the DSC providing the clock, including the clock source configurations on the other router/DSC.

This error condition results when a clock input on one router is configured to have the same priority as one configured on the other router. The original configuration command is not rejected; however, these error messages are issued to both routers when a duplicate priority condition is detected. The two clock inputs specified with identical priorities both go into the ordered list of clock sources, but the one received first by the DSC providing the active clock is assigned a higher priority.

**Recommended Action** Reconfigure the clock sources on the two routers so that they have different priorities.

**Error Message** Other router shelf is in split mode when this one is not.

**Explanation** The split mode is intended to support two router shelves connected to a single dial shelf. To use this arrangement, both connected router shelves should have split dial shelf configured. Problems can arise if there are two routers connected to the dial shelf, but one router is not configured in split mode.

**Recommended Action** Issue a **dial-shelf split slots** command to this router or a **no-dial-shelf split slots** command to the other router; however, there's no point in having a second router shelf unless both routers are in split mode.

**Error Message** Other router shelf is not in split mode when this one is.

**Explanation** The split mode is intended to support two router shelves connected to a single dial shelf. To use this arrangement, both connected router shelves should have split dial shelf configured. Problems can arise if there are two routers connected to the dial shelf, but one router is not configured in split mode.

**Recommended Action** Issue a **dial-shelf split slots** command to the other router or a **no-dial-shelf split slots** command to this router; however, there's no point in having a second router shelf unless both routers are in split mode.

**Error Message** Other router shelf has overlapping slot ownership specified in its split dial shelf configuration.

**Explanation** Each router shelf connects to one of the DSCs in the dial shelf. The dial shelf feature boards are divided between the two router shelves. Each router controls its own set of feature boards as if those were the only boards present—there is no interaction between feature boards owned by one router and feature boards owned by the other router, or with the other router.

This error message was issued because both routers are configured in split mode, but there is an overlap in the set of slots each router claims. While the conflict in slot ownership continues, both router shelves will periodically receive this error message.

**Recommended Action** Correct the configuration of one of the routers by issuing a **dial-shelf split slots** command with a list of slot numbers that does not include the slot that is reporting overlapping ownership. You must configure the division of the dial shelf slots between the two router shelves so that each router controls an appropriate mix of trunk and modem cards. Any card in a slot that is claimed by both routers will remain under the control of the router that claimed it first until you resolve the conflict by correcting the configuration.