« Motivations for Static program Analysis »

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VMCAI'05 Industrial Day

What is (or should be) the essential preoccupation of computer scientists?

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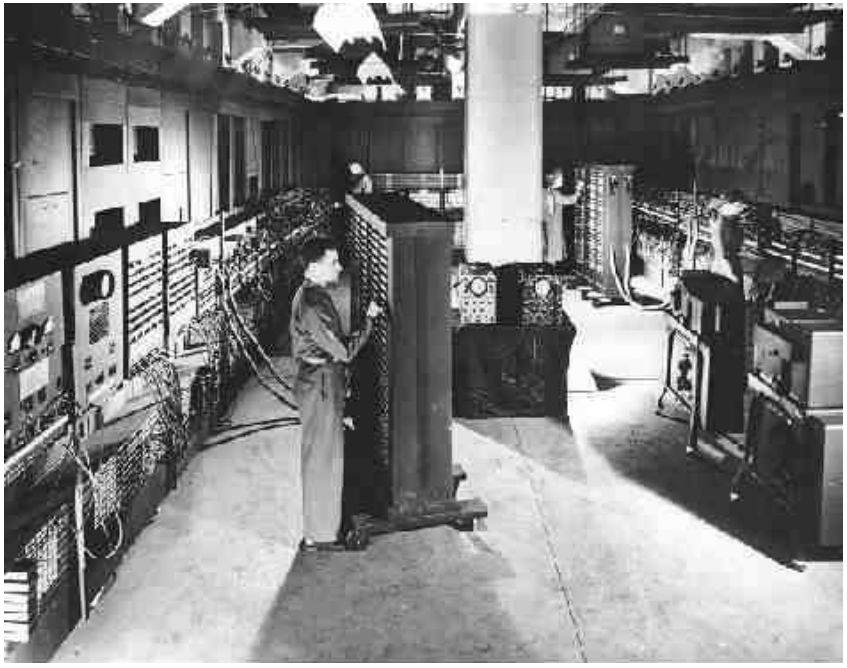
The production of reliable software, its maintenance and safe evolution year after year (up to 20 even 30 years).

Computer hardware change of scale

The 25 last years, computer hardware has seen its performances multiplied by 10^4 to $10^6/10^9$;



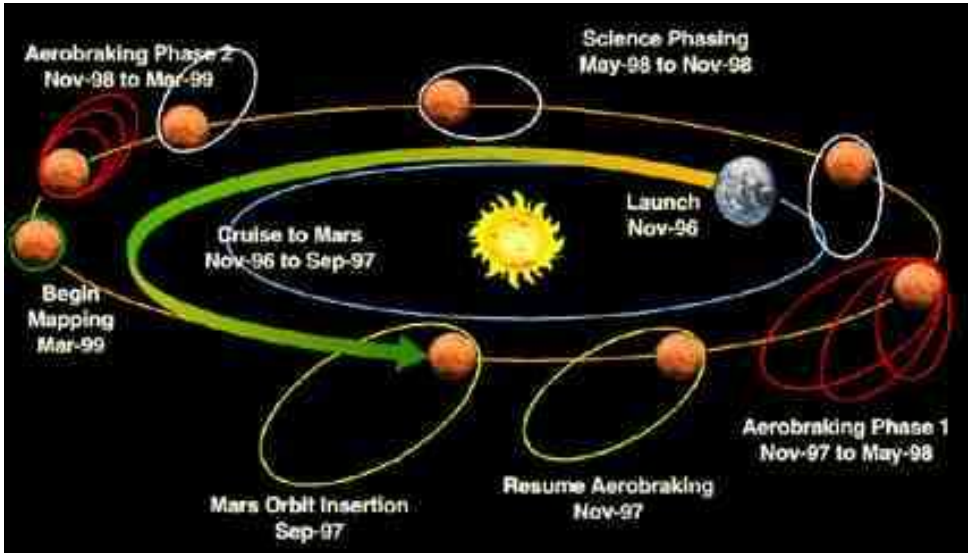
ENIAC (5000 flops)

Intel/Sandia Teraflops System (10^{12} flops)

The information processing revolution

A scale of 10^6 is typical of a significant **revolution**:

- Energy: nuclear power station / Roman slave;
- Transportation: distance Earth — Mars / Paris — Toulouse



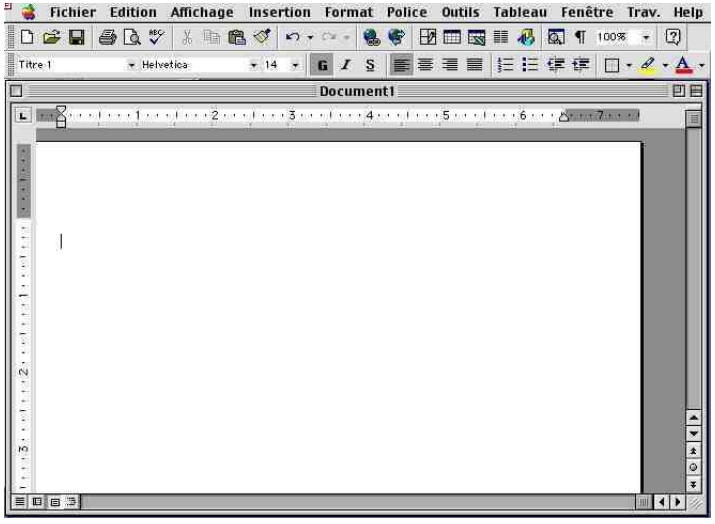
Computer software change of scale

– The size of the programs executed by these computers has grown up in similar proportions;

20 000 procedures;

400 files;

$>$ 15 years of development.



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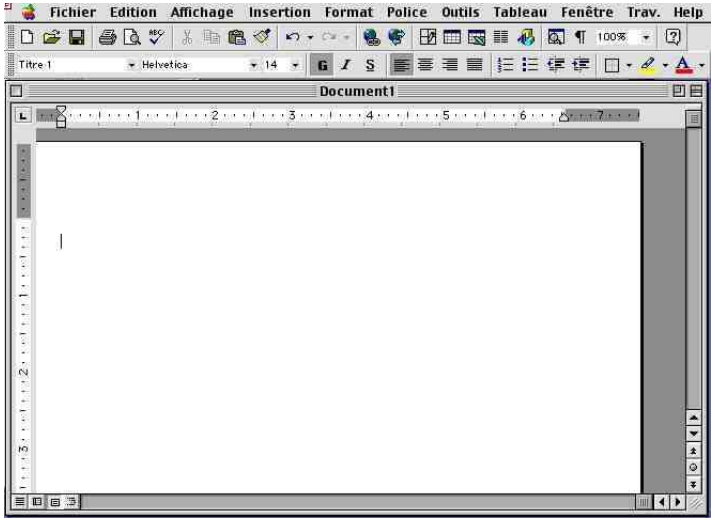
– **Example 1** (modern text editor for the general public):

- $>$ 1 700 000 lines of C [1];
- 20 000 procedures;
- 400 files;
- $>$ 15 years of development.

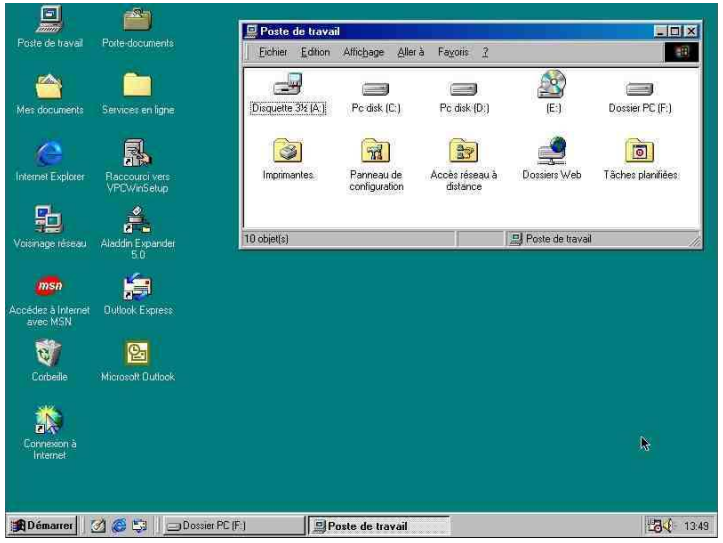


[1] full-time reading of the code (35 hours/week) would take at least 3 months!

Computer software change of scale (cont'd)

– **Example 2** (professional computer system):

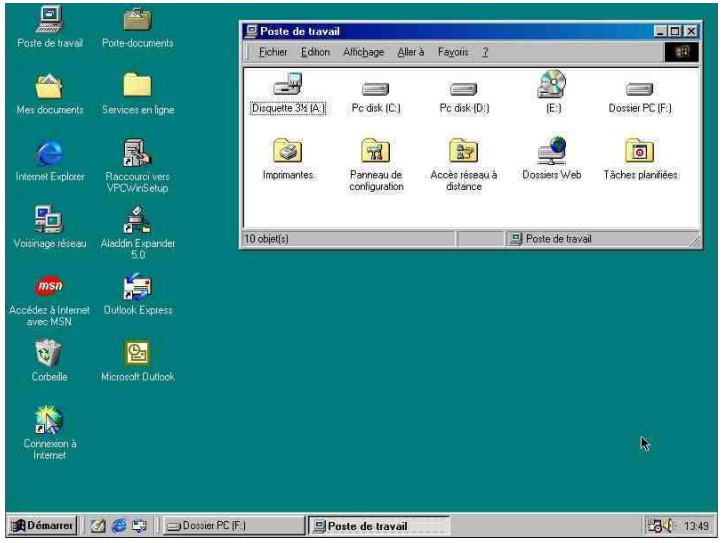
- 30 000 000 lines of code;



Computer software change of scale (cont'd)

– **Example 2** (professional computer system):

- 30 000 000 lines of code;
- 30 000 (known) bugs!



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- Bugs can be very difficult to discover in huge software;
- Bugs can have catastrophic consequences either very costly or inadmissible (embedded software in transportation systems);

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- The financial results of Arianespace were **negative** in 2000, for the first time since 20 years.

Who cares?

– No one is legally responsible for bugs:

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- So, no one cares about software verification
- And even more, one can even make money out of bugs (customers buy the next version to get around bugs in software)

Why no one cares?

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- And so no one ever bear any responsability

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- We can check for the absence of large categories of bugs (may be not all of them but a significant portion of them)
- The verification can be made automatically by mechanical tools
- Some bugs can be found completely automatically, without any human intervention

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- Because of complete tool automaticity, no one can be discharged from the duty of applying such state of the art tools
- Third parties of confidence can check software a posteriori to trace back bugs and prove responsabilities

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- Development costs arguments have shown to be ineffective
- Norms/laws might be much more convincing
- This requires effectiveness and complete automation (to avoid acquittal based on human capacity limitations arguments)

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- So responsabilities can be established (at least for automatically detectable bugs)
- Whence the law will change (by adjusting to the new state of the art)
- To ensure at least partial software verification
- For the benefit of all of us

THE END

More references at URL www.di.ens.fr/~cousot.

THE END, THANK YOU

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