Abstrakte Maschinen UE

UB14 Interpreter

Patrick Thier
e1028297@student.tuwien.ac.at

June 22, 2015

Outline

Language UB14


```
1  Program: { Def ';' } Begin ';'
2         ;
3
4  Begin: begin Stats end /* Programm Einstiegspunkt */
5       ;
6
7  Def: Funcdef
8     | Structdef
9     ;
10
11 Structdef: struct id ':'  /* Strukturname */
12             { id }        /* Felddefinition */
13             end
14           ;
15
16 Funcdef: func id          /* Funktionsname */
17          '(' { id } ')'   /* Parameterdefinition */
18          Stats end
19        ;
20
21 Stats: { Stat ';' }
22       ;
23
24 Stat: return Expr
25      | cond { Expr then Stats end ';' } end
26      | let { id '=' Expr ';' } in Stats end
27      | with Expr ':' id do Stats end
28      | Lexpr '=' Expr          /* Zuweisung */
29      | Term
30      ;
31
32 Lexpr: id             /* Schreibender Variablenzugriff */
33       | Term '.' id   /* Schreibender Feldzugriff */
34       ;
35
36 Expr: { not | '-' } Term
37      | Term { '+' Term }
38      | Term { '*' Term }
39      | Term { or Term }
40      | Term ( '>' | '<>' ) Term
41      | new id /* Speicher fuer struct anlegen */
42      ;
43
44 Term: '(' Expr ')'
45      | num
46      | Term '.' id   /* Lesender Feldzugriff */
47      | id            /* Lesender Variablenzugriff */
48      | id '(' { Expr ',' } [ Expr ] ')' /* Funktionsaufruf */
49      ;
```

Virtual Machine

- Token Threaded (gcc computed goto)
- no Datatypes (everything is long)
- 1 Data Area containing stack and heap
- 5 Registers (PC, SP, FP, VP, NP)

File Format

- Header
  - magic (0xFB0C9)
  - command count
  - function count
  - integer argument count
  - long argument count
- Functions
  - id
  - line number
  - argument count
  - local variable count
- integer values
- long values
- Instructions
  - zero or one argument
  - argument int or long

File Format

- Header
  - magic (0xFB0C9)
  - command count
  - function count
  - integer argument count
  - long argument count
- Functions
  - id
  - line number
  - argument count
  - local variable count
- integer values
- long values
- Instructions
  - zero or one argument
  - argument int or long

File Format

- Header
  - magic (0xFB0C9)
  - command count
  - function count
  - integer argument count
  - long argument count
- Functions
  - id
  - line number
  - argument count
  - local variable count
- integer values
- long values
- Instructions
  - zero or one argument
  - argument int or long

File Format

- Header
  - magic (0xFB0C9)
  - command count
  - function count
  - integer argument count
  - long argument count
- Functions
  - id
  - line number
  - argument count
  - local variable count
- integer values
- long values
- Instructions
  - zero or one argument
  - argument int or long

Instruction Set

- Constants
  - push
  - const_<0-7>, const_n<0-7>
- Variables
  - stor, load
  - st_<0-7>, ld_<0-7>
- Arithmetic
  - add, mul, or, greater, notequal, neg, not
- Functions
  - call, ret, print
- Control Flow
  - jmp, jef, halt
- Structs
  - new, getfield, storfield

Instruction Set

- Constants
  - push
  - const_<0-7>, const_n<0-7>
- Variables
  - stor, load
  - st_<0-7>, ld_<0-7>
- Arithmetic
  - add, mul, or, greater, notequal, neg, not
- Functions
  - call, ret, print
- Control Flow
  - jmp, jef, halt
- Structs
  - new, getfield, storfield

Instruction Set

- Constants
  - push
  - const_<0-7>, const_n<0-7>
- Variables
  - stor, load
  - st_<0-7>, ld_<0-7>
- Arithmetic
  - add, mul, or, greater, notequal, neg, not
- Functions
  - call, ret, print
- Control Flow
  - jmp, jef, halt
- Structs
  - new, getfield, storfield

Instruction Set

- Constants
  - push
  - const_<0-7>, const_n<0-7>
- Variables
  - stor, load
  - st_<0-7>, ld_<0-7>
- Arithmetic
  - add, mul, or, greater, notequal, neg, not
- Functions
  - call, ret, print
- Control Flow
  - jmp, jef, halt
- Structs
  - new, getfield, storfield

Instruction Set

- Constants
  - push
  - const_<0-7>, const_n<0-7>
- Variables
  - stor, load
  - st_<0-7>, ld_<0-7>
- Arithmetic
  - add, mul, or, greater, notequal, neg, not
- Functions
  - call, ret, print
- Control Flow
  - jmp, jef, halt
- Structs
  - new, getfield, storfield

Instruction Set

- Constants
  - push
  - const_<0-7>, const_n<0-7>
- Variables
  - stor, load
  - st_<0-7>, ld_<0-7>
- Arithmetic
  - add, mul, or, greater, notequal, neg, not
- Functions
  - call, ret, print
- Control Flow
  - jmp, jef, halt
- Structs
  - new, getfield, storfield

Function Calls


```
1   func f (x)
2     return x+1;
3   end;
4
5   func g (a b)
6     return f(7);
7   end;
```

Table: before calling f

5	7	$\leftarrow SP$
4	caller VP	
3	caller FP	
2	return adress	$\leftarrow FP$
1	1	
0	2	$\leftarrow VP$

Table: before returning from f

9	8 (ret value)	$\leftarrow SP$
8	0	
7	3	
6	return adress	$\leftarrow FP$
5	7	$\leftarrow VP$
4	...	

Benchmarks

Micro Benchmarks:

- 92!
- fib(40)
- Bubblesort (2000 elements, worst case)

Languages:

- ub14
- Java
- Java (interpreted)
- C (-O0)
- C (-O3)

Measurements: [1]

- File Size
- Execution Time
  - executed 30 Times
  - mean of results evaulated

[1] 2x 2,26 GHz Quad-Core Intel Xeon, 20 GB 1066 MHz DDR3 ECC RAM, OS X 10.10.3

Benchmarks

Micro Benchmarks:

- 92!
- fib(40)
- Bubblesort (2000 elements, worst case)

Languages:

- ub14
- Java
- Java (interpreted)
- C (-O0)
- C (-O3)

Measurements: [1]

- File Size
- Execution Time
  - executed 30 Times
  - mean of results evaulated

[1] 2x 2,26 GHz Quad-Core Intel Xeon, 20 GB 1066 MHz DDR3 ECC RAM, OS X 10.10.3

Benchmarks

Micro Benchmarks:

- 92!
- fib(40)
- Bubblesort (2000 elements, worst case)

Languages:

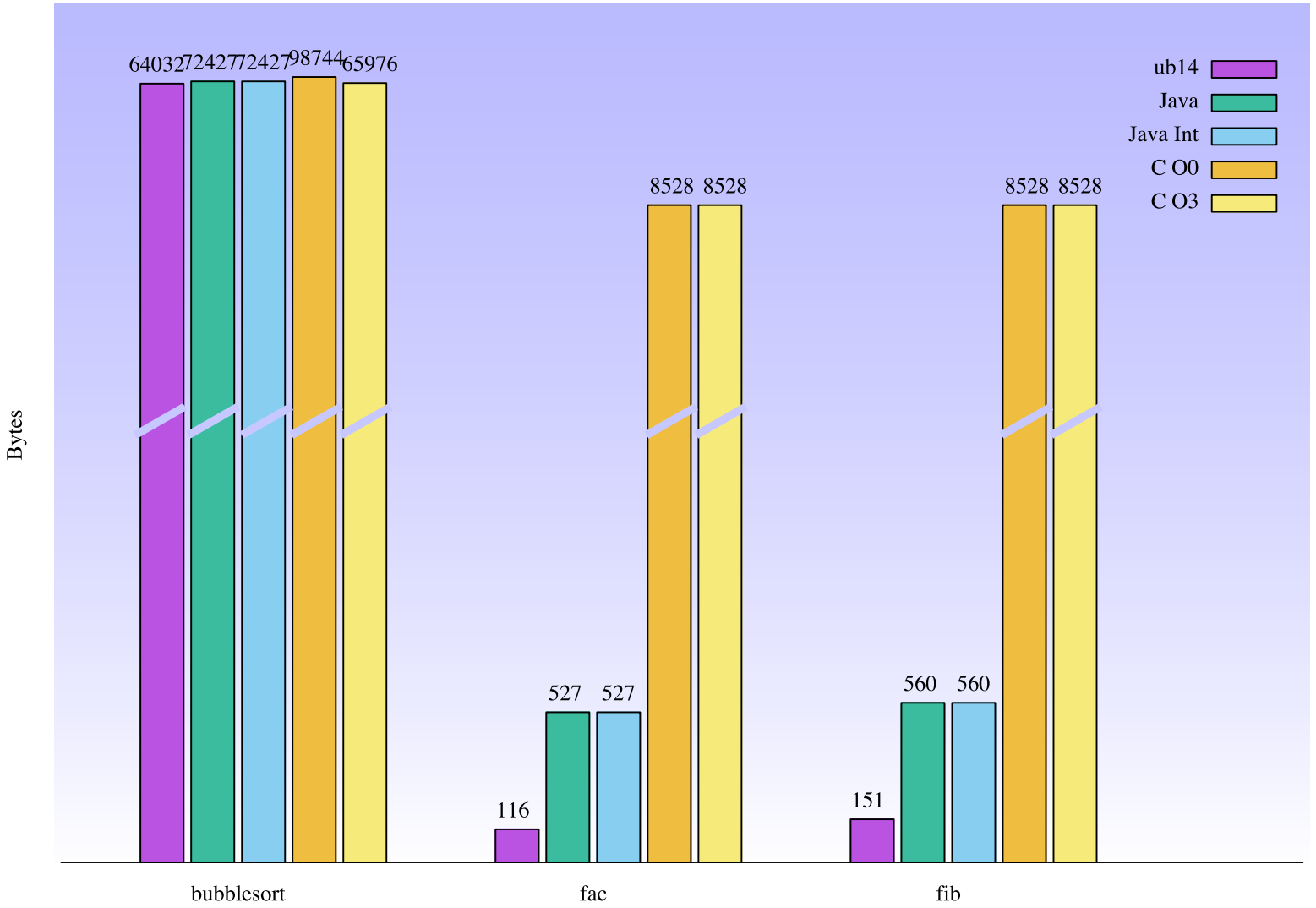
- ub14
- Java
- Java (interpreted)
- C (-O0)
- C (-O3)

Measurements: [1]

- File Size
- Execution Time
  - executed 30 Times
  - mean of results evaulated

[1] 2x 2,26 GHz Quad-Core Intel Xeon, 20 GB 1066 MHz DDR3 ECC RAM, OS X 10.10.3

File Size



Execution Time