Proposing LLVM Extensions for Generating Native Code Fragments

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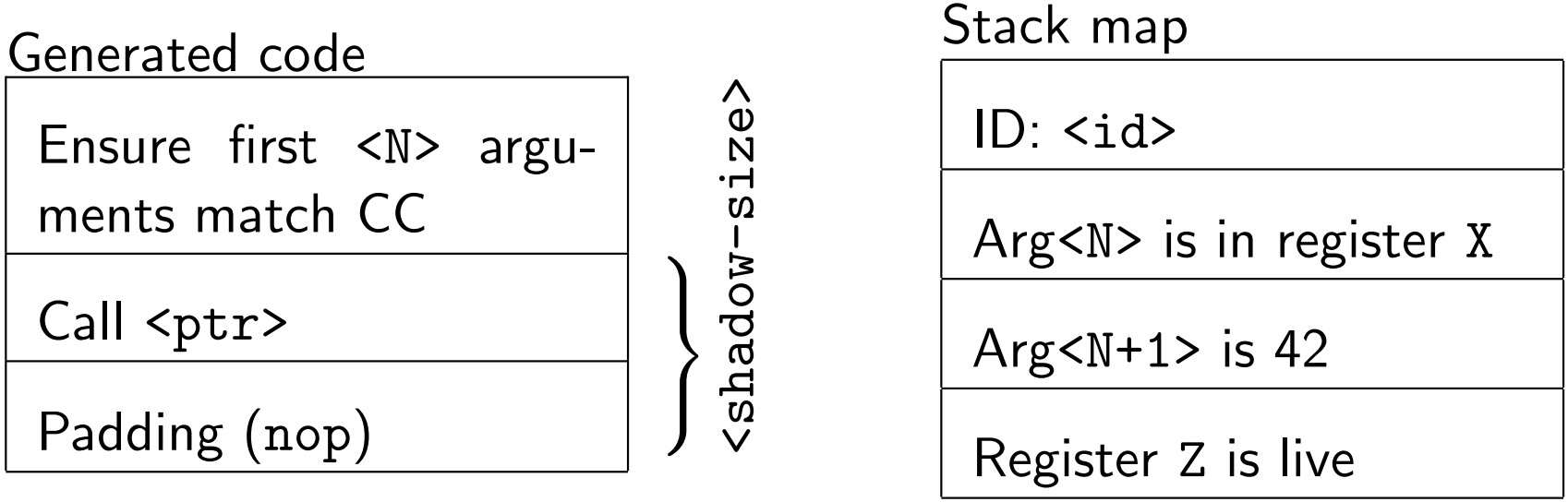
Who am I?

Senior researcher at the Swedish Institute of Computer Science (SICS) working on programming languages, tools and distributed systems.
Currently working on an Ericsson funded JIT-compiler for Erlang.

Patchpoints

```
call void (i64, i32, i8*, i32, ...)*
      @llvm.experimental.patchpoint.void(
           i64 <id>, i32 <shadow-size>,i8* <ptr>,
           i32 <N>, arg0, arg1, ....)
```



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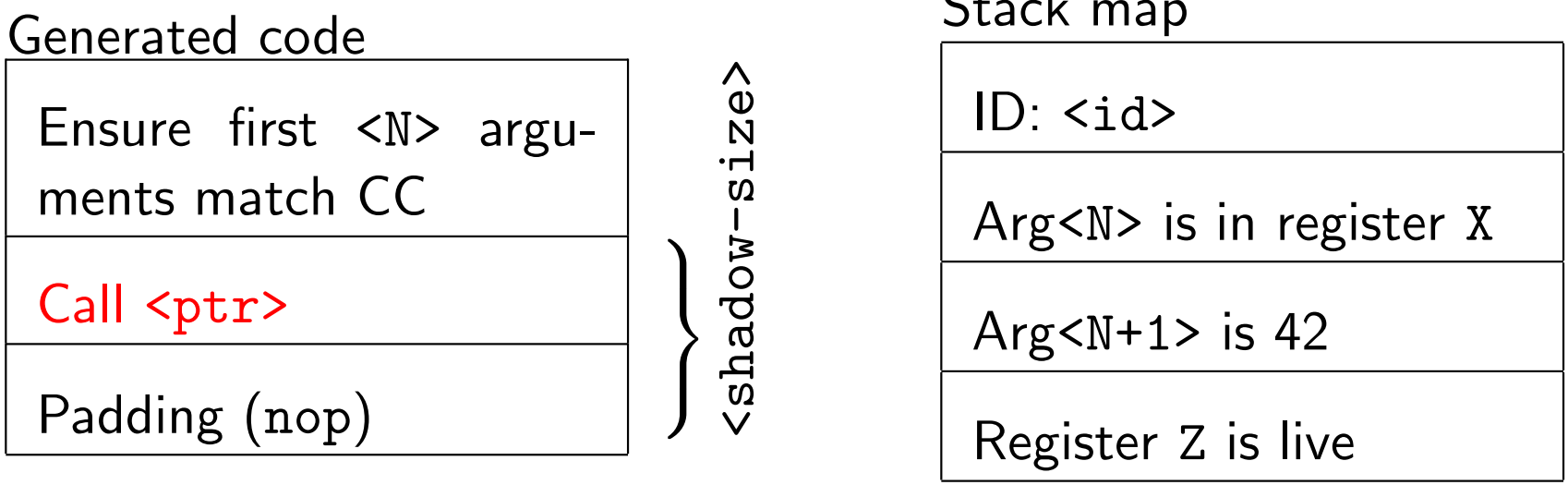

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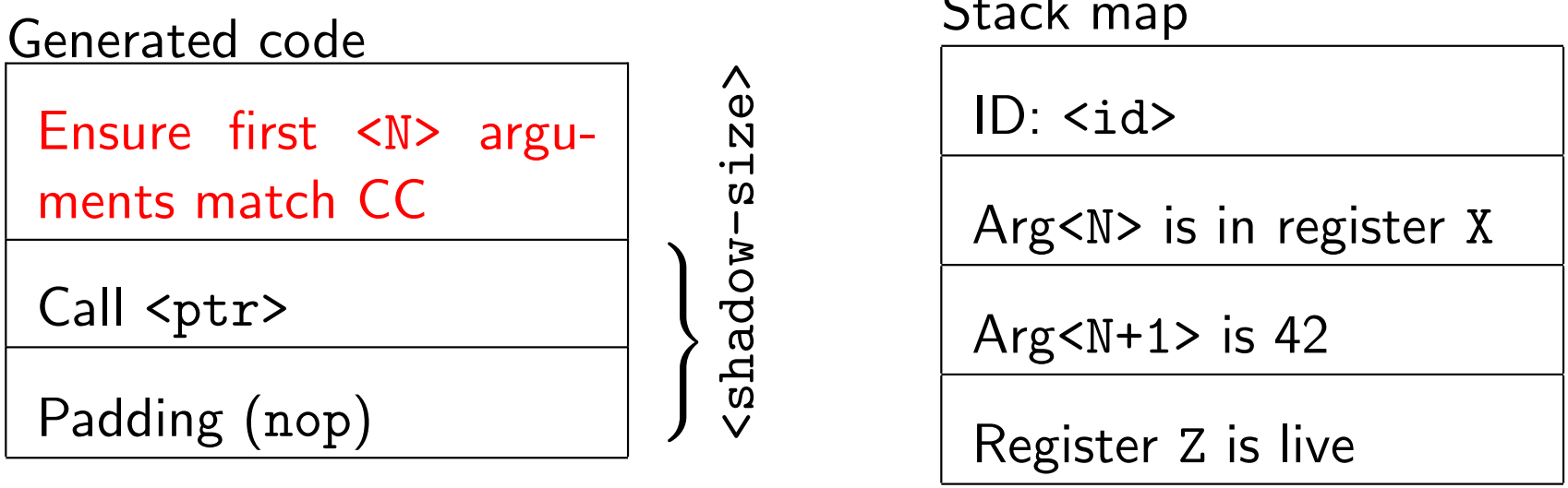

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Generated code

Ensure first <N> arguments match CC
Call <ptr>
Padding (nop)

<shadow-size>

Stack map

ID: <id>
Arg<N> is in register X
Arg<N+1> is 42
Register Z is live

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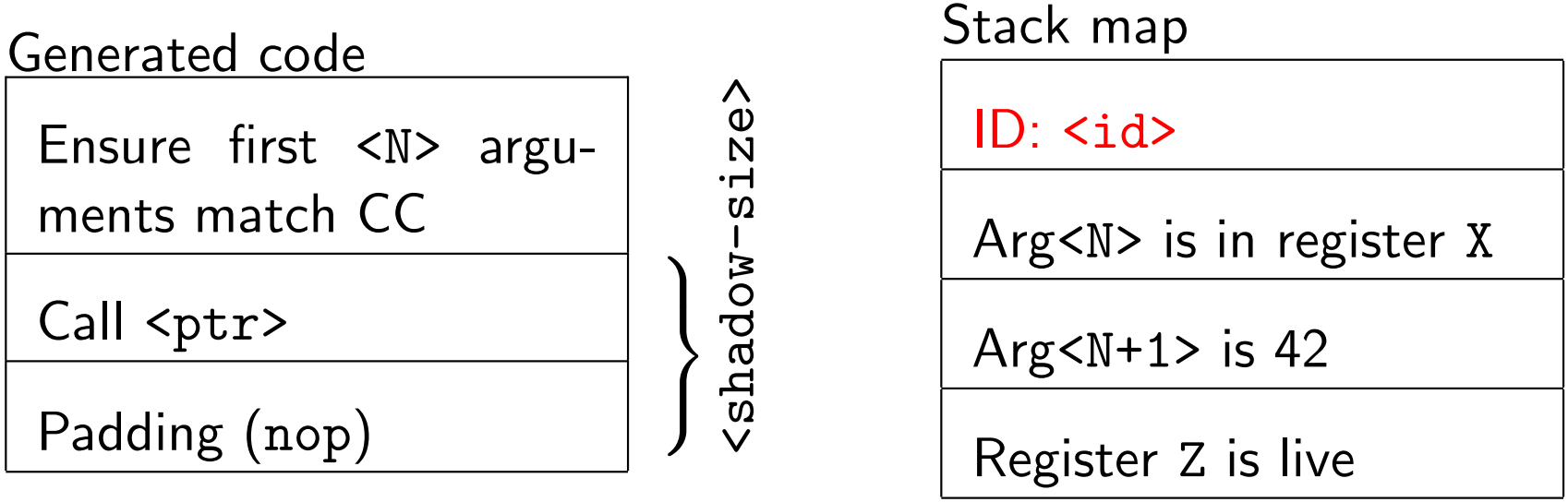

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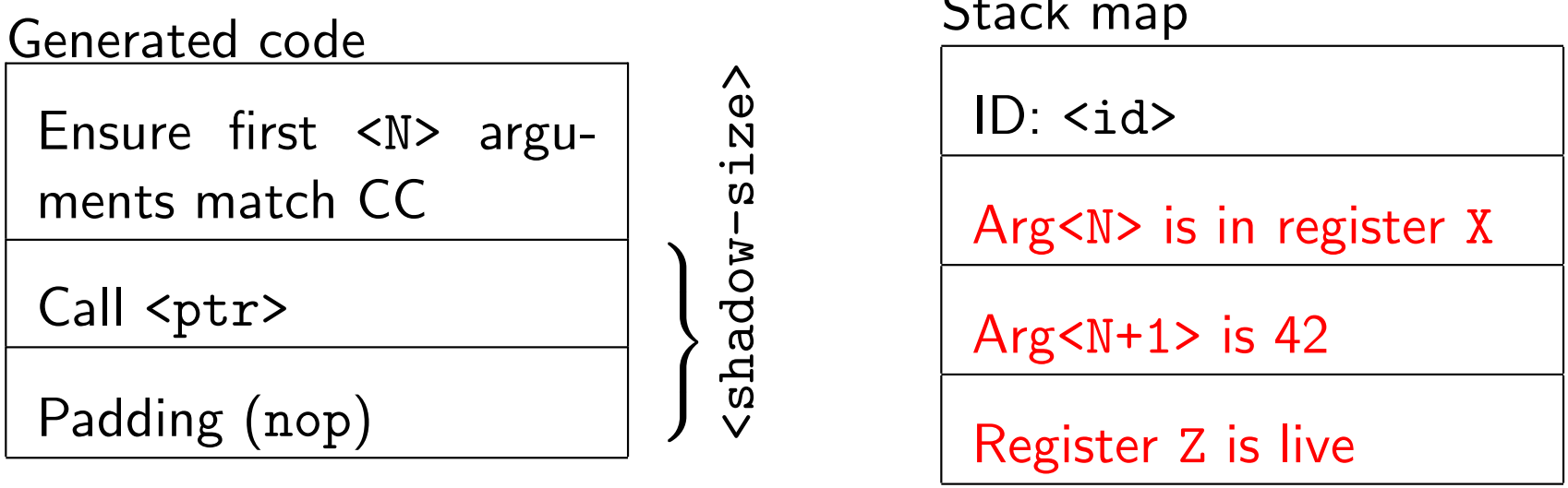

But how to create the function pointed to by <ptr>?

The explicitcc Calling Convention

```
define explicitcc void @foo(
            i64 hwreg(35) %p0,   ; rax
            i64 hwreg(37) %p1)   ; rbx
            noclobber(38, 40) { ; rcx, rdx

    call void (...)* @llvm.experimental.retwr(
            i64 hwreg(37) %p0,
            i64 hwreg(35) %p1)
}
```

Register allocator is told where the arguments are and which registers to preserve.

`llvm.experimental.retwr` allows returning values in registers.

Use the same internal register ids as the `llvm.read_register` and `llvm.write_register` intrinsics.

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Try it out

Complete patch series

http://reviews.llvm.org/D8953
http://reviews.llvm.org/D8954
http://reviews.llvm.org/D8955
http://reviews.llvm.org/D8956
http://reviews.llvm.org/D8957
http://reviews.llvm.org/D8959
http://reviews.llvm.org/D8960
http://reviews.llvm.org/D8961

Example

```
define explicitcc void @ex0(
  i64 hwreg(35) %p0, ; rax
  i64 hwreg(37) %p1) ; rbx
  noclobber() {
  call void (...)* @retwr(
    i64 hwreg(37) %p0,
    i64 hwreg(35) %p1)
  unreachable
}
```

Example

```
define explicitcc void @ex0(
  i64 hwreg(35) %p0, ; rax
  i64 hwreg(37) %p1) ; rbx
  noclobber() {
  call void (...)* @retwr(
    i64 hwreg(37) %p0,
    i64 hwreg(35) %p1)
  unreachable
}
```

```
ex0:
  movq    %rbx, %rcx
  movq    %rax, %rbx
  movq    %rcx, %rax
  retq
```

Example

```
define explicitcc void @ex0(
  i64 hwreg(35) %p0, ; rax
  i64 hwreg(37) %p1) ; rbx
  noclobber() {
  call void (...)* @retwr(
    i64 hwreg(37) %p0,
    i64 hwreg(35) %p1)
  unreachable
}
```

```
ex0:
  movq    %rbx, %rcx
  movq    %rax, %rbx
  movq    %rcx, %rax
  retq
```

```
define explicitcc void @ex1() {
  noclobber(38) {       ; rcx
  call void asm sideeffect
    "call foo", "~{rcx}"()
  ret
}
```

Example

```
define explicitcc void @ex0(
  i64 hwreg(35) %p0, ; rax
  i64 hwreg(37) %p1) ; rbx
  noclobber() {
  call void (...)* @retwr(
    i64 hwreg(37) %p0,
    i64 hwreg(35) %p1)
  unreachable
}
```

```
ex0:
  movq    %rbx, %rcx
  movq    %rax, %rbx
  movq    %rcx, %rax
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```

```
define explicitcc void @ex1() {
  noclobber(38) {       ; rcx
  call void asm sideeffect
    "call foo", "~{rcx}"()
  ret
}
```

```
ex1:
  pushq   %rcx
  callq   foo
  popq    %rcx
  retq
```