

Contents

[Introduction](#)

[Prerequisites](#)

[Requirements](#)

[Components Used](#)

[Conventions](#)

[Identifying Bus Error Crashes](#)

[Troubleshooting Bus Error Crashes](#)

[Troubleshooting Bus Error Crashes on 68000 Processor Platforms](#)

[Troubleshooting Bus Error Crashes on RISC Processor Platforms](#)

[Special Types of Bus Error Crashes](#)

[Troubleshooting Techniques for Bus Error Exception Boot Loops](#)

[Cisco IOS Software Loaded Does Not Support Installed Hardware](#)

[Software Failure](#)

[Mis-seated Hardware](#)

[Hardware Failure](#)

[Information to Collect if You Open a Service Request](#)

[Related Information](#)

Introduction

This document explains how to identify bus error crashes and how to troubleshoot those crashes depending on the type of processor you have in your Cisco router.

Prerequisites

Requirements

Cisco recommends that you read [Troubleshooting Router Crashes](#) before proceeding with this document.

Components Used

The information in this document is based on these software and hardware versions:

- All Cisco IOS® software versions
- All Cisco routers

Note: This document does not apply to Cisco Catalyst switches or MGX platforms.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to the [Cisco Technical Tips Conventions](#) for more information on document conventions.

Identifying Bus Error Crashes

The system encounters a bus error when the processor tries to access a memory location that either does not exist (a software error) or does not respond properly (a hardware problem). A bus error can be identified from the output of the show version command provided by the router if not power-cycled or manually reloaded.

If you have the output of a **show version** or **show technical-support** command (from enable mode) from your Cisco device, you can use it to display potential issues and fixes. In order to use it, you must be a [registered](#) customer, be logged in, and have JavaScript enabled.

At the console prompt, this error message can also be seen during a bus error:

After this, the router reloads. In some cases, however, the router goes into a loop of crashes and reloads and manual intervention is required to break out of this loop.

Another related issue is a Versatile Interface Processor (VIP) crash. If this problem occurs, error messages similar to these are logged:

Finally, another bus error crash type is a line card crash on a Cisco 12000 Series Internet Router. If this problem occurs, error messages similar to these are logged in the **show context** output:

```
Router#show context
...
CRASH INFO: Slot 1, Index 1, Crash at 11:27:15 utc Wed May 16 2001
VERSION:

GS Software (GLC1-LC-M), Version 12.0(16.5)S, EARLY DEPLOYMENT MAINTENANCE

INTERIM SOFTWARE

TAC Support: http://www.cisco.com/cgi-bin/ibld/view.pl?i=support

Compiled Thu 29-Mar-01 17:12 by ninahung

Card Type: 3 Port Gigabit Ethernet, S/N

System exception: SIG=10, code=0x2008, context=0x40D8DF44

System restarted by a Bus Error exception

STACK TRACE:

-Traceback= 40165800 4038D0FC 4025C7BC 4026287C 4029581C 402EECF8 400C0144

CONTEXT:

$0 : 00000000, AT : 00000000, v0 : 00000044, v1 : 0FE00020
a0 : 00000000, a1 : 0FE00000, a2 : 00000000, a3 : 39EC6AAB
t0 : 00000030, t1 : 34008D01, t2 : 34008100, t3 : FFFF00FF
t4 : 400C01E8, t5 : 00000001, t6 : 00000001, t7 : 00000001
```

```
s0 : 40DCDD20, s1 : 0FE00000, s2 : 00000000, s3 : 000005DC
s4 : 00000000, s5 : 0FE00020, s6 : 00000004, s7 : 414CF120
t8 : 41680768, t9 : 00000000, k0 : 00000000, k1 : FFFF8DFD
gp : 40CB9780, sp : 4105BFE8, s8 : 41652BA0, ra : 4038D0FC
EPC : 0x40165800, SREG : 0x34008D03, Cause : 0x00002008
```

```
ErrorEPC : 0xBFC22B94
```

```
-Process Traceback= No Extra Traceback
```

See [Troubleshooting Line Card Crashes on the Cisco 12000 Series Internet Router](#) for more details.

If you have the output of a **show context** command from your Cisco device, you can use [Cisco CLI Analyzer](#) to display potential issues and fixes. To use [Cisco CLI Analyzer](#), you must be a [registered](#) customer, be logged in, and have JavaScript enabled.

Troubleshooting Bus Error Crashes

The first thing to do is to find out which memory location (also known as the "address" or "address operand") the router tried to access when the bus error occurred. With this information, you have an indication as to whether the fault lies with the Cisco IOS Software or the router hardware. In the example, "System restarted by bus error at PC 0x30EE546, address 0xBB4C4", the memory location that the router tried to access is 0xBB4C4. Do not confuse this with the program counter (PC) value above.

The second thing to do is determine the type of processor in the router. Memory address locations for routers differ depending on the type of processor. There are two main types of processors in Cisco routers:

- **68000 Processors** This is part of a **show version** output that indicates that the router has a 68000 processor:
`cisco 2500 (68030) processor (revision D) with 8192K/2048K bytes of memory.`
Router platforms that have 68000 processors include:
Cisco 1000 Series Routers
Cisco 1600 Series Routers
Cisco 2500 Series Routers
Cisco 4000 Series Routers
Route Processor (RP) Modules on Cisco 7000 (RP) Series Routers
- **Reduced Instruction Set Computing (RISC) Processors** This is part of a **show version** output that indicates that the router has a RISC processor:
`cisco 3640 (R4700) processor (revision 0x00) with 49152K/16384K bytes of memory.`
The R in (R4700) indicates a RISC processor.
Router platforms that have RISC processors include:
Cisco 3600 Series Routers
Cisco 4500 Series Routers
Cisco 4700 Series Routers
Route Switch Processor (RSP) Modules on Cisco 7500 Series and Cisco 7000 (RSP7000) Series Routers
Network Processor Engine (NPE) Modules on Cisco 7200 Series Routers
Multilayer Switch Feature Card (MSFC) on the Cisco 7600 Series Routers or Catalyst 6000 Switch
Performance Routing Engine (PRE) Modules on Cisco 10000 Series Internet Routers
Gigabit Route Processor (GRP) Modules on Cisco 12000 Series Internet Routers

Once you have determined the address and the processor type, you can start with more detailed troubleshooting.

Troubleshooting Bus Error Crashes on 68000 Processor Platforms

With the address accessed by the router when the bus error occurred, use the **show region** command to determine the memory location the address corresponds to. If the address reported by the bus error does not fall within the ranges displayed in the **show region** output, this means that the router tried to access an address that is not valid. This indicates that it is a Cisco IOS Software problem. Use the [Cisco CLI Analyzer](#) (registered customers only) to decode the output of the **show stacks** command and identify the Cisco IOS Software bug that causes the bus error.

On the other hand, if the address falls within one of the ranges in the **show region** output, it means that the router accessed a valid memory address, but the hardware corresponding to that address does not respond properly. This indicates a hardware problem.

Here is an example of the **show region** output:

```
Router#show region
```

```
Region Manager:
```

Start	End	Size(b)	Class	Media	Name
0x00000000	0x007FFFFFFF	8388608	Local	R/W	main
0x00001000	0x0001922F	98864	IData	R/W	main:data
0x00019230	0x000666B3	316548	IBss	R/W	main:bss
0x000666B4	0x007FEFFF	7965004	Local	R/W	main:heap
0x007FF000	0x007FFFFFFF	4096	Local	R/W	main:flhlog
0x00800000	0x009FFFFFFF	2097152	Iomem	R/W	iomem
0x03000000	0x037FFFFFFF	8388608	Flash	R/O	flash
0x0304033C	0x037A7D3F	7764484	IText	R/O	flash:text

Note: In some earlier Cisco IOS Software versions, this command is not available. The **show region** output is part of the **show tech-support** output from Cisco IOS Software Release 12.0(9).

Addresses are displayed in hexadecimal format. The addresses that fall within the "Start" and "End" ranges are valid memory addresses.

Main corresponds to main memory or dynamic RAM (DRAM).

iomem corresponds to input/output (I/O) memory, which means different parts for different platforms. For example, DRAM for the Cisco 2500, shared RAM (SRAM) for the Cisco 4000.

Still using the previous example, System restarted by bus error at PC 0x30EE546, address 0xBB4C4, this bus error crash comes from a Cisco 2500 router with the **show region** output. The address 0xBB4C4 is equivalent to 0x000BB4C4. Using the **show region** output, this address falls within the range of "main", or more specifically, "main:heap" or 0x000666B4-0x007FEFFF. As mentioned earlier, "main" corresponds to the main memory or the DRAM, so the DRAM chips need to be checked.

If this is a new router, or if the router has been moved from one location to another, the memory chips often become loose. It's a good idea to reseal or firmly push the memory chips into the slot. Most of the time, this is sufficient for solving this type of crash.

For bus error crashes with addresses that do not fall within the **show region** address ranges, use the [Cisco CLI Analyzer](#) to decode the output of the **show stacks** command and identify the Cisco IOS Software bug that is causing the bus error. If you are uncertain which bug ID may match or which Cisco IOS software version contains the fix for the problem, upgrading your Cisco IOS software to the latest version in your release train is one option that often resolves the issue since this usually contains the fix for a large number of bugs.

If you have the output of a **show stacks** or **show technical-support** (from enable mode) command from your Cisco device, you can use [Cisco CLI Analyzer](#) to display potential issues and fixes. To use [Cisco CLI Analyzer](#), you must be a [registered](#) customer, be logged in, and have JavaScript enabled.

Troubleshooting Bus Error Crashes on RISC Processor Platforms

It is recommended that you read the section on [Troubleshooting Bus Error Crashes on 68000 Processor Platforms](#) before you proceed with this section.

On RISC processors, Cisco IOS Software uses virtual addresses through the use of the Translation Lookaside Buffer (TLB) that translates virtual addresses into physical addresses. The address reported by bus errors on RISC processors is therefore the virtual address as opposed to the physical address used by the 68000 processors.

The output of the **show region** command must be used to check the address reported by the bus error. To illustrate this, let's take the following example:

```
Router#show region
```

```
Region Manager:
```

Start	End	Size(b)	Class	Media	Name
0x00000000	0x007FFFFFFF	8388608	Local	R/W	main
0x00001000	0x0001922F	98864	IData	R/W	main:data
0x00019230	0x000666B3	316548	IBss	R/W	main:bss
0x000666B4	0x007FEFFF	7965004	Local	R/W	main:heap
0x007FF000	0x007FFFFFFF	4096	Local	R/W	main:flhlog
0x00800000	0x009FFFFFFF	2097152	Iomem	R/W	iomem
0x03000000	0x037FFFFFFF	8388608	Flash	R/O	flash
0x0304033C	0x037A7D3F	7764484	IText	R/O	flash:text

Using the **show region** command output below, you can verify that 0xC is not a valid virtual address, and you can conclude that the bus error was caused by a software problem. Use the [Cisco CLI Analyzer](#) ([registered](#) customers only) to decode the output of the **show stacks** or **show technical-support** (from enable mode) command and identify the Cisco IOS Software bug that is causing the bus error.

Another advantage of using the **show region** command is that the memory mapping depends on the amount of memory installed on the router. For example, if you have 64 MB of DRAM (64 x 1024 x 1024 = 67108864 bytes = 0x4000000 bytes), the DRAM range is 0x60000000 - 0x63FFFFFF for 64 MB. This is confirmed with the **show region** command:

```
Router#show version | i of memory
```

```
cisco RSP2 (R4700) processor with 65536K/2072K bytes of memory.
```

```
Router#show region
```

```
Region Manager:
```

Start	End	Size(b)	Class	Media	Name
0x40000000	0x40001FFF	8192	Iomem	REG	qa
0x40002000	0x401FFFFFFF	2088960	Iomem	R/W	memd
0x48000000	0x48001FFF	8192	Iomem	REG	QA:writethru
0x50002000	0x501FFFFFFF	2088960	Iomem	R/W	memd:(memd_bitswap)
0x58002000	0x581FFFFFFF	2088960	Iomem	R/W	memd:(memd_uncached)
0x60000000	0x63FFFFFFF	67108864	Local	R/W	main
0x60010908	0x60C80B11	13042186	IText	R/O	main:text
0x60C82000	0x60F5AF1F	2985760	IData	R/W	main:data
0x60F5AF20	0x610E35FF	1607392	IBss	R/W	main:BSS
0x610E3600	0x611035FF	131072	Local	R/W	main:fastheap
0x61103600	0x63FFFFFFF	49269248	Local	R/W	main:heap
0x80000000	0x83FFFFFFF	67108864	Local	R/W	main:(main_k0)
0x88000000	0x88001FFF	8192	Iomem	REG	QA_k0
0x88002000	0x881FFFFFFF	2088960	Iomem	R/W	memd:(memd_k0)
0xA0000000	0xA3FFFFFFF	67108864	Local	R/W	main:(main_k1)
0xA8000000	0xA8001FFF	8192	Iomem	REG	QA_k1
0xA8002000	0xA81FFFFFFF	2088960	Iomem	R/W	memd:(memd_k1)

If you have a bus error at 0x65FFFFFF, the **show region** output takes the amount of memory into account and tells you that it's an illegal address (software bug).

In summary:

- Use the **show region** command to verify whether the address indicated by the bus error is within the address ranges used by the router.
- If the address falls within a virtual address range, replace the hardware corresponding to this range.
- If the address does not fall within a virtual address range, use the [Cisco CLI Analyzer](#) ([registered](#) customers only) to decode the output of the **show stacks** or the **show technical-support** (from enable mode) command and identify the Cisco IOS software bug that is causing the bus error.
- Give serious consideration to installing the most recent maintenance release of the Cisco IOS

Software train that you are currently running.

Special Types of Bus Error Crashes

A special type of bus error crash is when the crash is caused by a corrupted program counter (PC). The PC value is the location of the instruction which the processor was executing when the bus error occurred. When a bus error caused by a corrupted PC occurs, the following message appears on the console:

```
Router#show version | i of memory
```

```
cisco RSP2 (R4700) processor with 65536K/2072K bytes of memory.
```

```
Router#show region
```

```
Region Manager:
```

Start	End	Size(b)	Class	Media	Name
0x40000000	0x40001FFF	8192	Iomem	REG	qa
0x40002000	0x401FFFFFFF	2088960	Iomem	R/W	memd
0x48000000	0x48001FFF	8192	Iomem	REG	QA:writethru
0x50002000	0x501FFFFFFF	2088960	Iomem	R/W	memd:(memd_bitswap)
0x58002000	0x581FFFFFFF	2088960	Iomem	R/W	memd:(memd_uncached)
0x60000000	0x63FFFFFFF	67108864	Local	R/W	main
0x60010908	0x60C80B11	13042186	IText	R/O	main:text
0x60C82000	0x60F5AF1F	2985760	IData	R/W	main:data
0x60F5AF20	0x610E35FF	1607392	IBss	R/W	main:BSS
0x610E3600	0x611035FF	131072	Local	R/W	main:fastheap
0x61103600	0x63FFFFFFF	49269248	Local	R/W	main:heap
0x80000000	0x83FFFFFFF	67108864	Local	R/W	main:(main_k0)
0x88000000	0x88001FFF	8192	Iomem	REG	QA_k0
0x88002000	0x881FFFFFFF	2088960	Iomem	R/W	memd:(memd_k0)
0xA0000000	0xA3FFFFFFF	67108864	Local	R/W	main:(main_k1)
0xA8000000	0xA8001FFF	8192	Iomem	REG	QA_k1
0xA8002000	0xA81FFFFFFF	2088960	Iomem	R/W	memd:(memd_k1)

In this case, the PC has jumped to the address 0x0 (probably because of a null pointer), but this is not where the instruction is located. This is a software problem so there is no need to check with the **show region** command.

On other RISC platforms (Cisco 3600, 4500, and so forth), you get a SegV exception when jumping to an illegal PC, not a bus error.

Another type of bus error crash that occurs from time to time is when the PC value is equal to the address value. For instance:

```
Router#show version | i of memory
```

```
cisco RSP2 (R4700) processor with 65536K/2072K bytes of memory.
```

```
Router#show region
```

```
Region Manager:
```

Start	End	Size(b)	Class	Media	Name
0x40000000	0x40001FFF	8192	Iomem	REG	qa
0x40002000	0x401FFFFFFF	2088960	Iomem	R/W	memd
0x48000000	0x48001FFF	8192	Iomem	REG	QA:writethru
0x50002000	0x501FFFFFFF	2088960	Iomem	R/W	memd:(memd_bitswap)
0x58002000	0x581FFFFFFF	2088960	Iomem	R/W	memd:(memd_uncached)
0x60000000	0x63FFFFFFF	67108864	Local	R/W	main
0x60010908	0x60C80B11	13042186	IText	R/O	main:text
0x60C82000	0x60F5AF1F	2985760	IData	R/W	main:data
0x60F5AF20	0x610E35FF	1607392	IBss	R/W	main:BSS
0x610E3600	0x611035FF	131072	Local	R/W	main:fastheap
0x61103600	0x63FFFFFFF	49269248	Local	R/W	main:heap
0x80000000	0x83FFFFFFF	67108864	Local	R/W	main:(main_k0)
0x88000000	0x88001FFF	8192	Iomem	REG	QA_k0
0x88002000	0x881FFFFFFF	2088960	Iomem	R/W	memd:(memd_k0)
0xA0000000	0xA3FFFFFFF	67108864	Local	R/W	main:(main_k1)
0xA8000000	0xA8001FFF	8192	Iomem	REG	QA_k1
0xA8002000	0xA81FFFFFFF	2088960	Iomem	R/W	memd:(memd_k1)

From the crashinfo file:

```
Router#show version | i of memory
```

```
cisco RSP2 (R4700) processor with 65536K/2072K bytes of memory.
```

```
Router#show region
```

```
Region Manager:
```

Start	End	Size(b)	Class	Media	Name
0x40000000	0x40001FFF	8192	Iomem	REG	qa

0x40002000	0x401FFFFFF	2088960	Iomem	R/W	memd
0x48000000	0x48001FFF	8192	Iomem	REG	QA:writethru
0x50002000	0x501FFFFFF	2088960	Iomem	R/W	memd:(memd_bitswap)
0x58002000	0x581FFFFFF	2088960	Iomem	R/W	memd:(memd_uncached)
0x60000000	0x63FFFFFF	67108864	Local	R/W	main
0x60010908	0x60C80B11	13042186	IText	R/O	main:text
0x60C82000	0x60F5AF1F	2985760	IData	R/W	main:data
0x60F5AF20	0x610E35FF	1607392	IBss	R/W	main:BSS
0x610E3600	0x611035FF	131072	Local	R/W	main:fastheap
0x61103600	0x63FFFFFF	49269248	Local	R/W	main:heap
0x80000000	0x83FFFFFF	67108864	Local	R/W	main:(main_k0)
0x88000000	0x88001FFF	8192	Iomem	REG	QA_k0
0x88002000	0x881FFFFFF	2088960	Iomem	R/W	memd:(memd_k0)
0xA0000000	0xA3FFFFFF	67108864	Local	R/W	main:(main_k1)
0xA8000000	0xA8001FFF	8192	Iomem	REG	QA_k1
0xA8002000	0xA81FFFFFF	2088960	Iomem	R/W	memd:(memd_k1)

Notice the k1 register value is 0x14 (hexadecimal) which is equal to 20 in decimal. This points to a Cache Parity Exception. In this particular case, the parity error is not handled properly and is being masked by a bus error. The router has crashed due to a software bus error in the function handling a Cache Parity Exception.

You should consider this crash as a regular processor memory parity error crash and follow the recommendations given in [Processor Memory Parity Errors \(PMPEs\)](#).

You should also consider upgrading the Cisco IOS software release to a version which has a fix for [CSCdv68388](#) - "Change cache error exception handler to resume not crash" which has been fixed since Cisco IOS Software Release 12.2(10).

Troubleshooting Techniques for Bus Error Exception Boot Loops

This section focuses on general troubleshooting techniques for bus error exception boot loops:

- Cisco IOS software loaded does not support installed hardware
- Software Failure
- Mis-seated Hardware
- Hardware Failure

Cisco IOS Software Loaded Does Not Support Installed Hardware

Verify that all network cards are supported by the Cisco IOS software. The [Software Advisor \(registered customers only\)](#) gives you the minimum versions of Cisco IOS software needed for hardware. Verify, also, that the bootflash image supports the hardware installed if you have a router that supports a boot image such as the Cisco 7200 or Cisco 7500 series router.

Software Failure

On 2600 and 3600 routers, the router's I/O memory is configurable as a percentage of the main memory. If the I/O memory settings are inappropriate for the installed network modules or WAN interface cards (WICs), the 2600/3600 platform may have trouble booting and may crash with bus errors.

If a software configuration change has recently been made, and the router is in a booting loop, a software bug may be causing this issue.

If the router is not able to boot up, you can bypass the configuration to identify whether that is causing the issue. Follow these steps:

1. Break into ROMMON by sending the break sequence to the router during the first 60 seconds of boot up.
2. From ROM Monitor, use the **confreg** command to change the configuration register to a setting, such as 0x2142, to ignore the router's configuration:
`Router#show version | i of memory`

```
cisco RSP2 (R4700) processor with 65536K/2072K bytes of memory.
```

```
Router#show region
```

```
Region Manager:
```

Start	End	Size(b)	Class	Media	Name
0x40000000	0x40001FFF	8192	Iomem	REG	qa
0x40002000	0x401FFFFFF	2088960	Iomem	R/W	memd
0x48000000	0x48001FFF	8192	Iomem	REG	QA:writethru
0x50002000	0x501FFFFFF	2088960	Iomem	R/W	memd:(memd_bitswap)
0x58002000	0x581FFFFFF	2088960	Iomem	R/W	memd:(memd_uncached)
0x60000000	0x63FFFFFF	67108864	Local	R/W	main
0x60010908	0x60C80B11	13042186	IText	R/O	main:text
0x60C82000	0x60F5AF1F	2985760	IData	R/W	main:data
0x60F5AF20	0x610E35FF	1607392	IBss	R/W	main:BSS
0x610E3600	0x611035FF	131072	Local	R/W	main:fastheap
0x61103600	0x63FFFFFF	49269248	Local	R/W	main:heap
0x80000000	0x83FFFFFF	67108864	Local	R/W	main:(main_k0)

0x88000000	0x88001FFF	8192	Iomem	REG	QA_k0
0x88002000	0x881FFFFFF	2088960	Iomem	R/W	memd:(memd_k0)
0xA0000000	0xA3FFFFFF	67108864	Local	R/W	main:(main_k1)
0xA8000000	0xA8001FFF	8192	Iomem	REG	QA_k1
0xA8002000	0xA81FFFFFF	2088960	Iomem	R/W	memd:(memd_k1)

If the router boots without any errors, there is a configuration issue causing the problem. Verify that your configuration is supported in the Cisco IOS software and by the hardware. If it is supported, use the [Bug Toolkit](#) (registered customers only) to identify any software bugs that you may be experiencing. Give serious consideration to installing the most recent maintenance release of the Cisco IOS software train that you are currently running.

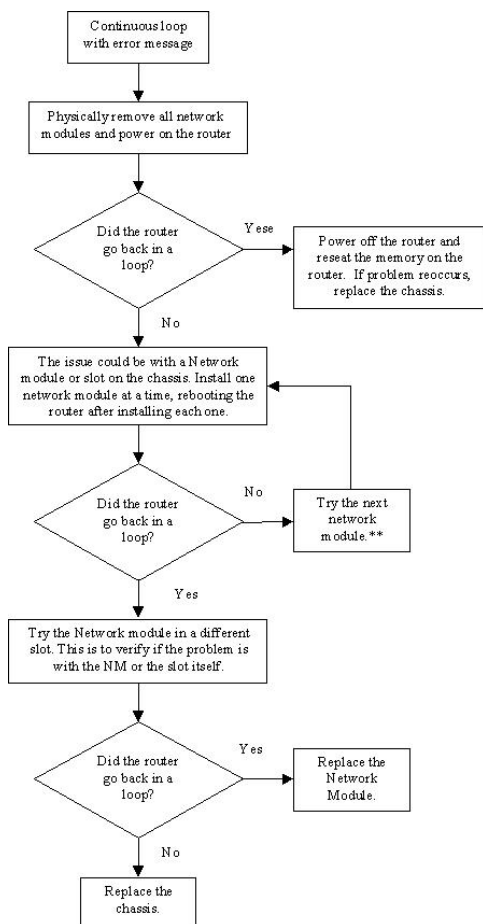
Mis-seated Hardware

If you are experiencing a bus error exception booting loop, it may be caused by mis-seated hardware. For lower-end platforms such as the 3600 or 4000 router, reseal the network modules/network processors.

For higher-end platforms such as the 7200 or 7500 routers, reseal the processor, VIP, port adapters, or line card that is reloading due to a bus error exception.

Hardware Failure

The information contained in the bus error does not help to isolate the hardware. Therefore, it is important to remove and reinsert cards to find the problem hardware. Here are some recommended steps to isolate the problem:



**If the router does not experience the continuous loop after following the troubleshooting steps above, then the problem may have been caused by a mis-seated network module. It is recommended that you monitor the router for 24 hours to be sure that the router continues to function without experiencing the issue again.

Information to Collect if You Open a Service Request

If you still need assistance after following the troubleshooting steps above and want to open a case with Cisco Technical Support, be sure to include the following information for troubleshooting a bus error or bus error exception:

- Troubleshooting performed before opening the case
- **show technical-support** output (if possible, in enable mode)
- **show log** output or console captures, if available
- [crashinfo file](#) (if present and not already included in the **show technical-support** output)
- **show region** output (if not already included in the **show technical-support** output)

Attach the collected data to your case in non-zipped, plain text format (.txt). You can attach information to your case by uploading it using the [Case Query Tool](#) (registered customers only) . If you cannot access the Case Query Tool, you can attach the relevant information to your case by sending it to attach@cisco.com with your case number in the subject line of your message.

Note: Do not manually reload or power-cycle the router before collecting the above information unless required to troubleshoot a bus error exception as this can cause important information to be lost that is needed for determining the root cause of the problem.

Related Information

- [Troubleshooting Router Crashes](#)
- [Troubleshooting Versatile Interface Processor Crashes](#)
- [Troubleshooting Line Card Crashes on the Cisco 12000 Series Internet Router](#)
- [Cisco CLI Analyzer](#) (registered customers only)
- [Technical Support - Cisco Systems](#)