



# CUDA Demo Suite

## Reference Manual

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# Chapter 1. Introduction

The CUDA Demo Suite contains pre-built applications which use CUDA. These applications demonstrate the capabilities and details of NVIDIA GPUs.

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# Chapter 2. Demos

Below are the demos within the demo suite.

## 2.1. deviceQuery

This application enumerates the properties of the CUDA devices present in the system and displays them in a human readable format.

## 2.2. vectorAdd

This application is a very basic demo that implements element by element vector addition.

## 2.3. bandwidthTest

This application provides the memcpy bandwidth of the GPU and memcpy bandwidth across PCI#e. This application is capable of measuring device to device copy bandwidth, host to device copy bandwidth for pageable and page-locked memory, and device to host copy bandwidth for pageable and page-locked memory.

### Arguments:

```
Usage: bandwidthTest [OPTION]...
Test the bandwidth for device to host, host to device, and device to device
transfers

Example: measure the bandwidth of device to host pinned memory copies in the range
1024 Bytes to 102400 Bytes in 1024 Byte increments
./bandwidthTest --memory=pinned --mode=range --start=1024 --end=102400 --
increment=1024 --dtoh
```

| Options             | Explanation                                     |
|---------------------|---|
| --help              | Display this help menu                          |
| --csv               | Print results as a CSV                          |
| --device=[deviceno] | Specify the device device to be used            |
| all                 | compute cumulative bandwidth on all the devices |

| Options  | Explanation  |
|--|--|
| 0,1,2,...,n  | Specify any particular device to be used   |
| --memory=[MEMMODE]<br>pageable<br>pinned                                   | Specify which memory mode to use<br>pageable memory<br>non-pageable system memory  |
| --mode=[MODE]<br>quick<br>range<br>shmoo                                   | Specify the mode to use<br>performs a quick measurement<br>measures a user-specified range of values<br>performs an intense shmoo of a large range of values |
| --htod   | Measure host to device transfers   |
| --dtoh   | Measure device to host transfers   |
| --dtod   | Measure device to device transfers   |
| --wc   | Allocate pinned memory as write-combined   |
| --cputiming  | Force CPU-based timing always  |
| Range Mode options<br>--start=[SIZE]<br>--end=[SIZE]<br>--increment=[SIZE] | Starting transfer size in bytes<br>Ending transfer size in bytes<br>Increment size in bytes  |

## 2.4. busGrind

Provides detailed statistics about peer-to-peer memory bandwidth amongst GPUs present in the system as well as pinned, unpinned memory bandwidth.

### Arguments:

| Options  | Explanation   |
|----------|---|
| -h       | print usage   |
| -p [0,1] | enable or disable pinned memory tests (default on)        |
| -u [0,1] | enable or disable unpinned memory tests (default off)     |
| -e [0,1] | enable or disable unpinned memory tests (default off)     |
| -u [0,1] | enable or disable p2p enabled memory tests (default on)   |
| -d [0,1] | enable or disable p2p disabled memory tests (default off) |
| -a       | enable all tests  |
| -n       | disable all tests   |

Order of parameters matters.

Examples:

```
./BusGrind -n -p 1 -e 1  Run all pinned and P2P tests
./BusGrind -n -u 1      Runs only unpinned tests
./BusGrind -a          Runs all tests (pinned, unpinned, p2p enabled, p2p
disabled)
```

## 2.5. nbody

This demo does an efficient all-pairs simulation of a gravitational n-body simulation in CUDA. It scales the n-body simulation across multiple GPUs in a single PC if available. Adding "-numbodies=num\_of\_bodies" to the command line will allow users to set # of bodies for simulation. Adding "-numdevices=N" to the command line option will cause the sample to use N devices (if available) for simulation. In this mode, the position and velocity data for all bodies are read from system memory using "zero copy" rather than from device memory. For a small number of devices (4 or fewer) and a large enough number of bodies, bandwidth is not a bottleneck so we can achieve strong scaling across these devices.

### Arguments:

| Options         | Explanation   |
|-----------------|---|
| -fullscreen     | run n-body simulation in fullscreen mode  |
| -fp64           | use double precision floating point values for simulation                       |
| -hostmem        | stores simulation data in host memory   |
| -benchmark      | run benchmark to measure performance  |
| -numbodies=N    | number of bodies (>= 1) to run in simulation                                    |
| -device=d       | where d=0,1,2,... for the CUDA device to use                                    |
| -numdevices=i   | where i=(number of CUDA devices > 0) to use for simulation                      |
| -compare        | compares simulation results running once on the default GPU and once on the CPU |
| -cpu            | run n-body simulation on the CPU  |
| -tipsy=file.bin | load a tipsy model file for simulation  |

## 2.6. oceanFFT

This is a graphical demo which simulates an ocean height field using the CUFFT library, and renders the result using OpenGL.

The following keys can be used to control the output:

| Keys | Function         |
|------|------------------|
| w    | Toggle wireframe |

## 2.7. randomFog

This is a graphical demo which does pseudo- and quasi- random numbers visualization produced by CURAND. On creation, randomFog generates 200,000 random coordinates in spherical coordinate space (radius, angle rho, angle theta) with curand's XORWOW algorithm. The coordinates are normalized for a uniform distribution through the sphere. The X axis is drawn with blue in the negative direction and yellow positive. The Y axis is drawn with green in the negative direction and magenta positive. The Z axis is drawn with red in the negative direction and cyan positive.

**The following keys can be used to control the output:**

| Keys    | Function   |
|---------|--|
| s       | Generate new set of random nos and display as spherical coordinates (Sphere)   |
| e       | Generate new set of random nos and display on a spherical surface (shEll)      |
| b       | Generate new set of random nos and display as cartesian coordinates (cuBe/Box) |
| p       | Generate new set of random nos and display on a cartesian plane (Plane)        |
| i, l, j | Rotate the negative Z-axis up, right, down and left respectively               |
| a       | Toggle auto-rotation   |
| t       | Toggle 10x zoom  |
| z       | Toggle axes display  |
| x       | Select XORWOW generator (default)  |
| c       | Select Sobol' generator  |
| v       | Select scrambled Sobol' generator  |
| r       | Reset XORWOW (i.e. reset to initial seed) and regenerate                       |
| ]       | Increment the number of Sobol' dimensions and regenerate                       |
| [       | Reset the number of Sobol' dimensions to 1 and regenerate                      |
| +       | Increment the number of displayed points by 8,000 (max. 200,000)               |
| -       | Decrement the number of displayed points by 8,000 (down to min. 8000)          |
| q/[ESC] | Quit the application.  |

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