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

<table>
<thead>
<tr>
<th>Status:</th>
<th>Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority:</td>
<td>Normal</td>
</tr>
<tr>
<td>Assignee:</td>
<td></td>
</tr>
<tr>
<td>Target version:</td>
<td>ruby 2.4.0dev (2016-04-12 trunk 54553) [x86_64-linux]</td>
</tr>
</tbody>
</table>

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](https://github.com/tarui/ruby/commit/dd993da80c7ad84340689137bf8b308793595cae)

It increases in the maintenance cost a little, but can I commit it?

```bash
$ ./ruby --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 --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.

```
git-svn-id: svn+ssh://ci.ruby-lang.org/ruby/trunk@54976 b2dd03c8-39d4-4d8f-98ff-823fe69b080e
```

Revision 54976 - 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.
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.

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.

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.

vm_insnhelper.c (vm_getivar): describe fast-path explicit (compiler friendy). [Bug #12274].

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

evaluation result:
fps: 19.21335880758348
->
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 val;

    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 {
          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 (!is_attr) {
              ic->ic_value.index = index;
              ic->ic_serial = RCLASS_SERIAL(klass);
            } else { /* call info */
              cc->aux.index = (int)index + 1;
            }

            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);
            val = Qundef;

            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 (index < len && (val = ptr[index]) != Qundef) {
                  return val;
                }
              }
            }
          }
        }
      }
    }
  } else if (UNLIKELY(val == Qundef)) {
    if (!is_attr && RTEST(ruby_verbose))
      rb_warning("instance variable %"PRIsVALUE" not initialized", QUOTE_ID(id));
    val = Qnil;
  }

  undefined:

  02/19/2020
  3/5
if (!is_attr && RTEST(ruby_verbose)) {
    rb_warning("instance variable %"PRIsVALUE" not initialized", QUOTE_ID(id));
}
return val;
return Qnil;
}
#endif /* USE_IC_FOR_IVAR */
if (is_attr)

---

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)?

#2 - 04/12/2016 08:41 PM - Eregon (Benoit Daloze)

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.

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

```ruby
$ ./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 ( 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
```

```ruby
$ ./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 ( 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
```

---

(Masaya TARUI)
No Tool, No Life.

#5 - 04/13/2016 07:17 AM - nobu (Nobuyoshi Nakada)
- Description updated

#6 - 04/13/2016 09:32 AM - Eregon (Benoit Daloze)
Masaya Tarui wrote:

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.

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?

#7 - 04/13/2016 12:55 PM - tarui (Masaya Tarui)

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.

#8 - 05/11/2016 12:50 PM - tarui (Masaya Tarui)
- Status changed from Open to Closed

Applied in changeset r54976.

- 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.