

# The Assembly

and what it's all about

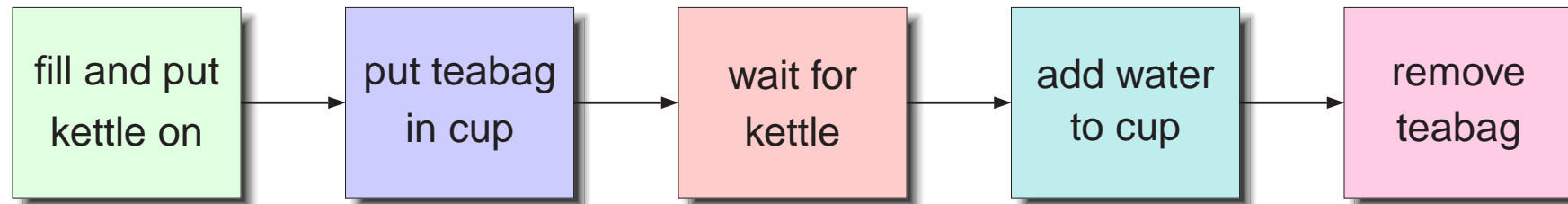


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# Computer Programming

- ▶ 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”

## Computer Programming

- 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:

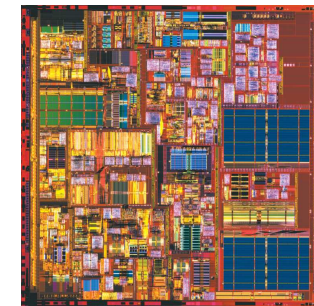
```
foo:
    subl $16, %esp
    movl 20(%esp), %eax
    decl %eax
    jz 0f
    pushl %eax
    call foo
0:
    addl $16, %esp
    ret
```

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

- ▶ Intel Pentium-4, on the outside:



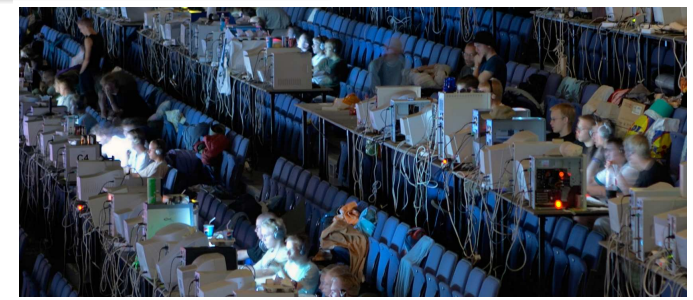
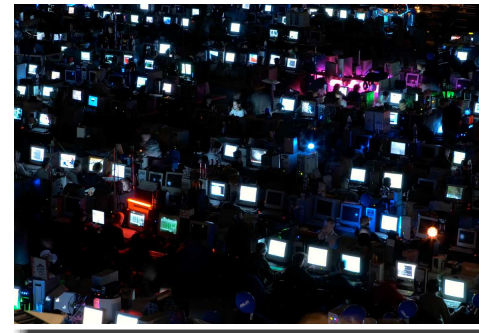
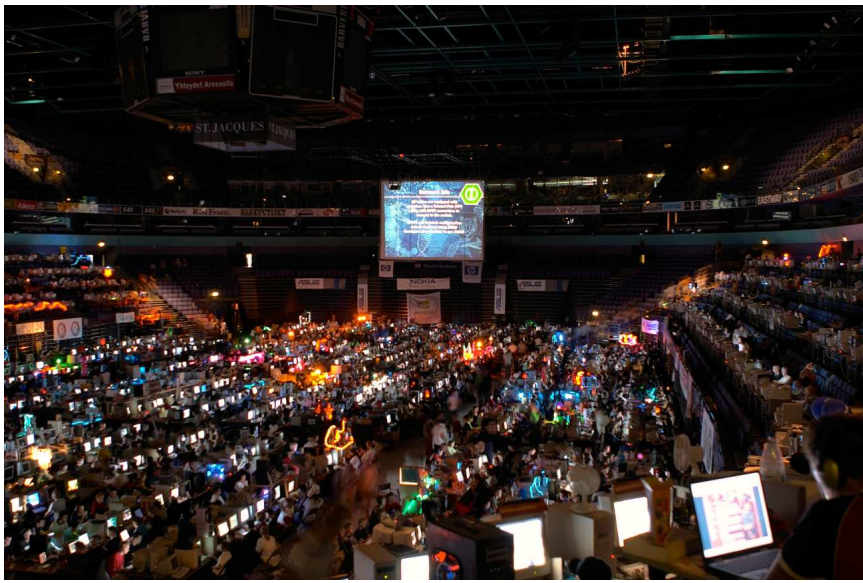
- ▶ and on the inside:



(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 Assembly

- ▶ 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/>

