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>
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<tbody>
<tr>
<td>Priority:</td>
<td>Normal</td>
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<tr>
<td>Assignee:</td>
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<td>Target version:</td>
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<tr>
<td>ruby -v:</td>
<td>ruby 2.4.0dev (2016-04-12 trunk 54553) [x86_64-linux]</td>
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<tr>
<td>Backport:</td>
<td>2.1: UNKNOWN, 2.2: UNKNOWN, 2.3: UNKNOWN</td>
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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 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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08/05/2021
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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

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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: 19.21335880758348
->
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];
                    } 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 ((long)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];
                                        } else if (is_attr) {
                                            ic->ic_value.index = index;
                                            ic->ic_serial = RCLASS_SERIAL(klass);
                                        } else { /* call_info */
                                            cc->aux.index = (int)index + 1;
                                        }
                                    } 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;
                                        }
                                    }
                                }
                            }
                        }
                    }
                }
            }
            else {
                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];
                        } else if (is_attr) {
                            ic->ic_value.index = index;
                            ic->ic_serial = RCLASS_SERIAL(klass);
                        } else { /* call_info */
                            cc->aux.index = (int)index + 1;
                        }
                    } 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 (LIKELY(!is_attr)) {
                if (is_attr && RTEST(ruby_verbose))
                    rb_warning("instance variable %"PRIsVALUE" not initialized", QUOTE_ID(id));
                val = Qnil;
                undefined:
            } else {
                if (RTEST(ruby_verbose))
                    rb_warning("instance variable %"PRIsVALUE" not initialized", QUOTE_ID(id));
                val = Qnil;
            }
        }
    
    if (UNLIKELY(val == Qundef)) {
        if (is_attr && RTEST(ruby_verbose))
            rb_warning("instance variable %"PRIsVALUE" not initialized", QUOTE_ID(id));
        val = Qnil;
        undefined:
    }
}
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:

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 ( 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)
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

--
樽家昌也(Masaya TARUI)

08/05/2021
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, rasing cache hit rate and rasing branch prediction hit rate are expected. A part of [Bug #12274].
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