

1 Overview

1.1 Location `$<APPSDKSamplesInstallPath>\samples\C++Amp\`

1.2 How to Run See the *Getting Started* guide for how to build samples. You must first compile the sample. Use the command line to change to the directory where the executable is located. The pre-compiled sample executable is at `$<APPSDKSamplesInstallPath>\samples\C++Amp\bin\x86\` for 32-bit builds, and `$<APPSDKSamplesInstallPath>\samples\C++Amp\bin\x86_64\` for 64-bit builds.

Ensure you have installed Microsoft® Visual Studio® 2012 or higher.

Type the following command(s).

1. `Sort`
This runs the program with the default option `s = 8`.
2. `Sort -h`
This prints the help file.

1.3 Command Line Options Table 1 lists, and briefly describes, the command line options.

Table 1 Command Line Options

Short Form	Long Form	Description
<code>-h</code>	<code>--help</code>	Shows all command options and their respective meaning.
<code>-q</code>	<code>--quiet</code>	Quiet mode. Suppresses all text output.
<code>-e</code>	<code>--verify</code>	Verify results against reference implementation.
<code>-t</code>	<code>--timing</code>	Print timing.
<code>-v</code>	<code>--version</code>	AMD APP SDK version string.
<code>-d</code>	<code>--deviceId</code>	Select deviceId to be used (0 to N-1, where N is the number of available devices).
<code>-s</code>	<code>--size</code>	The number of M data to be sorted.
<code>-i</code>	<code>--iterations</code>	Number of iterations for kernel execution.

2 Introduction

This sample implements a radix sort by using C++ Amp. The radix sort algorithm is divided into three phases:

1. Calculate the histogram of an unsorted array.

2. Scan the histogram bins.
3. Rank and permute to keys to get a sorted array.

3 Implementation Details

The implemented radix sort breaks keys (32 integers) into 16-bit digits and sorts one 16-bit digit at a time, starting with the least significant one. It loops eight times to complete sorting. In each i th loop, the following three phases sort the input array using i th 16-bit digit.

1. Calculate histogram bins.

There are $cNTiles * cTileSize$ threads to calculate histogram bins. $cTileSize$ is the number of threads per AMP tile. $cNTiles$ is the number of AMP tiles. The input array is divided into blocks of $regionSize * cNTiles$ elements. In this case, $cTileSize = 256$, $cNTiles = 64$. Each work-item calculates its histogram bin from the allotted 512 elements and passes this histogram to next phase.

2. Scan histogram bins.

In this phase the histogram bins are scanned column-wise, where histogram bins are arranged in the following way.

There are $B * N$ histogram bins, where B is the number of blocks, and N is the number of work-items in a block. Histogram bins are arranged such that the 0 th block bin comes first, and the $(B - 1)$ th block comes last. Each block's histogram bins are arranged so that the 0 th work-item bin comes first, and $(N - 1)$ th work-item bin comes last.

The scanned histogram is passed to next phase.

3. Rank and permute keys to get the sorted array.

Each work-item permutes the allotted 128 elements by using its scanned histogram bins.

4 References

1. Marcho Zagha and Guy E. Blelloch. "Radix Sort For Vector Multiprocessor." in: Conference on High Performance Networking and Computing, pp. 712-721, 1991.
2. Guy E. Blelloch, Prefix Sums and Their Applications, School of Computer Science, Carnegie Mellon University, Pittsburgh, 1990.

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