

Integrating Vmgen-based Interpreters

Christian Thalinger

Vienna University of Technology

`twisti@complang.tuwien.ac.at`

What is Vmgen?

- interpreter generation script
- written in Forth
- part of gforth (and gforth's interpreter is generated with vmgen)

Threaded Code

VM Code



VM instruction routines

Machine code for imul
Dispatch next instruction

Machine code for iadd
Dispatch next instruction

Vmgen Input File

- see `src/vm/jit/intrp/java.vmg` in CACAO (process with `vmgen java.vmg`)
- examples:

```
ICONST ( #vConst -- vConst )
```

```
IADD ( vValue1 vValue2 -- vResult )
```

```
{
```

```
    vResult = vValue2 + vValue1;
```

```
}
```

Generating Threaded Code

- see `src/vm/jit/intrp/codegen.c` in CACAO
- examples:

```
case ICMD_ICONST:  
    gen_ICONST(cd, iptr->val.i);  
    break;
```

```
case ICMD_IADD:  
    gen_IADD(cd);  
    break;
```

Static Super Instructions

- combines 2 or more instructions statically (no need for dispatch)
- examples (most frequent):

```
_ALOAD_GETFIELD_CELL_ = ALOAD GETFIELD_CELL
```

```
_DUP_ICONST_ = DUP ICONST
```

```
_ALOAD_ALOAD_ = ALOAD ALOAD
```

```
_ICONST_ICONST_ = ICONST ICONST
```

```
_DUP_ICONST_ICONST_ = DUP ICONST ICONST
```

- CACAO currently uses 100 static super instructions

Dynamic Super Instructions

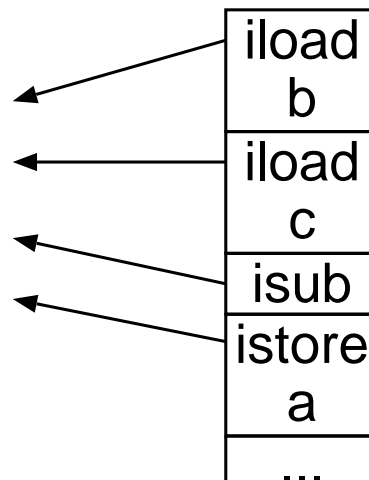
data segment

dyn. superinst code

Machine code for iload
Machine code for iload
Machine code for isub
Machine code for istore
...
Dispatch next

data segment

threaded VM Code

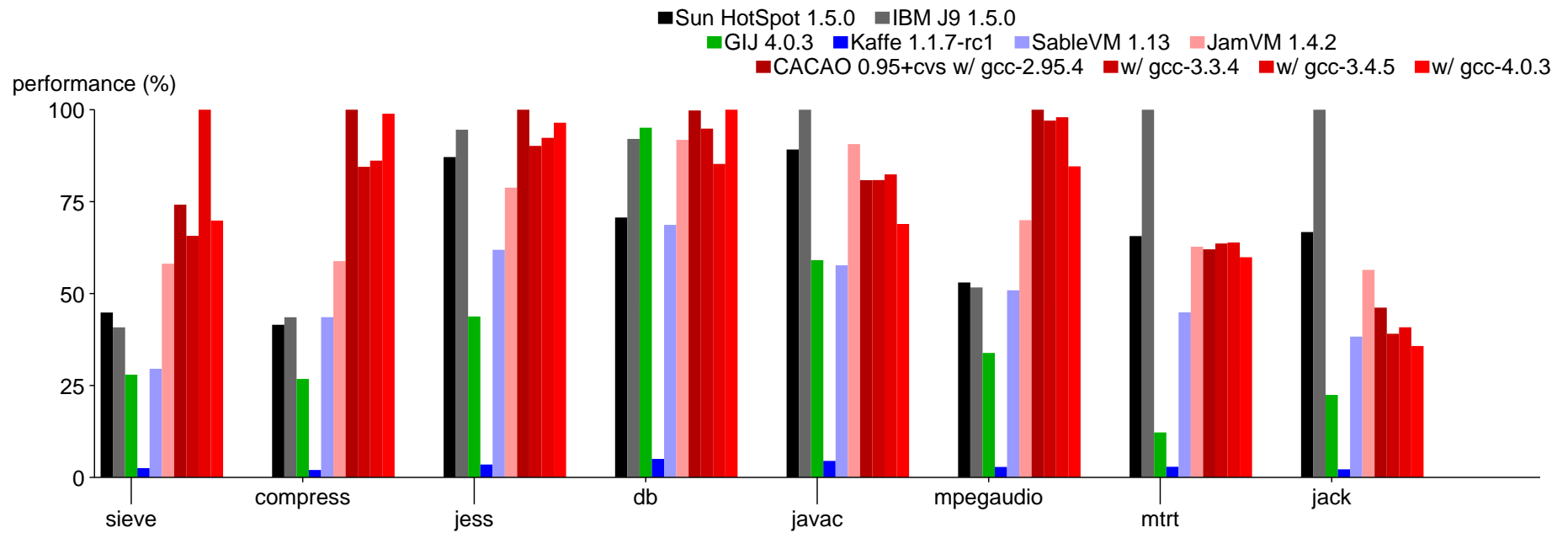


code segment

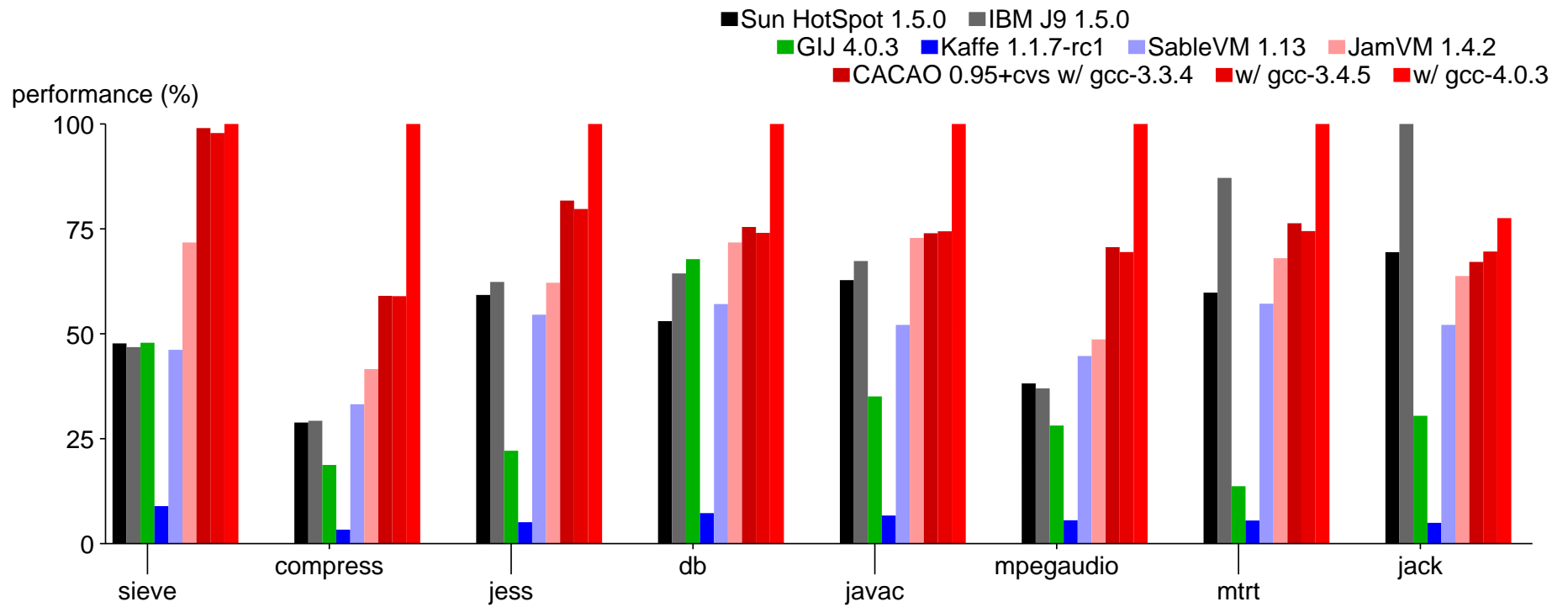
VM routine template

Machine code for isub
Dispatch next
Machine code for iload
Dispatch next
Machine code for istore
Dispatch next

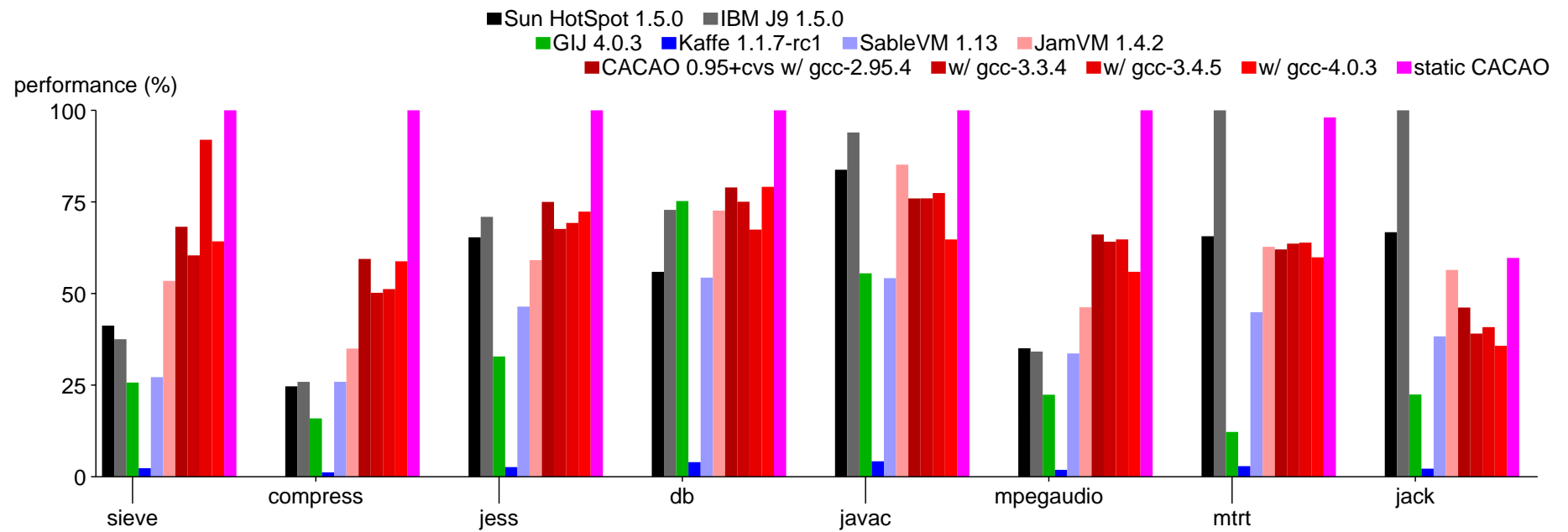
Comparison on IA32 (Dual-AMD Athlon XP)



Comparison on x86_64 (AMD Athlon 64 X2 Dual Core)



Comparison on IA32, the 2nd



Some things to notice

- uses GCC extensions (labels as jump targets)
- `-fomit-frame-pointer` for i386 (very important!)
- `-fno-reorder-blocks` with gcc-3.3 and later, otherwise no relocation possible
- need enhanced vmgen version (wait for next gforth release or use CACAO's vmgenx)