The Mono Project

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1 Mono

2 My Work

3 From C# to machine code

4 Questions?

5 Contact

What is Mono?

- A Free implementation of .NET
- Portable
  - Linux, MacOS X, Windows, iPhone, Nintendo Wii, . . .
  - x86, AMD64, PPC32/64, ARM, SPARC, S390(x), . . .
- Compilers for C#, VB.NET
- Many libraries and tools

History

- Project started in 2001 by Ximian
- Ximian acquired by Novell in 2003
- Mono 1.0 in 2004
- Spin-off projects
  - Moonlight
  - MonoTouch

Users

- Linux desktop applications
  - F-Spot, Banshee, Tomboy, Beagle, GNOME Do, . . .
- Second Life scripting engine
- Unity game development tool
  - Deploys on browser, Windows, MacOS X, iPhone, Wii
- . . .

The Team

- About 30 people
- Distributed world-wide
  - Austria, Brazil, France, Germany, Great Britain, Hungary, India, Italy, Japan, Mexico, Poland, Portugal, Spain, US
- Communication mainly via Email, IRC, mailing lists
- Some work at home, some at an office
- We meet now and then at conferences

Generic code sharing

- `List<string>` and `List<object>` methods should share the same machine code
- Not trivial, because type information must be available. For example, `List<T>` might do `new T[n]`.
- Value types, like `List<int>` have their own code, though
- We thought it would take a few weeks. It took a year.

PowerPC 64 port

- Extending PPC32 backend to also support PPC64
- Mostly straightforward work
- Lots of fiddling around to get calling conventions and corner cases right
- Who uses PowerPC? All current gaming consoles!

New garbage collector

- We're currently using the Boehm-Demers-Weiser collector, which is conservative, non-generational, mark-and-sweep
- SGen is our precise, generational, copying collector
- Very tough bugs, race conditions
- Also very performance-critical

C#

```
public static int Fib (int n) {
        if (n < 2)
                return n;
        int fn_2 = 0, fn_1 = 1;
        for (int i = 2; i < n; ++i) {
                int fn = fn_2 + fn_1;
                fn_2 = fn_1;
                fn_1 = fn;
        }
        return fn_2 + fn_1;
}
```

CIL

```
IL_0014:  ldloc.0        // fn_2
          ldloc.1        // fn_2 fn_1
          add            // fn_2+fn_1
          stloc.3        //
          ldloc.1        // fn_1
          stloc.0        //
          ldloc.3        // fn
          stloc.1        //
          ldloc.2        // i
          ldc.i4.1       // i 1
          add            // i+1
          stloc.2        //
          ldloc.2        // i
          ldarg.0        // n
          blt IL_0014    //
```

Mono IL 1/2

```
move R28 <- R18
move R29 <- R19
int_add R30 <- R18 R19
move R21 <- R30
move R31 <- R19
move R18 <- R19
move R32 <- R21
move R19 <- R21
move R33 <- R20
int_add_imm R35 <- R20 1
move R20 <- R35
move R36 <- R20
move R37 <- R17
icompare R20 R17
int_blt [B7B8]
```

Mono IL 2/2

```
int_add R21 <- R18 R19
move R18 <- R19
move R19 <- R21
int_add_imm R20 <- R20 1
icompare R20 R17
int_blt [B7B8]
```

AMD64

```
<BB>:7
   40:    mov   %r14,%rbx      // r14 == fn_2
   43:    add   %r13d,%ebx     // r13 == fn_1,  rbx == fn
   46:    mov   %r13,%r14
   49:    mov   %rbx,%r13
   4c:    inc   %r12d          // r12 == i
   4f:    cmp   %r15d,%r12d    // r15 == n
   52:    jl     40 <_Fib+0x40>
```

Questions?

Contact

- Mono
  `http://www.mono-project.com/`
- Mark Probst
  `mark.probst@gmail.com`
  `http://www.complang.tuwien.ac.at/schani/`

Get involved!

- Google Summer of Code
  - Application deadline is April 9th