



# COMPUTE SANITIZER

v2024.1.0 | February 2024

## Release Notes



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# Chapter 1.

## RELEASE NOTES

### 1.1. Updates in 2024.1

- ▶ Enable shared addressing support by default: removed option `--hmm-support` and replaced it with environment variable `NV_COMPUTE_SANITIZER_SHARED_ADDRESSING_SUPPORT`. See the [environment variables documentation](#) for more information.
- ▶ Changed default value for option `--target-processes` to `all`
- ▶ Added detection for `cuda::barrier` initialization race conditions in racecheck on Hopper.
- ▶ Added support for initcheck API errors suppression.
- ▶ Added memcheck support for `cuMemPoolImportPointer`.
- ▶ Added support for CUDA green contexts.
- ▶ Added support for CUDA graph device-side node update.
- ▶ Fixed potential false positives with synccheck when using different `cuda::barrier` in a single warp.
- ▶ Fixed potential false negatives with memcheck when using floating point atomics on Hopper.

### 1.2. Updates in 2023.3.1

- ▶ Fixed error output for WGMMMA instructions.

### 1.3. Updates in 2023.3

- ▶ Added support for Heterogeneous Memory Management (HMM) and Address Translation Service (ATS). The feature is opt-in using the `--hmm-support` command-line option.
- ▶ Added racecheck support for device graph launches.

- ▶ Added the ability to suppress known issues using the `--suppressions` command-line option. See the [suppressions documentation](#) for more information.
- ▶ Added support for [external memory objects](#). This effectively adds support for Vulkan and D3D12 interop.
- ▶ Added device backtrace support for WSL.
- ▶ Improve PC offset output. It is now printed next to the function name to clarify it is an assembly offset within that function.
- ▶ Several command-line options no longer require to explicitly specify "yes" or "no" when they are used.
- ▶ Renamed the options `--kernel-regex` and `--kernel-regex-exclude` to `--kernel-name` and `--kernel-name-exclude`.
- ▶ Added the regex filtering key to `--kernel-name` and `--kernel-name-exclude`.
- ▶ Added new command-line option `--racecheck-indirect-barrier-dependency` to enable indirect `cuda::barrier` tracking in racecheck.
- ▶ Added new command-line option `--coredump-behavior` to control the target application behavior after generating a GPU coredump.
- ▶ Added new command-line option `--detect-missing-module-unload` to detect missing calls to the `cuModuleUnload` driver API.
- ▶ Added new command-line option `--preload-library` to make the target application load a shared library before the injection libraries.
- ▶ Fix initcheck false positive when memory loads are widened and include padding bytes.
- ▶ Fix potential hang in racecheck and synccheck tools when the `bar.arrive` instruction is used.
- ▶ Added patching API support for the `setsmemsize` instruction.
- ▶ Added patching API support for `__syncthreads()` after the barrier is released.

## 1.4. Updates in 2023.2.1

- ▶ Fixed potential racecheck hang on H100 when using thread block clusters.
- ▶ Compute Sanitizer 2023.2.1 is incorrectly versioned as 2023.2.0 and need to be differentiated by its build ID 33053471.

## 1.5. Updates in 2023.2

- ▶ Added support for CUDA device graph launches.
- ▶ Added racecheck support for cluster entry and exit race detection for remote shared memory accesses. See the [cluster entry and exit race detection documentation](#) for more information.
- ▶ Added support for CUDA lazy loading when device heap checking is enabled. Requires CUDA driver version 535 or newer.
- ▶ Added support for tracking child processes launched with `system()` or `posix_spawn(p)` when using `--target-processes all`.
- ▶ Added support for `st.async` and `red.async` instructions.

- ▶ Improved support for partial warp synchronization using cooperative groups in racecheck.
- ▶ Improved support for `cuda::barrier::wait()` on SM 9.x.
- ▶ Added coredump support for Pascal architecture and multi-context applications.
- ▶ Added support for OptiX 8.0.
- ▶ Improved performance when using initcheck in OptiX applications in some cases. Using initcheck to track OptiX applications now requires the option `--check-optix yes`.

## 1.6. Updates in 2023.1.1

- ▶ Fixed bug where memcheck would report out-of-bound accesses when loading user parameter values using a ternary operator.
- ▶ Fixed potential crash when using leakcheck with applications using CUBLAS.
- ▶ Fixed potential false positives when using synccheck or racecheck with applications using CUDA barriers.

## 1.7. Updates in 2023.1

- ▶ Added racecheck support for distributed shared memory.
- ▶ Extended stream-ordered race detection to `cudaMemcpy` APIs.
- ▶ Added memcheck, synccheck and patching API support for warpgroup operations.
- ▶ Added `--coredump-name` CLI option to set the coredump file name.
- ▶ Added support for Unicode file paths.
- ▶ Added support for OptiX 7.7.

## 1.8. Updates in 2022.4.1

- ▶ Fixed bug where synccheck would incorrectly report illegal instructions for code using `cluster.sync()` and compiled with `--device-debug`
- ▶ Fixed incorrect address reports in SanitizerCallbackMemcpyAsync in some specific cases, leading to potential invalid results in memcheck and racecheck.
- ▶ Fixed potential hangs and invalid results with racecheck on OptiX applications.
- ▶ Fixed potential crash or invalid results when using CUDA Lazy Module Loading with memcheck or initcheck if `--check-device-heap` is enabled. Lazy Module Loading will be automatically disabled in these cases.

## 1.9. Updates in 2022.4

- ▶ Added support for `__nv_aligned_device_malloc`.
- ▶ Added support for `ldmatrix` and `stmatrix` instructions.

- ▶ Added support for cache control operations when using the `--check-cache-control` command-line option.
- ▶ Added new command-line option `--unused-memory-threshold` to control the threshold for unused memory reports.
- ▶ Improved support for CUDA pipeline memcpy-async related hazards in racecheck.

## 1.10. Updates in 2022.3

- ▶ Added support for the NVIDIA GH100/SM 9.x GPU architecture.
- ▶ Added support for the NVIDIA AD10x/SM 8.9 GPU architecture.
- ▶ Added support for lazy kernel loading.
- ▶ Added memcheck support for distributed shared memory.
- ▶ Added new options `--num-callers-device` and `--num-callers-host` to control the number of callers to print in stack traces.
- ▶ Added support for OptiX 7.6 applications.
- ▶ Fix bug on Linux ppc64le where the host stack trace was incomplete.

## 1.11. Updates in 2022.2.1

- ▶ Fixed incorrect device backtrace for applications compiled with `-lineinfo`.

## 1.12. Updates in 2022.2

- ▶ Added memcheck support for use-before-alloc and use-after-free race detection. See the [stream-ordered race detection documentation](#) for more information.
- ▶ Added leakcheck support for asynchronous allocations, OptiX resources and CUDA mmap (on Linux only for the latter).
- ▶ Added option to ignore `CUDA_ERROR_NOT_FOUND` error codes returned by the `cuGetProcAddress` API.
- ▶ Added new sanitizer API functions to allocate and free page-locked host memory.
- ▶ Added sanitizer API callbacks for the [event management](#) API.

## 1.13. Updates in 2022.1.1

- ▶ Fixed initcheck issue where the tool would incorrectly abort a CUDA kernel launch after reporting an uninitialized access on Windows with hardware scheduling enabled.

## 1.14. Updates in 2022.1

- ▶ Added support for generating coredumps.
- ▶ Improved support for stack overflow detection.



- ▶ Added new option `--target-processes-filter` to filter the processes being tracked by name.
- ▶ Added initcheck support for asynchronous allocations. Requires CUDA driver version 510 or newer.
- ▶ Added initcheck support for accesses on peer devices. Requires CUDA driver version 510 or newer.
- ▶ Added support for OptiX 7 applications.
- ▶ Added support for tracking the child processes of 32-bit processes in multi-process applications on Linux and Windows x86\_64.

## 1.15. Updates in 2021.3.1

- ▶ Fixed intermittent issue on vGPU where synccheck would incorrectly detect divergent threads.
- ▶ Fixed potential hang when tracking several graph launches.

## 1.16. Updates in 2021.3

- ▶ Improved Linux host backtrace.
- ▶ Removed requirement to call `cudaDeviceReset()` for accurate reporting of memory leaks and unused memory features.
- ▶ Fixed synccheck potential hang when calling `__syncthreads` in divergent code paths on Volta GPUs or newer.
- ▶ Added print of nearest allocation information for memcheck precise errors in global memory.
- ▶ Added warning when calling device-side `malloc` with an empty size.
- ▶ Added separate sanitizer API device callback for `cuda::memcpy_async`.
- ▶ Added new command-line option `--num-cuda-barriers` to override the expected number of `cuda::barrier` used by the target application.
- ▶ Added new command-line options `--print-session-details` to print session information and `--save-session-details` to save it to the output file.
- ▶ Added support for WSL2.

## 1.17. Updates in 2021.2.3

- ▶ Enabled SLS hardening and branch protection for L4T builds.

## 1.18. Updates in 2021.2.2

- ▶ Enabled stack canaries with random canary values for L4T builds.

## 1.19. Updates in 2021.2.1

- ▶ Added device backtrace for malloc/free errors in CUDA kernels.
- ▶ Improved racecheck host memory footprint.

## 1.20. Updates in 2021.2

- ▶ Added racecheck and synccheck support for `cuda::barrier` on Ampere GPUs or newer.
- ▶ Added racecheck support for `__syncwarp` with partial mask.
- ▶ Added `--launch-count` and `--launch-skip` filtering options. See the [Command Line Options documentation](#) for more information.
- ▶ `--filter` and `--exclude` options have been respectively renamed to `--kernel-regex` and `--kernel-regex-exclude`.
- ▶ Added support for QNX and Linux aarch64 platforms.
- ▶ Added support for CUDA graphs memory nodes.

## 1.21. Updates in 2021.1.1

- ▶ Fixed an issue where incorrect line numbers could be shown in errors reports.

## 1.22. Updates in 2021.1

- ▶ Added support for allocation padding via the `--padding` option.
- ▶ Added experimental support for NVTX memory API using option `--nvtx yes`. Please refer to [NVTX API for Compute Sanitizer Reference Manual](#) for more information.

## 1.23. Updates in 2020.3.1

- ▶ Fixed issue when launching a CUDA graph multiple times.
- ▶ Fixed false positives when using cooperative groups synchronization primitives with `initcheck` and `synccheck`.

## 1.24. Updates in 2020.3

- ▶ Added support for CUDA memory pools and CUDA API reduced serialization.
- ▶ Added host backtrace for unused memory reports.

## 1.25. Updates in 2020.2.1

- ▶ Fixed crash when loading cubins of size larger than 2 GiB.
- ▶ Fixed error detection on systems with multiple GPUs.
- ▶ Fixed issue when using CUDA Virtual Memory Management API `cuMemSetAccess` to remove access to a subset of devices on a system with multiple GPUs.
- ▶ Added sanitizer API to translate between sanitizer and CUDA stream handles.

## 1.26. Updates in 2020.2

- ▶ Added support for CUDA graphs and CUDA memmap APIs.
- ▶ The memory access callback of the sanitizer API has been split into three distinct callbacks corresponding to global, shared and local memory accesses.

## 1.27. Updates in 2020.1.2

- ▶ Added sanitizer stream API. This fixes tool crashes when per-thread streams are being used.

## 1.28. Updates in 2020.1.1

- ▶ Added support for Windows Hardware-accelerated GPU scheduling
- ▶ Added support for tracking child processes spawned by the application launched under the tool via the `--target-processes` CLI option.

## 1.29. Updates in 2020.1

- ▶ Initial release of the Compute Sanitizer (with CUDA 11.0)

Updates to the Sanitizer API :

- ▶ Added support for per-thread streams
- ▶ Added APIs to retrieve the PC and size of a CUDA function or patch
- ▶ Added callback for `cudaStreamAttachMemAsync`
- ▶ Added direction to memcpy callback data
- ▶ Added stream to memcpy and memset callbacks data
- ▶ Added launch callback after syscall setup
- ▶ Added visibility field to allocation callback data
- ▶ Added PC argument to block entry callback
- ▶ Added incoming value to memory access callbacks
- ▶ Added threadCount to barrier callbacks

- ▶ Added cooperative group flags for barrier and function callbacks

## 1.30. Updates in 2019.1

- ▶ Initial release of the Compute Sanitizer API (with CUDA 10.1)

## Chapter 2.

# KNOWN LIMITATIONS

- ▶ Applications run much slower under the Compute Sanitizer tools. This may cause some kernel launches to fail with a launch timeout error when running with the Compute Sanitizer enabled.
- ▶ Compute Sanitizer tools do not support device backtrace on Maxwell devices (SM 5.x).
- ▶ Compute Sanitizer tools do not support coredumps on WSL2.
- ▶ The memcheck tool does not support CUDA API error checking for API calls made on the GPU using dynamic parallelism.
- ▶ The racecheck, synccheck and initcheck tools do not support CUDA dynamic parallelism.
- ▶ CUDA dynamic parallelism is not supported when Windows Hardware-accelerated GPU scheduling is enabled.
- ▶ Compute Sanitizer tools cannot interoperate with other CUDA developer tools. This includes CUDA coredumps which are automatically disabled by the Compute Sanitizer. They can be enabled instead by using the **--generate-coredump** option.
- ▶ The initcheck tool does not support IPC allocations. Using it will result in false positives.
- ▶ Compute Sanitizer tools are not supported when SLI is enabled.

## Chapter 3.

# KNOWN ISSUES

- ▶ The racecheck tool may print incorrect data for "Current value" when reporting a hazard on a shared memory location where the last access was an atomic operation. This can also impact the severity of this hazard.
- ▶ On QNX, when using the **--target-processes all** option, analyzing shell scripts may hang after the script has completed. End the application using *Ctrl-C* on the command line in that case.
- ▶ The initcheck tool might report false positives for device-to-host `cudaMemcpy` operations on padded structs that were initialized by a CUDA kernel. The **#pragma pack** directive can be used to disable the padding as a workaround.
- ▶ When a hardware exception occur during a kernel launch that was skipped due to the usage of the **kernel-name**, **kernel-name-exclude**, **launch-count** or **launch-skip** options, the memcheck tool will not be able to report additional details as an imprecise error.
- ▶ The leakcheck feature is disabled under Confidential Computing.

# Chapter 4.

## SUPPORT

Information on supported platforms and GPUs.

### 4.1. Platform Support

Table 1 Platforms supported by Compute Sanitizer

| Platform            | Support |
|---------------------|---------|
| Windows             | Yes     |
| Linux (x86_64)      | Yes     |
| Linux (ppc64le)     | Yes     |
| Linux (aarch64sbsa) | Yes     |
| Linux (aarch64)     | Yes     |
| QNX                 | Yes     |
| MacOSX              | No      |

### 4.2. GPU Support

The compute-sanitizer tools are supported on all CUDA capable GPUs with SM versions 5.0 and above.

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