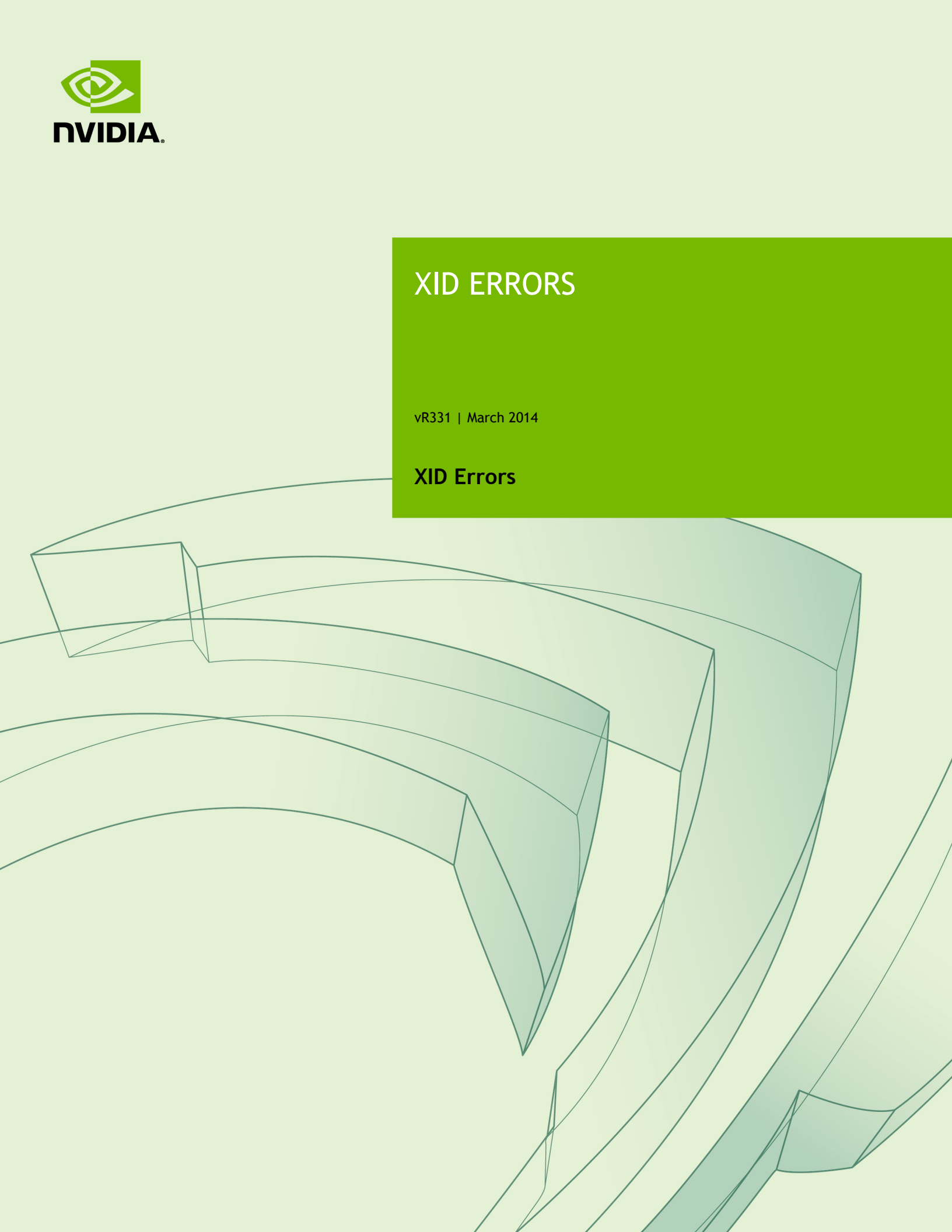

XID ERRORS

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XID Errors

Introduction 1
1.1. What Is an Xid Message 1
1.2. How to Use Xid Messages 1
Working with Xid Errors 2
2.1. Viewing Xid Error Messages 2
2.2. Tools That Provide Additional Information About Xid Errors 2
2.3. Analyzing Xid Errors 3
Xid Error Listing 4
Common XID Errors 8
4.1. XID 13: GR: SW Notify Error 8
4.2. XID 31: Fifo: MMU Error 8
4.3. XID 32: PBDMA Error 9
4.4. XID 45: OS: Preemptive Channel Removal 9
4.5. XID 48: DBE (Double Bit Error) ECC Error 9

INTRODUCTION

This document explains what Xid messages are, and is intended to assist system administrators, developers, and FAEs in understanding the meaning behind these messages as an aid in analyzing and resolving GPU-related problems.

1.1. What Is an Xid Message

The Xid message is an error report from the NVIDIA driver that is printed to the operating system's kernel log or event log. Xid messages indicate that a general GPU error occurred, most often due to the driver programming the GPU incorrectly or to corruption of the commands sent to the GPU. The messages can be indicative of a hardware problem, an NVIDIA software problem, or a user application problem.

These messages provide diagnostic information that can be used by both users and NVIDIA to aid in debugging reported problems.

The meaning of each message is consistent across driver versions.

1.2. How to Use Xid Messages

Xid messages are intended to be used as debugging guides. Because many problems can have multiple possible root causes it’s not always feasible to understand each issue from the Xid value alone.

For example, an Xid error might indicate that a user program tried to access invalid memory. But, in theory, memory corruption due to PCIE or frame buffer problems could corrupt any command and thus cause almost any error. Generally, the Xid classifications listed below should be used as a starting point for further investigation of each problem.

WORKING WITH XID ERRORS

2.1. Viewing Xid Error Messages

Under Linux, the Xid error messages are placed in the location /var/log/messages.

Grep for “NVRM: Xid”to find all the Xid messages.

The following is an example of a Xid string:

```
[…] NVRM: GPU at 0000:03:00: GPU-b850f46d-d5ea-c752-ddf3-c4453e44d3f7
```

```
[…] NVRM: Xid (0000:03:00): 14, Channel 00000001
```

The first Xid in the log file is preceded by a line that contains the GPU GUID and device IDs.

In the above example,

The GUID is a globally unique, immutable identifier for each GPU.

Each subsequent Xid line contains the device ID, the Xid error, and information about the Xid.

In the above example,

2.2. Tools That Provide Additional Information About Xid Errors

NVIDIA provides two additional tools that may be helpful when dealing with Xid errors.

nvidia-smi is a command-line program that installs with the NVIDIA driver. It reports basic monitoring and configuration data about each GPU in the system. nvidia-smi can list ECC error counts (Xid 48) and indicate if a power cable is unplugged (Xid 54), among other things. Please see the nvidia-smi man page for more info. Run ‘nvidia-smi –q’ for basic output.

NVIDIA healthmon is a health checking tool that is provided as part of the Tesla Deployment Kit, located at https://developer.nvidia.com/tesla-deployment-kit.

Healthmon can check for basic GPU health, including the presence of ECC errors, PCIe problems, bandwidth issues, and general problems with running CUDA programs. Healthmon documentation is included in the Tesla Deployment Kit.

2.3. Analyzing Xid Errors

The following table lists the recommended actions to take for various issues encountered.

Issue	Recommended Action
Suspected User Programming Issues	Run the debugger tools. See the cuda-memcheck and cuda-gdb docs at http://docs.nvidia.com/cuda/index.html
Suspected Hardware Problems	Contact the hardware vendor. They can run through their hardware diagnostic process.
Suspected Driver Problems	File a bug with NVIDIA.

XID ERROR LISTING

The following table lists the Xid errors along with the potential causes for each.

XID	Failure	Causes						
		HW Error	Driver Error	User App Error	System Memory Corruption	Bus Error	Thermal Issue	FB Corruption
1	Invalid or corrupted push buffer stream		X		X	X		X
2	Invalid or corrupted push buffer stream		X		X	X		X
3	Invalid or corrupted push buffer stream		X		X	X		X
4	Invalid or corrupted push buffer stream		X		X	X		X
	GPU semaphore timeout		X	X	X	X		X
5	Unused							
6	Invalid or corrupted push buffer stream		X		X	X		X
7	Invalid or corrupted push buffer address		X			X		X
8	GPU stopped processing		X	X		X	X	
9	Driver error programming GPU		X					
10	Unused							
11	Invalid or corrupted push buffer stream		X		X	X		X
12	Driver error handling GPU exception		X					
13	Graphics Engine Exception		X	X	X	X	X	X
14	Unused							

XID	Failure	Causes						
		HW Error	Driver Error	User App Error	System Memory Corruption	Bus Error	Thermal Issue	FB Corruption
15	Unused							
16	Display engine hung		X					
17	Unused							
18	Bus mastering disabled in PCI Config Space		X					
19	Display Engine error		X					
20	Invalid or corrupted Mpeg push buffer		X		X	X		X
21	Invalid or corrupted Motion Estimation push buffer		X		X	X		X
22	Invalid or corrupted Video Processor push buffer		X		X	X		X
23	Unused							
24	GPU semaphore timeout		X	X	X	X	X	X
25	Invalid or illegal push buffer stream		X	X	X	X		X
26	Framebuffer timeout		X					
27	Video processor exception		X					
28	Video processor exception		X					
29	Video processor exception		X					
30	GPU semaphore access error		X					
31	GPU memory page fault		X	X				
32	Invalid or corrupted push buffer stream		X		X	X	X	X
33	Internal micro-controller error		X					
34	Video processor exception		X					
35	Video processor exception		X					
36	Video processor exception		X					
37	Driver firmware error		X		X	X		
38	Driver firmware error		X					
39	Unused							
40	Unused							

XID	Failure	Causes						
		HW Error	Driver Error	User App Error	System Memory Corruption	Bus Error	Thermal Issue	FB Corruption
41	Unused							
42	Video processor exception		X					
43	GPU stopped processing		X					
44	Graphics Engine fault during context switch		X					
45	Preemptive cleanup, due to previous errors -- Most likely to see when running multiple cuda applications and hitting a DBE		X					
46	GPU stopped processing		X					
47	Video processor exception		X					
48	Double Bit ECC Error	X						
49	Unused							
50	Unused							
51	Unused							
52	Unused							
53	Unused							
54	Auxiliary power is not connected to the GPU board							
55	Unused							
56	Display Engine error	X	X					
57	Error programming video memory interface	X	X					X
58	Unstable video memory interface detected	X	X					
	EDC error – clarified in printout	X						
59	Internal micro-controller error (older drivers)		X					
60	Video processor exception		X					
61	Internal micro-controller breakpoint/warning (newer drivers)							

XID	Failure	Causes						
		HW Error	Driver Error	User App Error	System Memory Corruption	Bus Error	Thermal Issue	FB Corruption
62	Internal micro-controller halt (newer drivers)	X	X				X	
63	ECC page retirement recording event	X	X					X
64	ECC page retirement recording failure	X	X					
65	Video processor exception	X	X					
66	Illegal access by driver		X	X				
67	Illegal access by driver		X	X				
68	Video processor exception	X	X					

COMMON XID ERRORS

This section provides more information on some common Xid errors.

4.1. XID 13: GR: SW Notify Error

This event is logged for general user application faults. Typically this is an out-of-bounds error where the user has walked past the end of an array, but could also be an illegal instruction, illegal register, or other case.

In rare cases, it's possible for a hardware failure or system software bugs to materialize as XID 13.

When this event is logged, NVIDIA recommends the following:

Run the application in cuda-gdb or cuda-memcheck , or
Run the application with CUDA_DEVICE_WAITS_ON_EXCEPTION=1 and then attach later with cuda-gdb, or
File a bug if the previous two come back inconclusive to eliminate potential NVIDIA driver or hardware bug.

Note: The cuda-memcheck tool instruments the running application and reports which line of code performed the illegal read.

4.2. XID 31: Fifo: MMU Error

This event is logged when a fault is reported by the MMU, such as when an illegal address access is made by an applicable unit on the chip Typically these are application-level bugs, but can also be driver bugs or hardware bugs.

When this event is logged, NVIDIA recommends the following:

Run the application in cuda-gdb or cuda-memcheck , or
Run the application with CUDA_DEVICE_WAITS_ON_EXCEPTION=1 and then attach later with cuda-gdb, or
File a bug if the previous two come back inconclusive to eliminate potential NVIDIA driver or hardware bug.

Note: The cuda-memcheck tool instruments the running application and reports which line of code performed the illegal read.

4.3. XID 32: PBDMA Error

This event is logged when a fault is reported by the DMA controller which manages the communication stream between the NVIDIA driver and the GPU over the PCI-E bus. These failures primarily involve quality issues on PCI, and are generally not caused by user application actions.

4.4. XID 45: OS: Preemptive Channel Removal

This event is logged when the user application aborts and the kernel driver tears down the GPU application running on the GPU. Control-C, GPU resets, sigkill are all examples where the application is aborted and this event is created.

In many cases, this is not indicative of a bug but rather a user or system action.

4.5. XID 48: DBE (Double Bit Error) ECC Error

This event is logged when the GPU detects that an uncorrectable error occurs on the GPU. This is also reported back to the user application. A GPU reset or node reboot is needed to clear this error.

The tool nvidia-smi can provide a summary of ECC errors. See “Tools That Provide Additional Information About Xid Errors”.

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