

## Ruby trunk - Feature #6615

### Release GVL in zlib when calling inflate() or deflate()

06/21/2012 09:20 AM - drbrain (Eric Hodel)

<b>Status:</b>	Closed
<b>Priority:</b>	Normal
<b>Assignee:</b>	
<b>Target version:</b>	2.0.0
<b>Description</b>	
<p>This patch switches from zstream_run from using rb_thread_schedule() to rb_thread_blocking_region().</p> <p>I don't see a way to safely interrupt deflate() or inflate() so the unblocking function is empty.</p> <p>This patch should allow use of output buffer sizes larger than 16KB. I suspect 16KB was chosen to allow reasonable context-switching time for ruby 1.8 and earlier. A larger buffer size would reduce GVL contention when processing large streams.</p> <p>An alternate way to reduce GVL contention would be to move zstream_run's loop outside the GVL, but some manual allocation would be required as currently the loop uses a ruby String as the output buffer.</p>	

#### Associated revisions

##### Revision 36270 - 07/02/2012 09:03 PM - drbrain (Eric Hodel)

- ext/zlib/zlib.c (zstream\_run): Process zlib streams without GVL. [Feature #6615]
- NEWS: ditto.

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##### Revision 36283 - 07/03/2012 05:52 AM - drbrain (Eric Hodel)

- ext/zlib/zlib.c (zstream\_run\_func): Fix bug that caused early exit of GVL-free loop. [Feature #6615]
- ext/zlib/zlib.c: Fix style to match existing functions.

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## History

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### #1 - 06/21/2012 11:53 AM - normalperson (Eric Wong)

"drbrain (Eric Hodel)" [drbrain@segment7.net](mailto:drbrain@segment7.net) wrote:

I don't see a way to safely interrupt deflate() or inflate() so the unblocking function is empty.

I think you can safely specify NULL for the ubf in this case instead of using an empty function.

This patch should allow use of output buffer sizes larger than 16KB. I suspect 16KB was chosen to allow reasonable context-switching time for ruby 1.8 and earlier. A larger buffer size would reduce GVL contention when processing large streams.

Cool!

### #2 - 06/21/2012 03:56 PM - drbrain (Eric Hodel)

- *File `zlib.release_gvl.2.patch` added*

This second patch moves the entire run loop outside the GVL, but messes with the internals of String to expand z->buf.

This patch allows large streams to be processed without GVL contention.

**#3 - 06/26/2012 08:27 AM - drbrain (Eric Hodel)**

- File `zlib.release_gvl.3.patch` added

This patch allocates one extra byte for the '\0' sentinel like `rb_str_resize()`

**#4 - 06/26/2012 11:47 AM - kosaki (Motohiro KOSAKI)**

Can you please measure performance impact? Because GVL acquire is costly operation. The performance benefit is not obvious to me.

**#5 - 06/27/2012 03:23 AM - drbrain (Eric Hodel)**

Here is a demonstration video:

<http://www.youtube.com/watch?v=uvidgwKyPh4>

To skip past the code, use:

<http://www.youtube.com/watch?v=uvidgwKyPh4#t=41>

**#6 - 06/27/2012 06:02 AM - drbrain (Eric Hodel)**

=begin

Here is a second benchmark using a gzipped file of 1GB from `/dev/random`, but only for a single thread using

`ruby 2.0.0dev (2012-06-26 trunk 36225) [x86_64-darwin11.4.0]`

Code:

```
require 'zlib'
require 'benchmark'
```

```
gz = File.read '1G.gz'
```

```
z = Zlib::Inflate.new Zlib::MAX_WBITS + 32 # automatic gzip detection
```

```
times = Benchmark.measure do
  z.inflate gz
  z.finish
end
```

```
puts times
```

Without patch:

```
$ ruby20 test.rb
1.850000 0.950000 2.800000 ( 2.802966)
[ 13:55 drbrain@YPCMC10014:~/Work/svn/ruby/trunk ]
$ ruby20 test.rb
1.840000 0.950000 2.790000 ( 2.791687)
[ 13:55 drbrain@YPCMC10014:~/Work/svn/ruby/trunk ]
$ ruby20 test.rb
1.870000 0.990000 2.860000 ( 2.850076)
```

With patch 3:

```
$ make runruby
./miniruby -I./lib -I. -I.ext/common ./tool/runruby.rb --extout=.ext -- --disable-gems ./test.rb
1.850000 0.960000 2.810000 ( 2.807008)
$ make runruby
./miniruby -I./lib -I. -I.ext/common ./tool/runruby.rb --extout=.ext -- --disable-gems ./test.rb
1.840000 0.930000 2.770000 ( 2.771213)
$ make runruby
./miniruby -I./lib -I. -I.ext/common ./tool/runruby.rb --extout=.ext -- --disable-gems ./test.rb
1.840000 0.970000 2.810000 ( 2.817809)
```

So for large files there is no perceptible difference for a single thread.

=end

### #7 - 06/27/2012 06:23 AM - drbrain (Eric Hodel)

=begin

This benchmark inflates ~43,000 100KB deflate strings (~1GB total input) using the same ruby version as above.

Code:

```
require 'zlib'  
require 'benchmark'
```

```
r = Random.new 0
```

```
file_count = 2**30 / 100_000 # 100KB chunks in 1GB
```

```
deflated = (0..file_count).map do  
  input = r.bytes 100_000  
  Zlib::Deflate.deflate input  
end
```

```
times = Benchmark.measure do  
  deflated.each do |input|  
    Zlib::Inflate.inflate input  
  end  
end
```

```
puts times
```

Without patch:

```
$ ruby20 test.rb  
1.350000 0.040000 1.390000 ( 1.378062)  
$ ruby20 test.rb  
1.330000 0.010000 1.340000 ( 1.343311)  
$ ruby20 test.rb  
1.350000 0.020000 1.370000 ( 1.363618)  
$ ruby20 test.rb  
1.430000 0.030000 1.460000 ( 1.464801)
```

With patch:

```
$ make runruby  
1.170000 0.020000 1.190000 ( 1.198120)  
$ make runruby  
1.250000 0.020000 1.270000 ( 1.273507)  
$ make runruby  
1.320000 0.010000 1.330000 ( 1.333873)
```

So there is a slight increase in performance, probably due to use of realloc vs REALLOC\_N

=end

## #8 - 06/27/2012 06:47 AM - drbrain (Eric Hodel)

=begin

This benchmarks inflates 100,000 1000byte deflate strings. 1000 bytes is smaller than the default Zlib buffer size, so use of realloc vs REALLOC\_N should not matter.

Code:

```
require 'zlib'  
require 'benchmark'
```

```
r = Random.new 0
```

```
file_count = 100_000
```

```
deflated = (0..file_count).map do  
  input = r.bytes 1000  
  Zlib::Deflate.deflate input  
end
```

```
times = Benchmark.measure do  
  deflated.each do |input|  
    Zlib::Inflate.inflate input  
  end  
end
```

```
puts times
```

Without patch:

```
$ for f in jot 5; do ruby20 test.rb; done  
0.810000 0.060000 0.870000 ( 0.864994)  
0.800000 0.050000 0.850000 ( 0.863737)  
0.800000 0.060000 0.860000 ( 0.851056)  
0.830000 0.060000 0.890000 ( 0.887332)  
0.810000 0.060000 0.870000 ( 0.866989)
```

With patch:

```
$ for f in jot 5; do make runruby; done  
0.780000 0.060000 0.840000 ( 0.851944)  
0.800000 0.060000 0.860000 ( 0.865989)  
0.770000 0.050000 0.820000 ( 0.823333)  
0.770000 0.060000 0.830000 ( 0.828246)  
0.760000 0.060000 0.820000 ( 0.828063)
```

Slight increase in performance.

=end

## #9 - 06/27/2012 06:57 AM - drbrain (Eric Hodel)

=begin  
Since the last benchmark is so close, this benchmark uses the same deflate file set, but adds GVL contention by deflating the set across four threads.  
Since no buffer expansion occurs this will benchmark cost of GVL release vs rb\_thread\_schedule() in present Zlib code.

Code:

```
require 'zlib'
require 'benchmark'

r = Random.new 0

file_count = 100_000

deflated = (0..file_count).map do
  input = r.bytes 1000
  Zlib::Deflate.deflate input
end

times = Benchmark.measure do
  (0..3).map do
    Thread.new do
      deflated.each do |input|
        Zlib::Inflate.inflate input
      end
    end
  end.each do |t|
    t.join
  end
end

puts times
```

Without patch:

```
$ for f in jot 5; do ruby20 test.rb; done
5.420000  5.970000 11.390000 ( 8.162893)
5.400000  6.270000 11.670000 ( 8.263046)
5.460000  5.920000 11.380000 ( 8.133742)
5.410000  6.290000 11.700000 ( 8.289913)
5.500000  6.620000 12.120000 ( 8.478085)
```

With patch:

```
$ for f in jot 5; do make runruby; done
5.120000  6.240000 11.360000 ( 8.039715)
5.240000  6.260000 11.500000 ( 8.097961)
5.280000  5.940000 11.220000 ( 8.004246)
5.210000  6.360000 11.570000 ( 8.171124)
5.240000  6.200000 11.440000 ( 8.054929)
```

Again, slight improvement, but not as great as the video.

The inflate function is able to operate in parallel a small fraction of the time which is able to make up for the cost of GVL release/acquire.  
=end

#10 - 06/27/2012 07:29 AM - drbrain (Eric Hodel)

=begin  
Re-running this last benchmark with only 10,000 files across 50 runs, using ministat from FreeBSD to calculate the decrease in time, the real run time is reduced 2.6% +/- 1.9% at 99% confidence:

```
$ ministat -c 99 -s without with
x without
+ with
+-----+
|          +  ++ x  * xx  x          |
|  +  x+ +  + + + + x  +xx*xx  x* x+  x |
|+  +++++ x + x*+ * + ++x+x++x*++x* ***+xxx * +x**** * + x x  xx|
|          |-----|          |
|          |-----|          |
+-----+
N      Min      Max      Median      Avg      Stddev
x 50  0.61660767  0.71641994  0.66669798  0.66647618  0.022548872
+ 50  0.59242272  0.69294882  0.64941692  0.64917859  0.02509235
Difference at 99.0% confidence
-0.0172976 +/- 0.0125332
-2.59538% +/- 1.88051%
(Student's t, pooled s = 0.0238545)
```

See <http://www.freebsd.org/cgi/man.cgi?query=ministat> for the ministat man page

=end

#11 - 06/28/2012 12:58 PM - kosaki (Motohiro KOSAKI)

Thank you. I'm convinced this is good feature. :)  
So, +1 from me.

#12 - 07/03/2012 06:03 AM - drbrain (Eric Hodel)

- Status changed from Open to Closed  
- % Done changed from 0 to 100

This issue was solved with changeset [r36270](#).  
Eric, thank you for reporting this issue.  
Your contribution to Ruby is greatly appreciated.  
May Ruby be with you.

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- ext/zlib/zlib.c (zstream\_run): Process zlib streams without GVL. [Feature [#6615](#)]
  - NEWS: ditto.

## Files

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zlib.release_gvl.patch	2.32 KB	06/21/2012	drbrain (Eric Hodel)
zlib.release_gvl.2.patch	5.3 KB	06/21/2012	drbrain (Eric Hodel)
zlib.release_gvl.3.patch	5.35 KB	06/26/2012	drbrain (Eric Hodel)