## 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

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?

```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.

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 friendly). [Bug #12274].

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

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

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

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

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: 19.21335880758348
->
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 klass = RBASIC(obj)->klass;
    +     VALUE val;
    +
    +     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 (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];
    -             } else {
    -                 st_data_t index;
    -                 struct st_table *iv_index_tbl = ROBJECT_IV_INDEX_TBL(obj);
    -                 goto undefined;
    -             }
    +             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 ((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 (/* 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 %PRIsVALUE" not initialized", QUOTE_ID(id));
    -                 val = Qnil;
    -             undefined:
    +                 undefined:
    -         }
    -     }
    - }
    +
    +
    +
    +
    +}
    - if (UNLIKELY(val == Qundef)) {
    -     if (!is_attr && RTEST(ruby_verbose))
    -         rb_warning("instance variable %PRIsVALUE" not initialized", QUOTE_ID(id));
    -     val = Qnil;
    + undefined:
    04/16/2020
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)

--- 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)?

--- 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.

--- 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

$ ./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

--- (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.

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?

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.

- 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.