An Observable OCaml

Compiling OCaml into C

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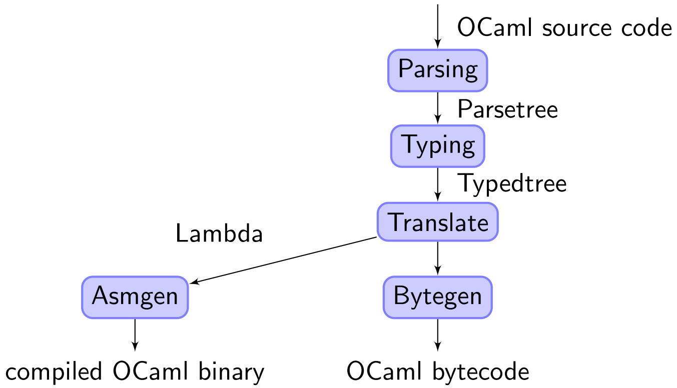
5th February, 2018

Structure of the project



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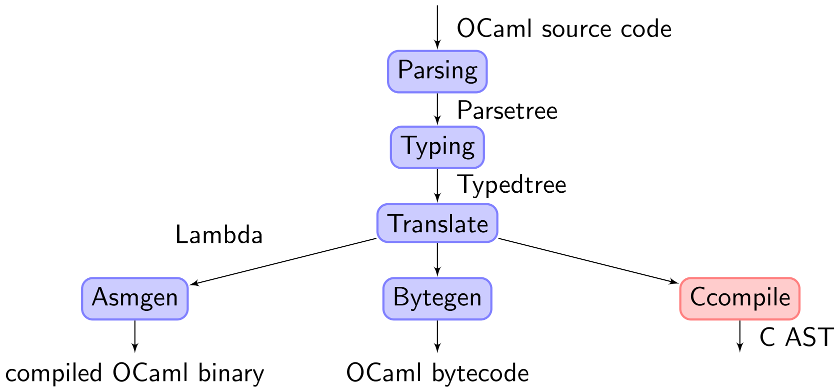

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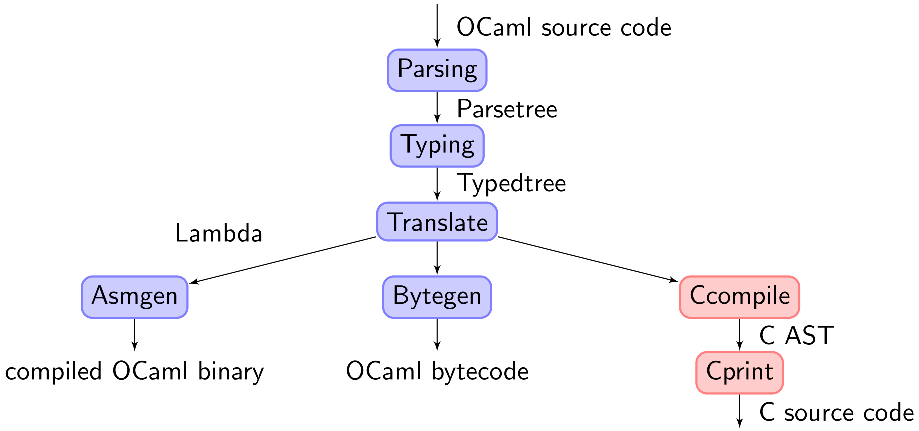

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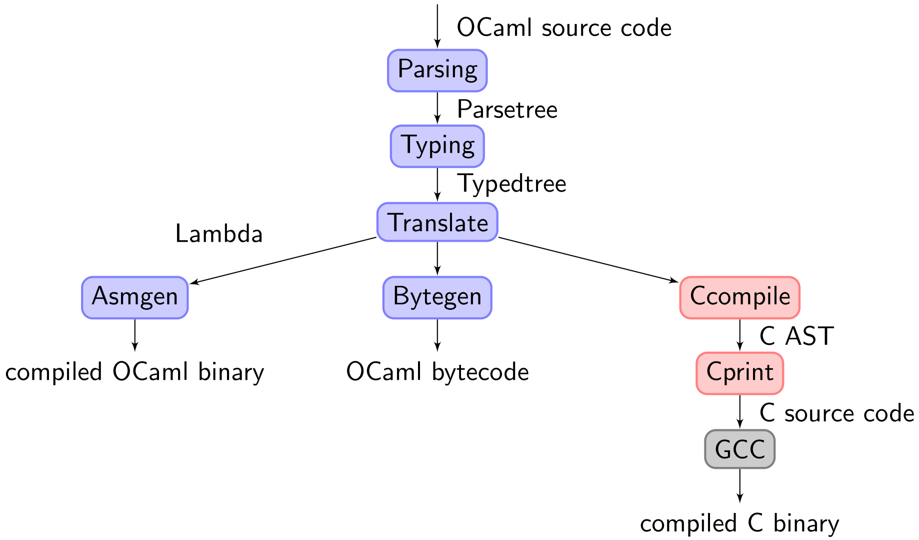

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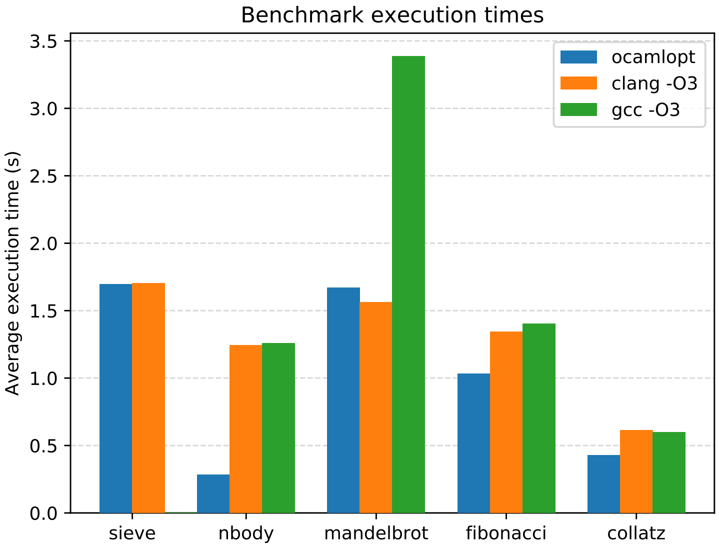
- design of algebraic data structure representation and implementation
- design of closure representation, closure conversion, and function and data structure polymorphism
- library of toy OCaml programs for testing and benchmarking
- some evaluation into performance and observability of compiled output

Benchmarks



Benchmark execution times
Average execution time (s)
3.5
3.0
2.5
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ocamlopt
clang -O3
gcc -O3
sieve
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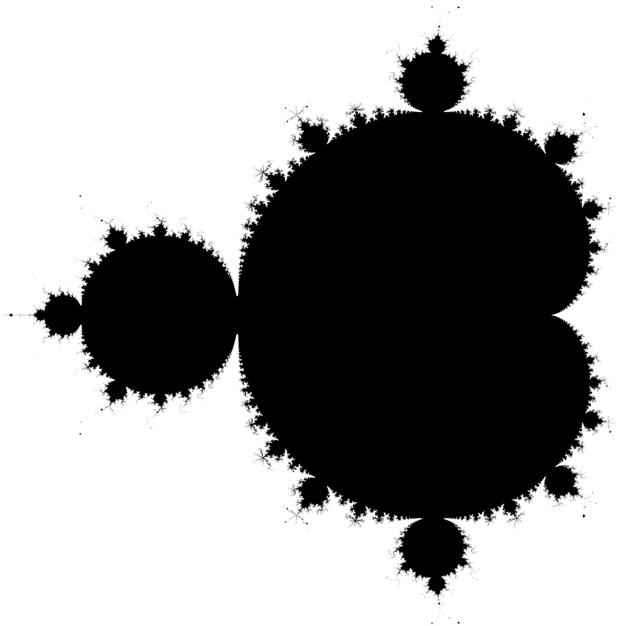

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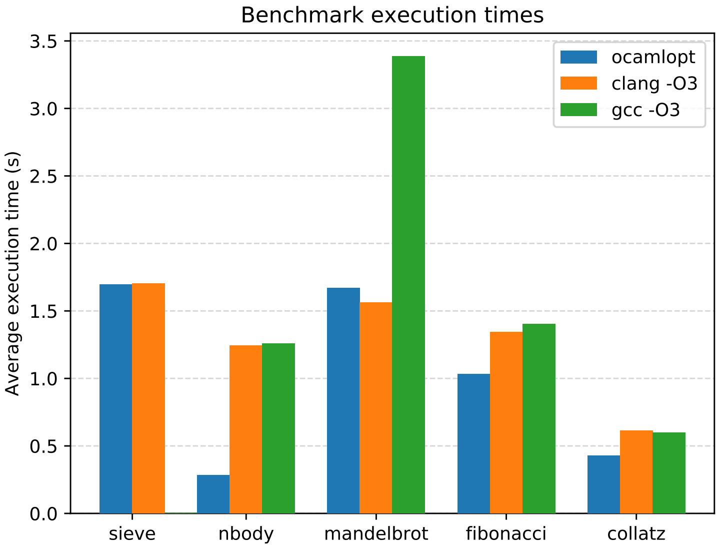
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Observability Demo

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1       let sum xs =
2         let rec go acc = function
3           | x :: xs -> go (acc + x) xs
4           | [] -> acc
5         in go 0 xs
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7       let a = sum [3]
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2         let rec go acc = function
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local_func_1215 (acc_1207=0, param_1210=..., closure_obj_1214=0x602050) at tes
2         let rec go acc = function
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3             | x :: xs -> go (acc + x) xs
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(gdb) p x_1208
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Observability Demo

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```

Observability Demo

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3           | x :: xs -> go (acc + x) xs
(gdb) p x_1208
$1 = 3
(gdb) p acc_1207
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Observability Demo

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(gdb) p xs_1209
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(gdb) p x_1208
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(gdb) p acc_1207
$2 = 0
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$3 = {i = 1, block = 0x1}
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local_func_1215 (acc_1207=3, param_1210=..., closure_obj_1214=0x602050) at tes
2         let rec go acc = function
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4           | [] -> acc
(gdb) finish
```

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```
(gdb)
3           | x :: xs -> go (acc + x) xs
(gdb) p x_1208
$1 = 3
(gdb) p acc_1207
$2 = 0
(gdb) p xs_1209
$3 = {i = 1, block = 0x1}
(gdb) s
local_func_1215 (acc_1207=3, param_1210=..., closure_obj_1214=0x602050) at tes
2         let rec go acc = function
(gdb)
4           | [] -> acc
(gdb) finish
Run till exit from #0  local_func_1215 (acc_1207=3, param_1210=..., closure_ob
0x0000000000400740 in local_func_1215 (acc_1207=0, param_1210=..., closure_obj
3           | x :: xs -> go (acc + x) xs
Value returned is $4 = 3
(gdb)
```

Further work

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Extension tasks:

- improving closure creation performance
- compilation of modules, functors and exceptions
- compilation of standard library modules

Some example C code

```
#line 2 "tests/observability/sum.ml"
intptr_t local_func_1215(intptr_t acc_1207,value_type param_1210,
    closure_t closure_obj_1214){closure_t go_1206;go_1206=
    TO_CLOSURE(closure_obj_1214[(TO_INT(*(closure_obj_1214))-1)]);
#line 2 "tests/observability/sum.ml"
intptr_t ifelse_return_1216;if(UNBOX_INT(param_1210)){variable_type
     field_access_1217;field_access_1217=UNBOX_BLOCK(param_1210)
    [2];intptr_t let_return_1218;{{value_type xs_1209;xs_1209=
    TO_VALUE(field_access_1217);variable_type field_access_1219;
    field_access_1219=UNBOX_BLOCK(param_1210)[1];intptr_t
    let_return_1220;{{intptr_t x_1208;x_1208=TO_INT(
    field_access_1219);
#line 3 "tests/observability/sum.ml"

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intptr_t binop_result_1221;binop_result_1221=(acc_1207+x_1208);
    intptr_t temp_1222;temp_1222=binop_result_1221;value_type
    temp_1223;temp_1223=xs_1209;intptr_t apply_result_1224;
    apply_result_1224=((intptr_t(*)(intptr_t,value_type,closure_t))
    ((intptr_t(*)(intptr_t,value_type,closure_t))TO_FUNC(go_1206[(
```