WaveScript Benchmarks Performance Report

August 13, 2008

Machine information:
Linux chastity 2.6.22-14-generic #1 SMP Tue Feb 12 07:42:25 UTC 2008 i686 GNU/Linux

WaveScript SVN:
Revision: 3479

WaveScope Engine SVN:
(omitted for now)

1 Microbenchmarks

This section reports various microbenchmarks that stress the implementation of particular language constructs or data types.
Per-stream-element overheads

One thing that you can see, is that currently (2007.10) the C++/XStream engine has a high per-tuple (that is, per-element) on the communication channels relative to the ML backend. The `just_timer` test stresses this, doing nothing but passing a large number of unit tuples.

Focusing on scheduling overheads a bit more, we turn to the following data passing microbenchmarks. These do nothing but generate a stream of numbers, and then add up windows of those numbers. We vary the window size in the following graphs. The numbers are passed either one at a time ("raw"), or in bulk using arrays or lists.

Notes:
• FFT results for Scheme above depend on whether or not it is configured to use FFTW, or a native Scheme fourier transform.

2 Language Shootout Benchmarks

This is where I will accumulate some of the small benchmarks from the language shootout. Here are some per-benchmark comments:

• fannkuch - “pancake flipping”. This is a translation of the gcc version of the benchmark. Tests indexed access to a small array.

3 Application Benchmarks

This section includes performance results on larger programs, namely, our current applications. Presently (2007.10) the largest of these by far is the marmot application.

3.1 Marmot Application

We start off by looking at the original, hand-optimized marmot application that we deployed.
4 Data Representation Profiling

This is stale data for now... having sneaky problems with the datarep Makefile that are hosing regression tests. [2007.11.07]

This section includes an analysis of the efficiency of different data representations under different backends. This should theoretically be run on different hardware platforms as well (such as the ARM-based ensboxes).

4.1 Arrays of Arrays

Arrays of arrays are notable because they cannot generally be flattened (the inner arrays will always be pointers). In the future we may look at tentative flattening based on profiling data. But first, here are the times for repeatedly allocating an array of arrays, and for repeatedly folding the values in an array of arrays.

Next we look at allocating arrays of tuples and vice versa. We look at both square sizes and at highly skewed dimensions. This is limited by not being able to make tuples very large.
Then we do examine folding over arrays of tuples and tuples of arrays.

A Appendix: Raw numbers for above graphs

Microbenchmarks

## User time for each benchmark/backend
Benchmark mltonO3 c2boehm c2boehmseglst c2 c2seglist c2def c2defseglst
just_timer 188.000 156.000 180.000 180.000 188.000 292.000 268.000
readfile_bigwins 2308.000 220.000 196.000 4.000 12.000 24.000 12.000
printing_lists 1292.000 472.000 440.000 444.000 452.000 444.000 432.000
conv_SigsegArr 2264.000 352.000 7268.000 876.000 5748.000 52.000 6408.000
fft 80.000 488.000 484.000 440.000 448.000 456.000 460.000

Language Shootout:

## User time for each language-shootout benchmark/backend
Benchmark c2
fannkuch2 4564.000

Application Benchmarks:

Benchmark mltonO3 c2boehm c2boehmseglst c2 c2seglist c2def c2defseglst
## Running orig marmot phase 1
# Running marmot2
```
run_first_phase 1496.000 2408.000 1052.000 1552.000 1136.000 1464.000 816.000
```

## Running marmot2
test_marmot2 2356.000 5284.000 5264.000 4644.000 4720.000 4656.000 4588.000

## Running marmot3
test_heatmap 7884.000 3312.000 3308.000 2632.000 2608.000 3288.000 3308.000

## Running marmot multinode offline
```
run_3phases 9353.000 5952.000 4904.000 5692.000 5356.000 5560.000 4888.000
```

## Appendix: Additional system information

### Top results before running benchmarks:
```
top - 16:12:48 up 23 days, 46 min, 5 users, load average: 0.99, 1.00, 0.75
Tasks: 158 total, 2 running, 156 sleeping, 0 stopped, 0 zombie
Cpu(s): 34.8%us, 4.4%sy, 1.8%ni, 58.2%id, 0.1%wa, 0.4%hi, 0.4%si, 0.0%st
Mem: 2073956k total, 338844k free, 69552k buffers
```

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### Top results after running benchmarks:
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top - 16:29:19 up 23 days, 1:03, 5 users, load average: 1.08, 1.08, 0.94
Tasks: 158 total, 1 running, 157 sleeping, 0 stopped, 0 zombie
Cpu(s): 34.8%us, 4.4%sy, 1.7%ni, 58.2%id, 0.1%wa, 0.4%hi, 0.4%si, 0.0%st
Mem: 2073956k total, 1118356k used, 955600k free, 19152k buffers
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