Ruby master - Bug #12274
accessing to instance variable should be fast.
04/12/2016 03:50 PM - tarui (Masaya Tarui)

Status: Closed
Priority: Normal
Assignee: 
Target version:
ruby -v: ruby 2.4.0dev (2016-04-12 trunk 54553) [x86_64-linux]
Backport: 2.1: UNKNOWN, 2.2: UNKNOWN, 2.3: UNKNOWN

Description
Currently, accessing to instance variable is quite slower than accessing to local variable. I think accessing to instance variable is basic operation and it should be fast, so tried to improve.

patch: https://github.com/tarui/ruby/commit/dd993da80c7ad84340689137bf8b308793595cae

On mame's optcarrot benchmark, (https://github.com/mame/optcarrot/) it is 10%(!) faster than trunk. It increases in the maintenance cost a little, but can I commit it?

```
$ ./ruby -v --disable-gems ../optcarrot/bin/optcarrot --benchmark ../optcarrot/examples/Lan_Master.nes
ruby 2.4.0dev (2016-04-12 trunk 54553) [x86_64-linux]
fps: 13.664029283085743
checksum: 59662
```
```
$ ./ruby -v --disable-gems ../optcarrot/bin/optcarrot --benchmark ../optcarrot/examples/Lan_Master.nes
ruby 2.4.0dev (2016-04-12 fast-ivar-access 54553) [x86_64-linux]
fps: 15.120651593726231
checksum: 59662
```

Associated revisions
Revision 44916ec4 - 05/11/2016 12:50 PM - tarui (Masaya Tarui)

* compile.c (iseq_compile_each): share InlineCache during same instance variable accesses. Reducing memory consumption, raising cache hit rate and raising branch prediction hit rate are expected. A part of [Bug #12274].

  * iseq.h (struct iseq_compile_data): introduce instance variable IC table for sharing.

  * iseq.c (prepare_iseq_build, compile_data_free): construct/destruct above table.

Revision 54976 - 05/11/2016 12:50 PM - tarui (Masaya Tarui)

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History
#1 - 04/12/2016 07:21 PM - ko1 (Koichi Sasada)
Tarui-san suggested another way to optimize and this is my version of that technique (with some refactoring).

evaluation result:
fps: 19.2135880758348
->
fps: 22.16285461090967
vm_getivar(VALUE obj, ID id, IC ic, struct rb_call_cache *cc, int is_attr)
{
  #if USE_IC_FOR_IVAR
    if (RB_TYPE_P(obj, T_OBJECT)) {
      VALUE val = Qundef;
      VALUE klass = RBASIC(obj)->klass;
      VALUE ic_value;
  
      if (LIKELY(is_attr ? cc->aux.index > 0 : ic->ic_serial == RCLASS_SERIAL(klass))) {
        const long len = ROBJECT_NUMIV(obj);
        const VALUE *const ptr = ROBJECT_IVPTR(obj);
        long index = !is_attr ? (long)ic->ic_value.index : (long)(cc->aux.index - 1);
        if (LIKELY(is_attr ? cc->aux.index > 0 : ic->ic_serial == RCLASS_SERIAL(klass))) {
          long index = !is_attr ? (long)ic->ic_value.index : (long)(cc->aux.index - 1);
          if (index < len) {
            val = ptr[index];
          }  
          if (index < len && (val = ptr[index]) != Qundef) {
            return val;
          }
        }  
        else if (RB_TYPE_P(obj, T_OBJECT)) {
          const long len = ROBJECT_NUMIV(obj);
          const VALUE *const ptr = ROBJECT_IVPTR(obj);
          st_data_t index;
          struct st_table *iv_index_tbl = ROBJECT_IV_INDEX_TBL(obj);
          goto undefined;
        }  
        else if (RB_TYPE_P(obj, T_OBJECT)) {
          const long len = ROBJECT_NUMIV(obj);
          const VALUE *const ptr = ROBJECT_IVPTR(obj);
          st_data_t index;
          struct st_table *iv_index_tbl = ROBJECT_IV_INDEX_TBL(obj);
          val = Qundef;
          if (iv_index_tbl) {
            if (st_lookup(iv_index_tbl, id, &index)) {
              if (!(long)index < len) {
                val = ptr[index];
              }  
              if (!is_attr) {
                ic->ic_value.index = index;
                ic->ic_serial = RCLASS_SERIAL(klass);
              }  
              else { /* call_info */
                cc->aux.index = (int)index + 1;
              }  
            }  
            else if (iv_index_tbl) {
              if (st_lookup(iv_index_tbl, id, &index)) {
                if (!is_attr) {
                  ic->ic_value.index = index;
                  ic->ic_serial = RCLASS_SERIAL(klass);
                }  
                else { /* call_info */
                  cc->aux.index = (int)index + 1;
                }  
              }  
              if (!(long)index < len && (val = ptr[index]) != Qundef) {
                return val;
              }
            }
          }  
          if (UNLIKELY(val == Qundef)) {
            if (!is_attr && RTEST(ruby_verbose))
              rb_warning("instance variable \"%s\" not initialized", QUOTE_ID(id));
            val = Qnil;
            undefined:
          }  
        }  
      }  
    }  
  }  
  return val;
}
Koichi Sasada wrote:

Tarui-san suggested another way to optimize and this is my version of that technique (with some refactoring).

The diff is hard to read, would you have a commit on GitHub or a patch file?

Tarui-san, could you explain a bit the technique?
I am not sure to understand, it seems vm_getinstancevariable already has some inline cache.
Is it some manual inlining in the instruction code + avoiding some ID2SYM/INT2FIX (but these two seem performed at compile time, so mostly irrelevant for the benchmark)?

#3 - 04/13/2016 01:13 AM - tarui (Masaya Tarui)

there are 2 parts of optimization.

- share inline cache between same symbol(at compile.c)
- inline fast pass only and cut useless check(RB_TYPE_P).(at insns.def)

We can skip st_lookup from the 2nd insns by sharing cache.

Inlining register pass may have a bit penalty.
Cutting check was a accidental :-), but it is not necessary if cached serial equals class one.

#4 - 04/13/2016 01:32 AM - tarui (Masaya Tarui)

2016-04-13 5:41 GMT+09:00
eregontp@gmail.com:

Issue #12274 has been updated by Benoit Daloze.
avoiding some ID2SYM/INT2FIX (but these two seem performed at compile time, so mostly irrelevant for the benchmark)?

It is not for avoiding ID2SYM (In fact, it is calculated every time :-), it is for sharing.
Please check the 0007 below

```
$ ./ruby -v --disable-gems --dump=insns -e"@a=1;p@a"
ruby 2.4.0dev (2016-04-12 trunk 54553) [x86_64-linux]
== disasm: #<ISeq:<main>@-e>============================================
0000 trace 1
0002 putobject_OP_INT2FIX_O_1_C_
0003 setinstancevariable :@a, <is:0>
0006 putself
0007 getinstancevariable :@a, <is:1>
0010 opt_send_without_block <callinfo!mid:p, argc:1, FCALL|ARGS_SIMPLE>, <callcache>
0013 leave
```

```bash
$ ./ruby -v --disable-gems --dump=insns -e"@a=1;p@a"
ruby 2.4.0dev (2016-04-12 fast-ivar-access 54553) [x86_64-linux]
== disasm: #<ISeq:<main>@-e>============================================
0000 trace 1
0002 putobject_OP_INT2FIX_O_1_C_
0003 setinstancevariable :@a, <is:0>
0006 putself
0007 getinstancevariable :@a, <is:0>
0010 opt_send_without_block <callinfo!mid:p, argc:1, FCALL|ARGS_SIMPLE>, <callcache>
0013 leave
```
there are 2 parts of optimization.

- share inline cache between same symbol (at compile.c)
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We can skip st_lookup from the 2nd insns by sharing cache.

Inlining register pass may have a bit penalty.

Cutting check was a accidental ;-), but it is not necessary if cached serial equals class one.

I see, thanks for explaining :)

About the object check, is it not problematic to do (struct RBasic* obj)->klass if obj is a tagged integer (since klass is the second member, after flags)?
Or is there a hidden check before doing that?

Thank you for pointing out.
I'll revive check.

About the object check, is it not problematic to do (struct RBasic* obj)->klass if obj is a tagged integer (since klass is the second member, after flags)?

Thank you for pointing out.
I'll revive check.

Applied in changeset r54976.

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