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

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Priority:</td>
<td>Normal</td>
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<td>Assignee:</td>
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<td>2.1: UNKNOWN, 2.2: UNKNOWN, 2.3: UNKNOWN</td>
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ruby -v:
```
ruby 2.4.0dev (2016-04-12 trunk 54553) [x86_64-linux]
```

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)

On mame's optcarrot benchmark, ([https://github.com/mame/optcarrot/](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 rasing 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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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].
git-svn-id: svn+ssh://ci.ruby-lang.org/ruby/trunk@54977 b2dd03c8-39d4-4d8f-98ff-823fe69b080e

Compilation: 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.

Evaluation result:
fps: 19.21335880758348
->
fps: 22.16285461090967

Tarui-san suggested another way to optimize and this is my version of that technique (with some refactoring).
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))) {
+        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))) {
-            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 (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) {
+            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);
+                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 ALOG информация
+                            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 ALOG информации
+                                    cc->aux.index = (int)index + 1;
+                            } else {
+                                if ((long)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:
+                    }
```c
+ if (!is_attr &amp;&amp; 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)?

#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 an 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:

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 ( 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 ( 1)
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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
```

--樽家昌也(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].
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