The Assembly

and what it’s all about
Programs are essentially a series of instructions performed by a computer
- not unlike, e.g. instructions for baking a cake, making a cup of tea, etc.

Instructions in the real world come in a variety of languages:
- english, spanish, greek, french, chinese, ...

And in potentially different forms
- as above (series of individual steps)
- something else: e.g. a list of “if your tea looks like this” then “do this”
Similarly with computers, a wide range of (programming) languages exist

Usually grouped into one of four categories:
- imperative: Java, C, Modula-3, Pascal, assembler, ...
- functional: Haskell, Miranda, \(\lambda\)-calculus, ML, Erlang, ...
- parallel: occam, CSP, Ada, ...
- declarative: Prolog, Lisp, ...

And at varying levels of abstraction: high-level (abstract) vs. low-level (concrete)

Most “real-world” programming is imperative — i.e. do this, then, do that
- computer programming at its lowest level (assembler) is imperative
Assembler Programming

- Of all the ways of representing computer programs, assembler is the most basic
  - anything that the computer is capable of doing can be programmed
  - assembler varies depending on the hardware used — e.g. Intel, ARM, M68k
- Assembly language itself is quite terse:

```assembly
foo:
    subl $16, %esp
    movl 20(%esp), %eax
    decl %eax
    jz 0f
    pushl %eax
    call foo
0:
    addl $16, %esp
    ret
```

- Intel Pentium-4, on the outside:

- and on the inside:

  a 2.4 GHz P4 can execute around 1 billion such instructions every second!

(photos: Intel corp.)
The Assembly

Each year (since 1992), a competition is held for assembler demos

- real-time generated graphics demonstrating hardware capability
- must be programmed in assembly language – PC most common

Now attended by several thousand enthusiasts from all over the world

(photos: ASSEMBLY organising / Pekka Aakko, Oleg Hartsenko)
The DVD shown is a recording of the best demos last year (2004)

Entries are divided into several categories:

- full demo: up to 15 minutes of unlimited sound and graphics!
- 64k intro: executable program size limited to 65536 bytes
- 4k intro: limited to 4096 bytes (around 80 lines of text!)

New categories for demos on handheld devices (e.g. PDAs and mobile phones):

http://www.assembly.org/