

What's new?

Friday, May 22, 2020 2:52 PM

Now support reporting data races in two mode.

1. In **memaddr mode**, data races are reported based on address. That is, each set of conflicting memory accesses on the same address are counted as a data race. If the same instructions causes a data race on different address, it will be report separately.

It is just has the same behavior as version 1.0

To use this mode, replace [script/race_check_helper.py](#) by [script/race_check_helper_memaddr.py](#)

Sample output:

```
Warning! There may be a data race in address(GLOBAL): 0x00007F1031500000 where:  
    Load from blocks: (35 0 0)-[Thread (1 0) ]  
                      (8 0 0)-[Thread (0 0) ]  
                      (1 0 0)-[Thread (0 0) ]  
                      (38 0 0)-[Thread (1 0) ]  
                      (54 0 0)-[Thread (2 0) ]  
                      (83 0 0)-[Thread (4 0) ]  
                      (25 0 0)-[Thread (1 0) ]  
                      (42 0 0)-[Thread (2 0) ]  
                      (76 0 0)-[Thread (3 0) ]  
                      (94 0 0)-[Thread (4 0) ]
```

2. In **default mode**, data races are reported based on instructions. That is, each set of conflicting memory accesses instruction are counted as a data race. If the same instructions causes a data race on different address, they will be grouped into one data race.

This is new in version 1.1

Sample output:

```
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R6], R12  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R12, [R6+0x18]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R4, [R6]  
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R4], R6  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R2, [R2]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R4], R6  
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R6], R12  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R12, [R6]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R4, [R6]  
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R6], R12  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R4, [R6]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R12, [R6+0x10]  
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R12, [R6+0x8]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R6], R12  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R4, [R6]
```

Testing result on Rodinia 3.1 are included in this report. It is done under the default mode.

Result of Rodinia 3.1

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b+tree: the same result as CURD (which reports no data races)

for input `mil.txt + common.txt`: too slow to work



small

for input `small.txt + common_small.txt`:

`no data race is found in the 1th execution of kernel.`



command...

backprop: fail to run with CUDA 10.2

```
./backprop: error while loading shared libraries: libcudart.so.7.0: cannot open shared object file: No such file or directory
```

bfs: the same result as CURD (which reports 6 global data races)

for input `graph4096.txt`: 3 intra block global data races + 3 inter block global data races

```
Warning! There may be a intra block global memory data race involving following instructions:  
at Kernel12(bool*, bool*, bool*, bool*, int), STG.E.U8 [R2], R0  
Warning! There may be a inter block global memory data race involving following instructions:  
at Kernel12(bool*, bool*, bool*, bool*, int), STG.E.U8 [R2], R0
```

```
Warning! There may be a intra block global memory data race involving following instructions:  
at Kernel(Node*, int*, bool*, bool*, bool*, int*, int), @!P0 STG.E [R6], R16  
Warning! There may be a intra block global memory data race involving following instructions:  
at Kernel(Node*, int*, bool*, bool*, bool*, int*, int), @!P0 STG.E.U8 [R12], R11  
Warning! There may be a inter block global memory data race involving following instructions:  
at Kernel(Node*, int*, bool*, bool*, bool*, int*, int), @!P0 STG.E [R6], R16  
Warning! There may be a inter block global memory data race involving following instructions:  
at Kernel(Node*, int*, bool*, bool*, bool*, int*, int), @!P0 STG.E.U8 [R12], R11
```

for input `graph65536.txt`: the same data races

for input `inputGen/graph1k.txt`: the same data races

for input `inputGen/graph16k.txt`: the same data races

dwt2d: the same result as CURD (which reports no data races)

for input `inputGen/4.bmp -f -5 -l 3`:

for input `inputGen/8.bmp -f -5 -l 3`:

`no data race is found in the 10th execution of kernel.`

for input `inputGen/64.bmp -f -5 -l 3`:

`no data race is found in the 10th execution of kernel.`

for input `inputGen/64.bmp -f -5 -l 3`:

`no data race is found in the 10th execution of kernel.`

gaussian: the same result as CURD (which reports no data races)

for input `-f matrix4.txt`:

`no data race is found in the 6th execution of kernel.`

for input `-f matrix16.txt`:

`no data race is found in the 30th execution of kernel.`

for input `-f matrix208.txt`:

`no data race is found in the 414th execution of kernel.`

for input `-s 4`:

`no data race is found in the 6th execution of kernel.`

for input `-s 16`:

```
no data race is found in the 30th execution of kernel.
```

for input -s 32:

```
no data race is found in the 62th execution of kernel.
```

for input -s 256:

```
no data race is found in the 254th execution of kernel.
```

heartwall: not the same as the result of CURD (CURD reports 1 shared data race and 1 global data race)

for input test.avi 20: too slow to work

for input test.avi 2: too slow to work

for input test.avi 1:

```
no data race is found in the 1th execution of kernel.
```

hybridsort: not exactly the same as the result of CURD (CURD reports 2 shared data race)

for input 50000.txt: 4 shared memory data race

```
Warning! There may be an intra block shared memory data race involving following instructions:  
at histogram1024Kernel(unsigned int*, float*, float, float, int), STS [R9], R7  
at histogram1024Kernel(unsigned int*, float*, float, float, int), LDS.U.32 R8, [R9]  
Warning! There may be an intra block shared memory data race involving following instructions:  
at histogram1024Kernel(unsigned int*, float*, float, float, int), STS [R9], R7  
at histogram1024Kernel(unsigned int*, float*, float, float, int), LDS.U.32 R7, [R9]  
Warning! There may be an intra block shared memory data race involving following instructions:  
at histogram1024Kernel(unsigned int*, float*, float, float, int), STS [R9], R7  
Warning! There may be an intra block shared memory data race involving following instructions:  
at histogram1024Kernel(unsigned int*, float*, float, float, int), STS [R9], R7  
at histogram1024Kernel(unsigned int*, float*, float, float, int), LDS.U.32 R7, [R9]  
at histogram1024Kernel(unsigned int*, float*, float, float, int), LDS.U.32 R8, [R9]
```

for input small.txt: 1 shared memory data race (one of the data race reported in 50000.txt)

```
Warning! There may be an intra block shared memory data race involving following instructions:  
at histogram1024Kernel(unsigned int*, float*, float, float, int), STS [R9], R7
```



small

for input small2.txt: 2 shared memory data race (a new data race compared to 50000.txt)

```
Warning! There may be an intra block shared memory data race involving following instructions:  
at histogram1024Kernel(unsigned int*, float*, float, float, int), STS [R9], R7  
Warning! There may be an intra block shared memory data race involving following instructions:  
at bucketcount(float*, int*, unsigned int*, int), STS [R10], R8  
at bucketcount(float*, int*, unsigned int*, int), LDS.U.32 R9, [R10]  
at bucketcount(float*, int*, unsigned int*, int), LDS.U.32 R7, [R10]
```



small2

for input small3.txt: (sort only 7 numbers)

```
no data race is found in the 28th execution of kernel.
```



small3

leukocyte: fail to run with CUDA 10.2

```
./CUDA/leukocyte: error while loading shared libraries: libcudart.so.5.5: cannot open shared object file: No such file or directory
```

myocyte: not exactly the same with the result of CURD (CURD reports 1 global data race)

for input 100 1 0: 3 inter block global memory races:

```
Warning! There may be an inter block global memory data race involving following instructions:  
at kernel(int, float*, float*, float*, float*), STG.E [R12+-0xf0], R14  
at kernel(int, float*, float*, float*, float*), STG.E [R2+0x4], R0  
Warning! There may be an inter block global memory data race involving following instructions:  
at kernel(int, float*, float*, float*, float*), STG.E [R2+0x8], R6  
at kernel(int, float*, float*, float*, float*), STG.E [R14+-0x128], R16  
Warning! There may be an inter block global memory data race involving following instructions:  
at kernel(int, float*, float*, float*, float*), STG.E [R12+-0xb8], R14  
at kernel(int, float*, float*, float*, float*), STG.E [R2], R12
```

for input 100 1 1: (a different execution mode on the same input)

```
no data race is found in the 1th execution of kernel.
```

for input 10 2 1:

```
no data race is found in the 1th execution of kernel.
```

for input 10 2 0: the same races as 100 1 0

particlefilter_naive: the same result as CURD (which reports no data races)

for input -x 128 -y 128 -z 10 -np 1000:

```
no data race is found in the 9th execution of kernel.
```

particlefilter_naive: not exactly the same as the result of CURD (CURD reports 2 global data race)

for input -x 128 -y 128 -z 10 -np 1000: 5 inter block global data race

```
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R6], R12  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R12, [R6+0x18]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R4, [R6]  
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R4], R6  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R2, [R2]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R4], R6  
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R6], R12  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R12, [R6]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R4, [R6]  
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R6], R12  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R4, [R6]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R12, [R6+0x10]  
Warning! There may be an inter block global memory data race involving following instructions:  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R12, [R6+0x8]  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), STG.E.64 [R6], R12  
at normalize_weights_kernel(double*, int, double*, double*, double*, int*), LDG.E.64 R4, [R6]
```

hotspot: the same result as CURD (which reports no data races)

for input 64 2 2 temp_64 power_64 output:

```
no data race is found in the 1th execution of kernel.
```

hotspot3D: the same result as CURD (which reports no data races)

for input 64 8 100 temp_64x8 power_64x8 output:

```
no data race is found in the 100th execution of kernel.
```

huffman: not the same as the result of CURD (CURD reports no data race)

for input test1024_H2.206587175259.in:

```
Warning! There may be an inter block global memory data race involving following instructions:  
at histo_kernel(unsigned char*, long, unsigned int*), LD.E R6, [R6], P0  
at histo_kernel(unsigned char*, long, unsigned int*), ST.E [R4], R3, P0
```

This may due to the fact that two stream are used in this program. Which is not supported yet.

```
// kernel launch - 2x the number of mps gave best timing  
histo_kernel<<<blocks*2,256,0,stream0>>>( dev_buffer0, partSize, dev_histo );  
histo_kernel<<<blocks*2,256,0,stream1>>>( dev_buffer1, partSize, dev_histo );
```

kmeans: [the same result as CURD \(which reports no data races\)](#)

```
for input -o -i 100:  
no data race is found in the 1th execution of kernel.  
  
no data race is found in the 2th execution of kernel.  
  
no data race is found in the 3th execution of kernel.
```

lavaMD: [the same result as CURD \(which reports no data races\)](#)

```
for input -boxes1d 1:  
no data race is found in the 1th execution of kernel.  
  
for input -boxes1d 2:  
no data race is found in the 1th execution of kernel.
```

lua: [the same result as CURD \(which reports no data races\)](#)

```
for input -s 256 -v:  
no data race is found in the 22th execution of kernel.  
  
for input -s 64 -v:  
no data race is found in the 4th execution of kernel.
```

pathfinder: [the same result as CURD \(which reports no data races\)](#)
while BARRACUDA reports 7 shared data races

```
for input 100 100 20:  
no data race is found in the 5th execution of kernel.  
  
for input 1000 100 20:  
no data race is found in the 5th execution of kernel.
```

sradv1: [the same result as CURD \(which reports no data races\)](#)

```
for input 100 0.5 502 458:  
no data race is found in the 2th execution of kernel.
```

streamcluster: [the same result as CURD \(which reports no data races\)](#)

```
for input 10 20 256 655 655 1000 none output.txt 1:  
no data race is found in the 24th execution of kernel.
```

nn: the same result as CURD (which reports no data races)

```
for input filelist_4 -r 5 -lat 30 -lbg 90:  
no data race is found in the 1th execution of kernel.
```

nw: the same result as CURD (which reports no data races)

```
for input 2048 10:
```

Conclusion:

There are 22 testbenches in Rodinia 3.1.

2 programs fail to run in my environment

5 programs are reported to have data races

1 false negative with respect to the result of CURD

1 false positive with respect to the result of CURD