

Computer science in four eras

Jean-Jacques Lévy
Inria Paris & Irif

Huashang College - 2

COMPUTER SCIENCE VS REAL WORLD



Science

nature

life sciences

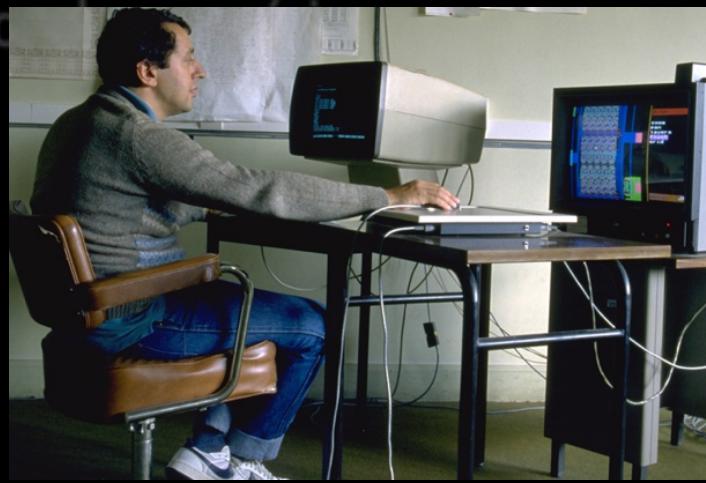
machines







1970



Inria
rs du mo

PRIMARY
THE LOGIQIAN

(1910 - 1950)

From paradoxes in logic

“the set of all sets”

to

Computability

The logicians

Hilbert → Gödel → Church → Turing



Kleene

Post

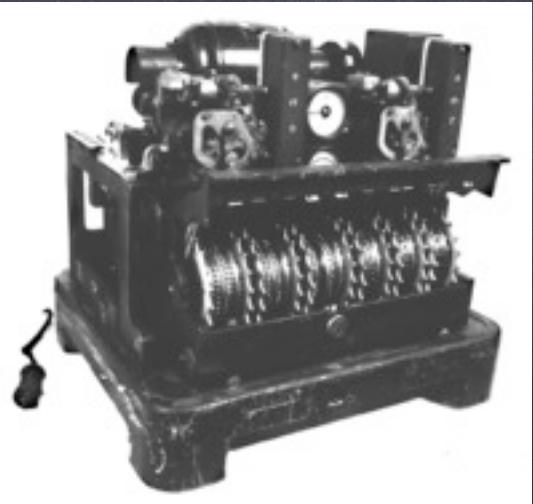
von Neumann



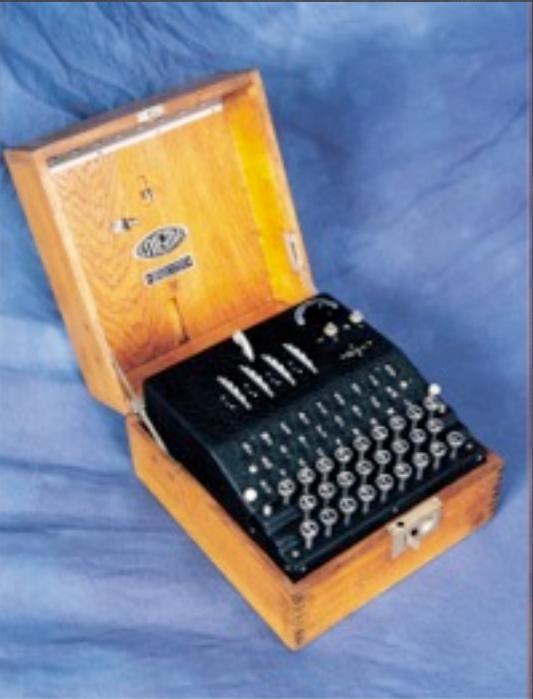
The logicians

- Turing : finite control, infinite memory
(decoding Enigma machine)
- von Neumann : data AND programs in
memory
(Manhattan project)
- machines at UPenn, Cambridge, Mark I

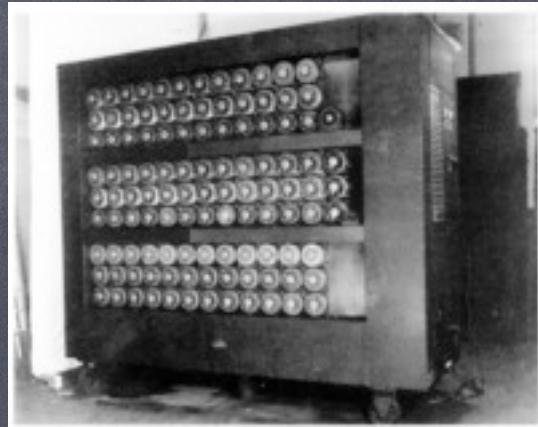
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Lorenz



Enigma



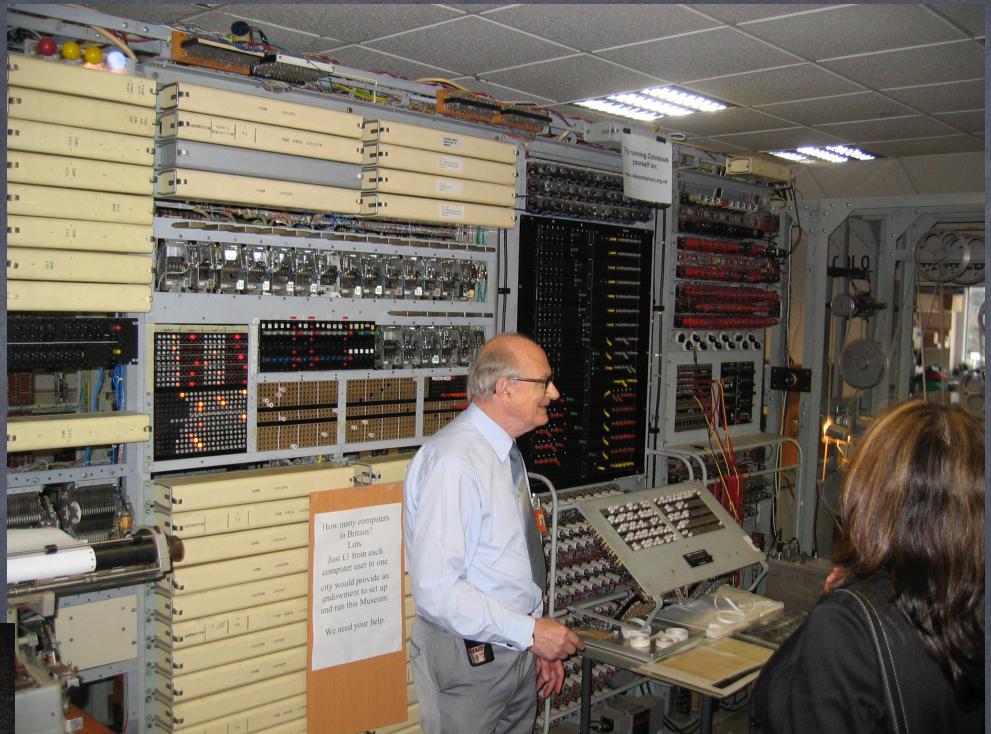
The Bombe



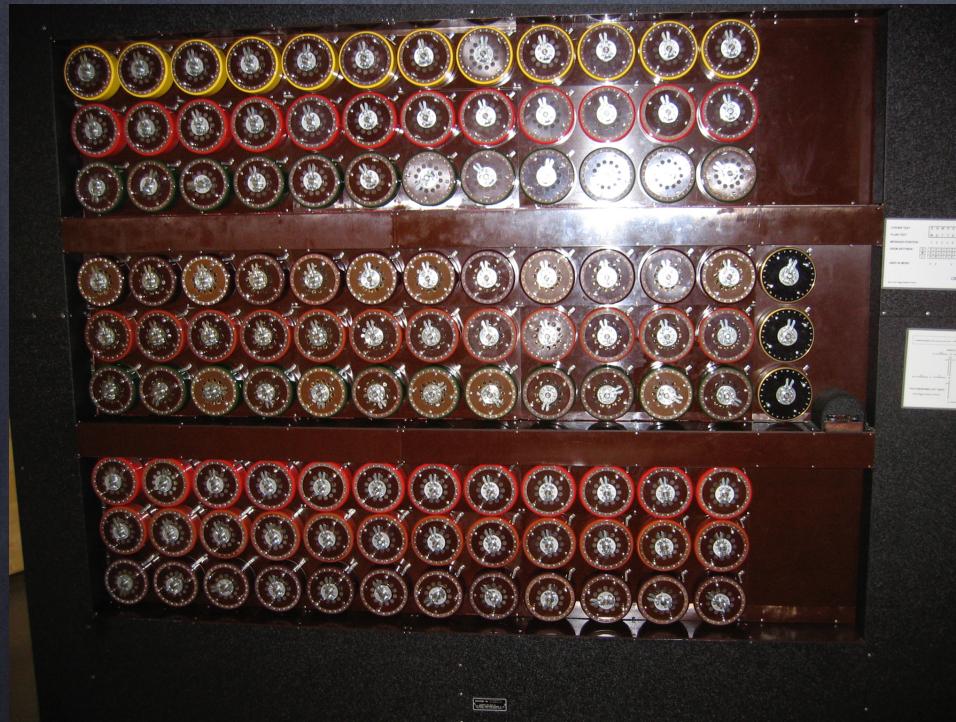
Colossus

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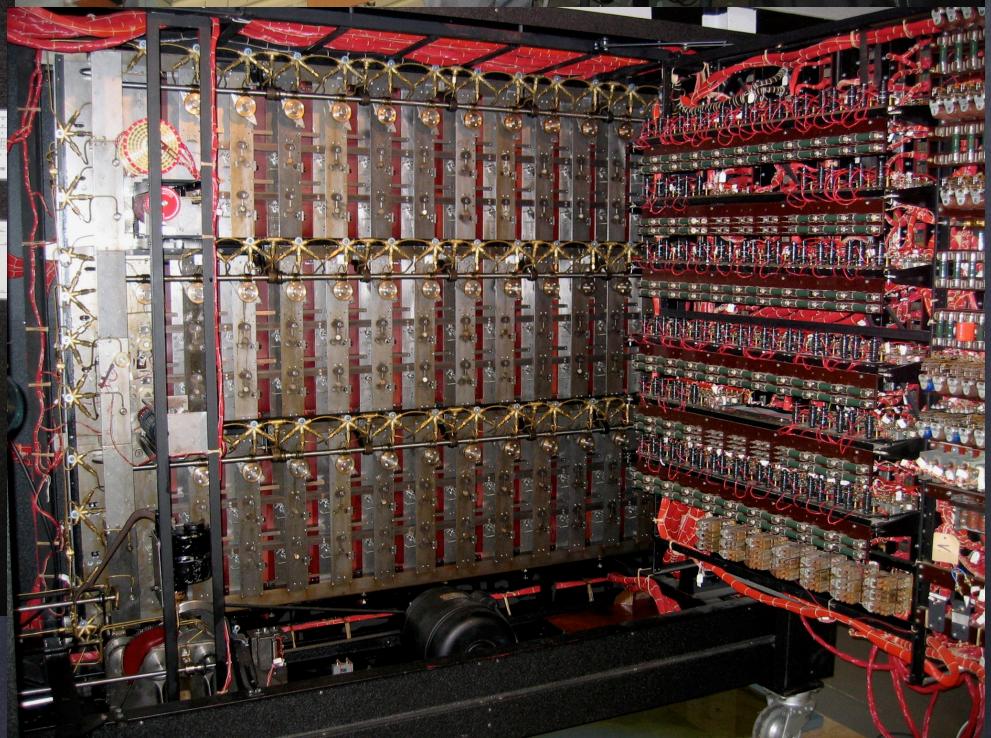
the Colossus



Bletchley Park



the Bombe





Bletchley Park

Tony Sale
and the Colossus rebuild team
Cliff Horrocks, team manager
Bob Alexander Don Grieg John Pether
Frank Carter Phil Hayes Don Skeggs
Charles Coultas Gil Hayward David Stanley
Ron Clayton Mark Hyman Derek Turton
Adrian Cole John Lloyd Richard Watson
Rob Dickson Peter Merriman John Whetton

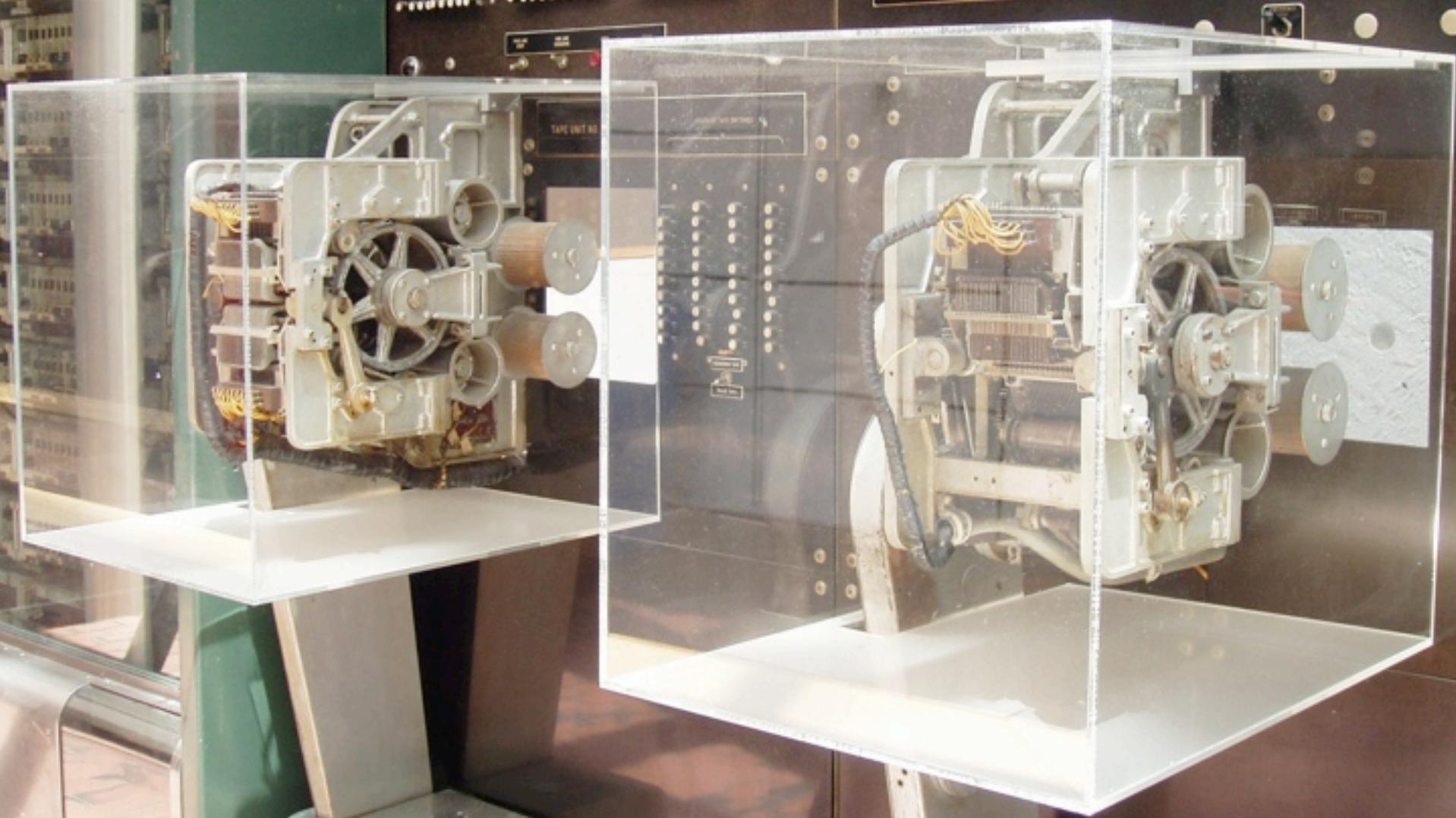
AIKEN - IBM AUTOMATIC SEQUENC



Mark I, Harvard



Mark I, Harvard



The logicians



Mark II,
Harvard

92

9/9

- 0800 Antran started
 1000 " stopped - antran ✓ { 1.2700 9.037847025
 13" 00 (032) MP - MC ~~1.982142000~~ 9.037846995 correct
 (033) PRO 2 2.130476415
 correct 2.130676415
 Relays 6-2 in 033 failed special speed test
 in relay " 10.000 test -
 Relays changed
 1100 Started Cosine Tape (Sine check)
 1525 Started Multi Adder Test.

Relay
2145
Relay 3370

1545

Relay #70 Panel F
(moth) in relay.

1630

First actual case of bug being found.

Antran started.

closed down.

Grace Hopper - Mark II

SECONDARY THE IBMZOÏC

(1950-1980)

Multics

- IBM 704, 7040, 360/370
- SDS 940 (Lamson)
- GE 645, Multics; MIT, Bull



- batch processing, time sharing
- 10 to 100 users / computer
- electronic mail

Unix, the nirvana of programmers

- simplification of Multics
- modular “small is beautiful”

Thompson Ritchie



- AT&T Bell laboratories
- theoreticians AND practitioners
- system of hackers for hackers
- pdp 11; Vax 780/750

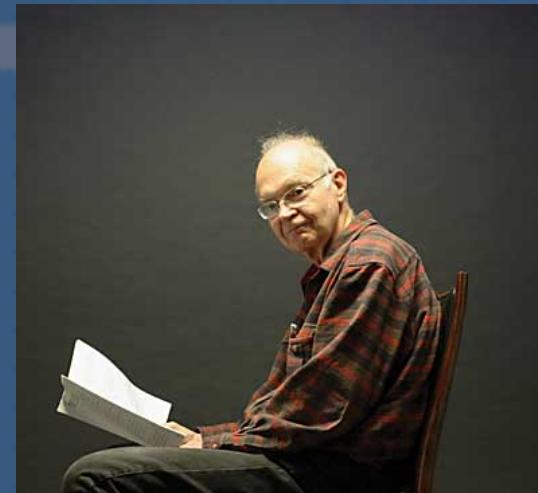
Run programs

- programming languages
- write correct programs



Jean Ichbiah

- find simple algorithms
- moreover efficient



Don Knuth



Steve Cook

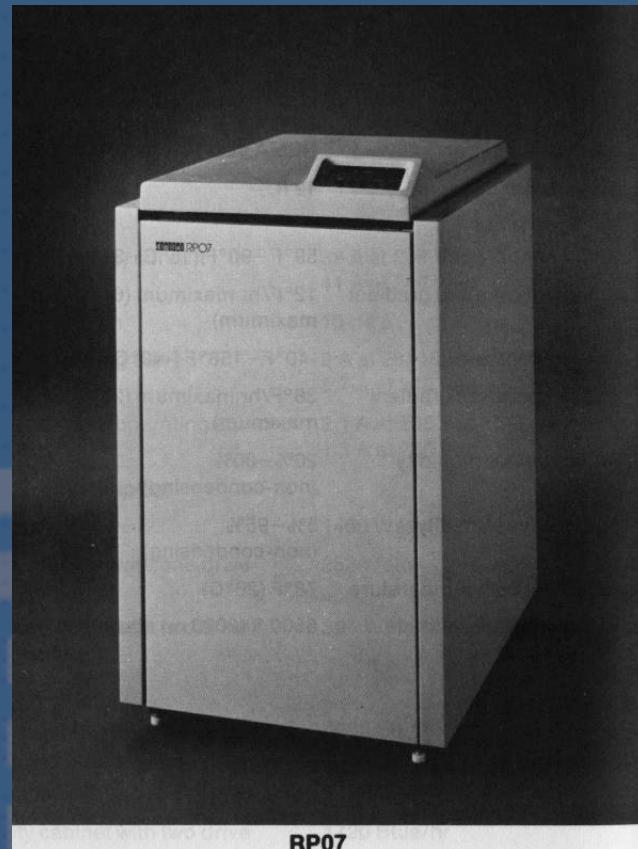
P=NP ?



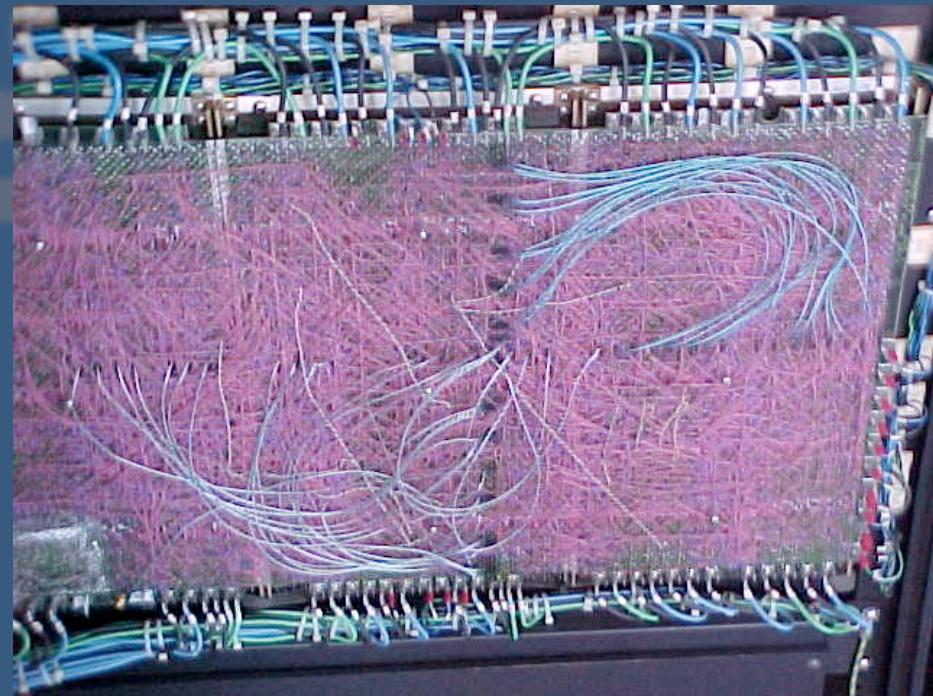
vax 11/750



RM05 (256 MO)



RP07
(700MO)



back
of a
dec 10



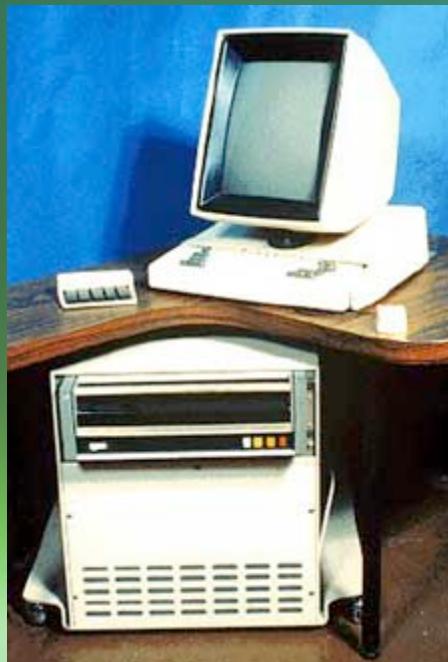
vax 11/780

TERNARY THE WINDOZOÏC

(1980-2000)

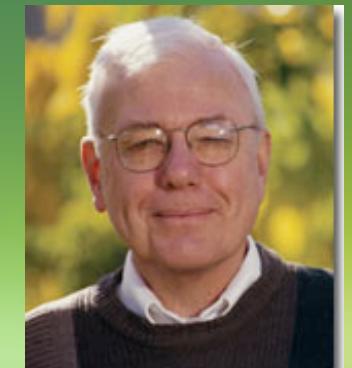
The garage

- intel 4004
- Xerox PARC (alto, dorado)
- the Apple garage (apple II, lisa, macintosh)
- IBM PC (ms-dos)



Alto

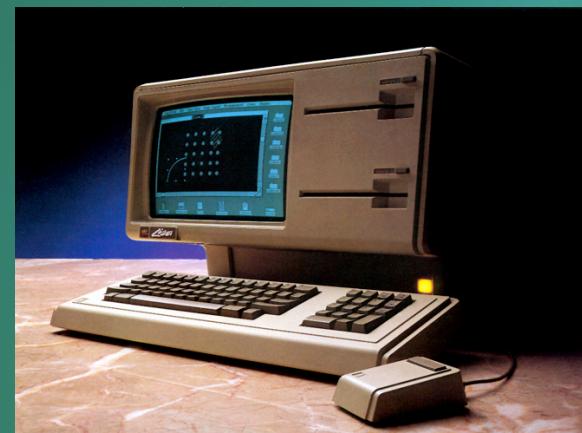
- selfish vision
- everyone has his own computer
- all is in user interface



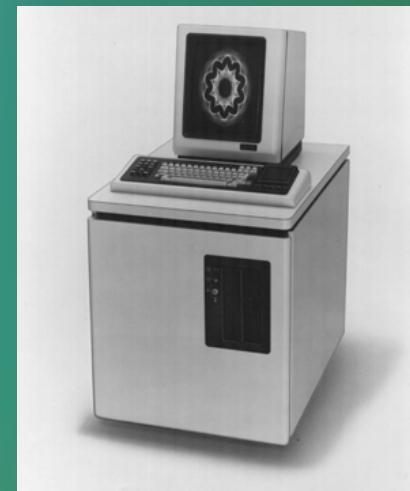
Chuck Thacker



Apple II



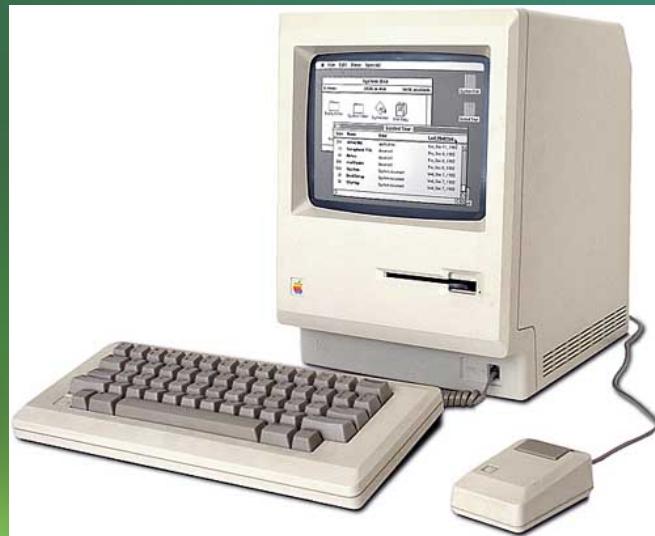
Lisa



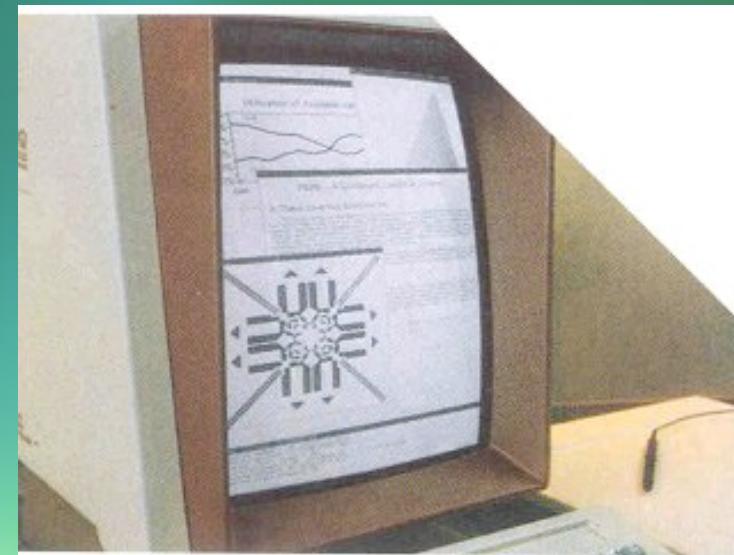
Apollo



Sun 1



Macintosh



PerQ



Blit 5620

Microsoft

- computer in each home
- bureautics (Word, Excel, Powerpoint)
- editor of software, no hardware
- improvements in systems (NT, 95, XP, Vista, ...)



- Dave Cutler (DEC-VMS, NT)

Charles Simonyi

Linux and free software

- Emacs, extendible text editor
- gcc, C compiler of the Free Software Foundation
- Linux = Unix redone by Linus Tordsvald
- everyone participates to Linux
- source is public but invasive
- high quality software



Richard Stallman

Xerox PARC

Aug. 7 1972

AUG '72

2487

A Personal Computer for Children of All Ages

Alan C. Kay
Xerox Palo Alto Research Center

Abstract

This note speculates about the emergence of personal, portable information manipulators and their effects when used by both children and adults. Although it should be read as science fiction, current trends in miniaturization and price reduction almost guarantee that many of the notions discussed will actually happen in the near future.

teacher? Maybe. But first, it must decide that it is a necessary and desirable goal to do so.

What we would like to do in this brief note is to discuss some aspects of the learning process which we feel can be augmented through technological media. Most of the notions have at their root a number of theories about the child that lie much closer to Piaget than to Skinner. We feel that a child is a "verb" rather than a "noun", an actor rather than an object; he is not

Distributed calculations

- $F_9 = 2^{512} + 1$
=
13407807929942597099574024998205846127479365820592393377723
56144372176403007354697680187429816690342769003185818648605
0853753882811946569946433649006084097
= 2424833
 $\times 7455602825647884208337395736200454918783366342657$
 $\times 7416400626275308015247871419019374740599407810975190239058$
213161444157 59504705008092818711693940737
- 100 machines during 1 month [Manasse, Lenstra, 1990].

QUATERNARY THE GOOGLOÏC

(2000-2018)

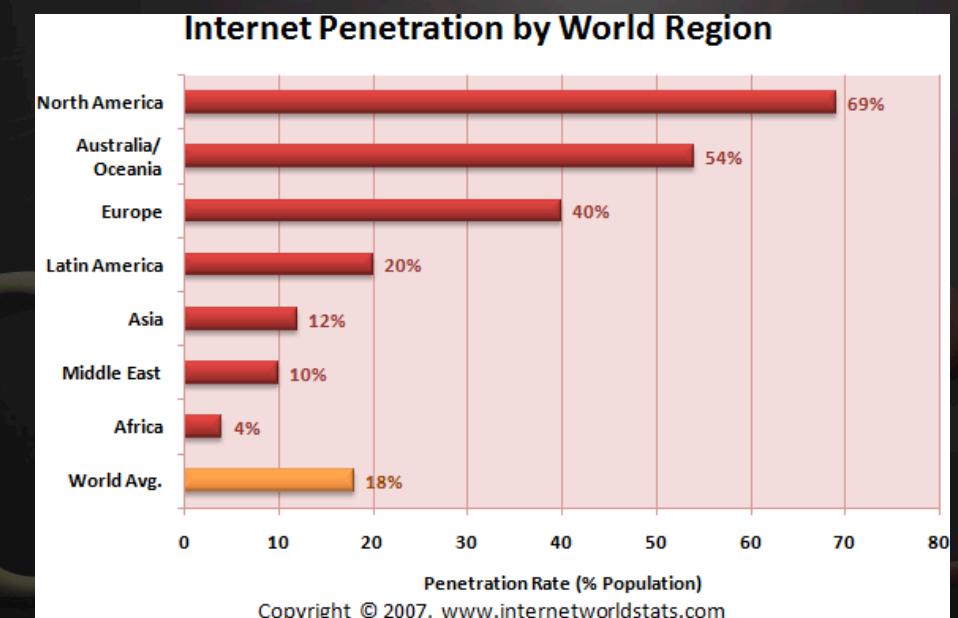
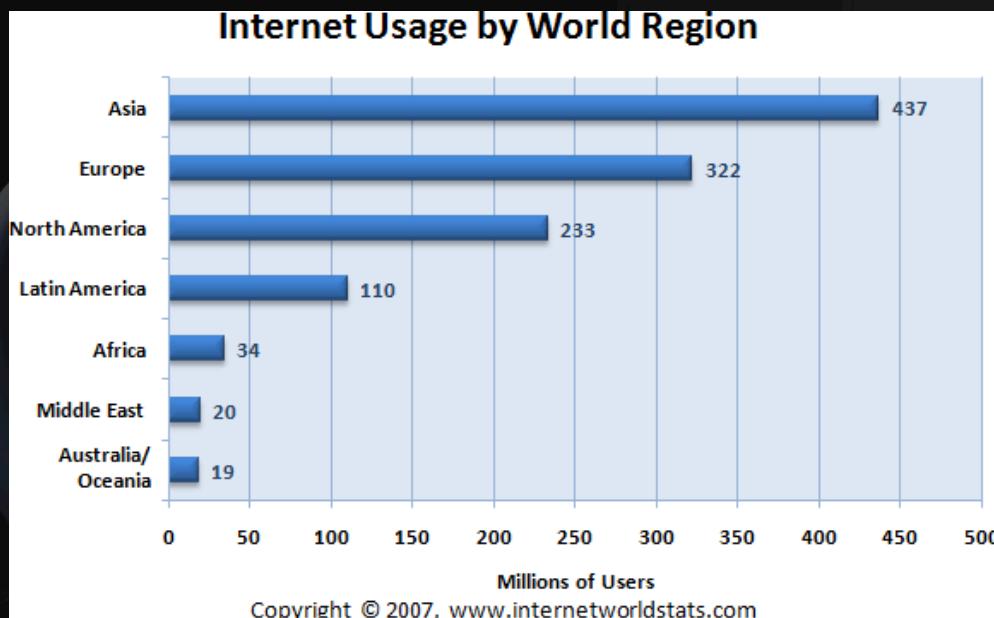
1 - Internet (1/3)

- arpanet (1970), ethernet - cyclades (1975)
- uucp (1985), internet (1992), wifi (1999)
- 1 billion of internauts (2007)
- web 30%, p2p 30%, mail 2% of traffic (2007)
- 25% of phone is on IP



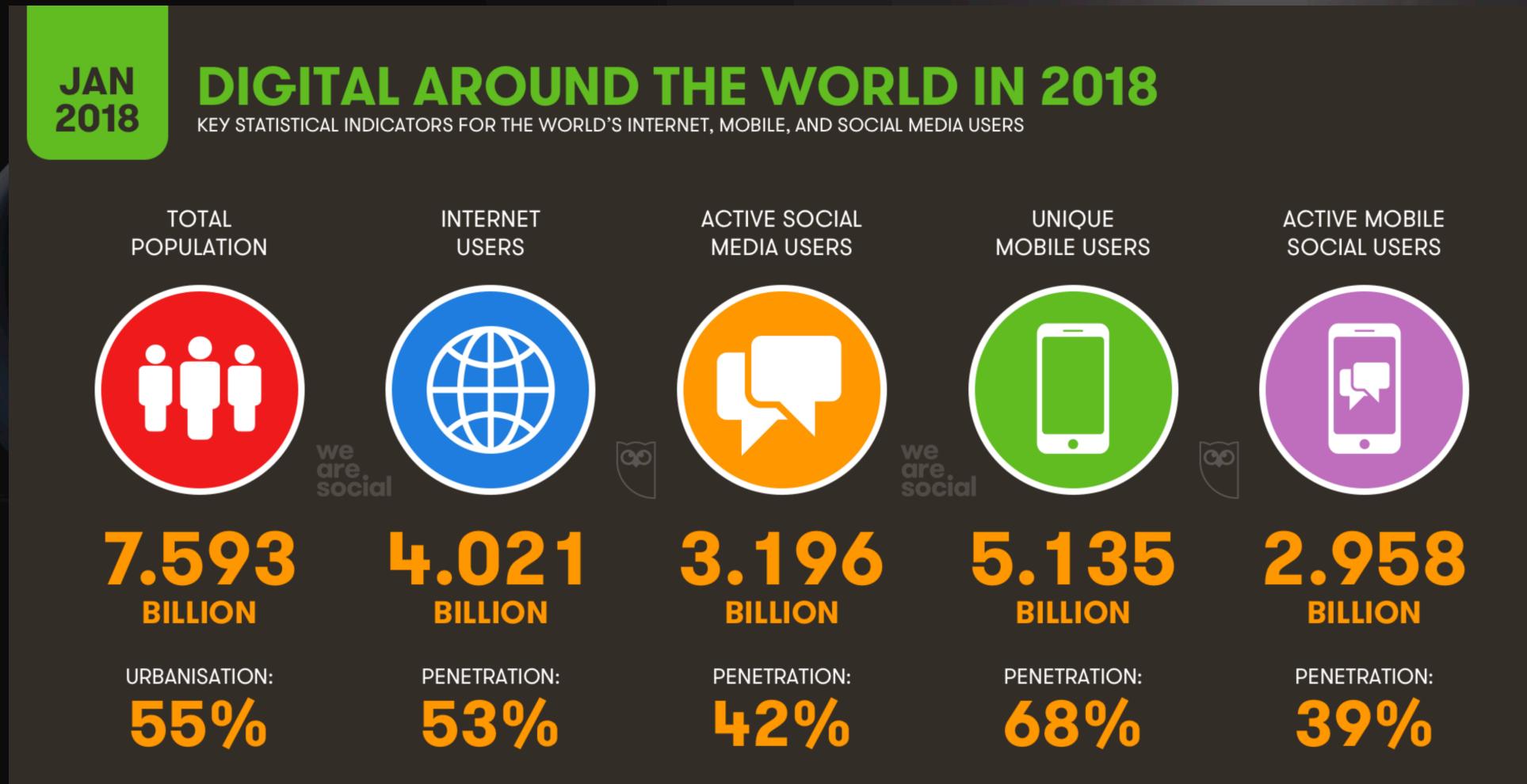
Louis Pouzin

1 - Internet (2/3)



- 33 M internauts in France (2007)
- 53 M internauts in France (2018)

1 - Internet (3/3)



2 - Indexers (1/2)

- data is ubiquitous
- internet is the property of everybody
- data are no longer localized
- need for indexing (google, baidu, bing ...)

Louis Monier



Mike Burrows



altavista

2 - Google (2/2)

- global search
- hired most of Unix team from Bell labs
- 15 centers with global data
- ~1 million of servers
- net services (mail, calendar, maps)

3 - Smart phones

- Ericsson, Nokia, LG, Samsung, Blackberry
- iPhone (2007) with tactile interface
- integration of music, photo, and video
- net services
- appStore (iPhone), Googleplay



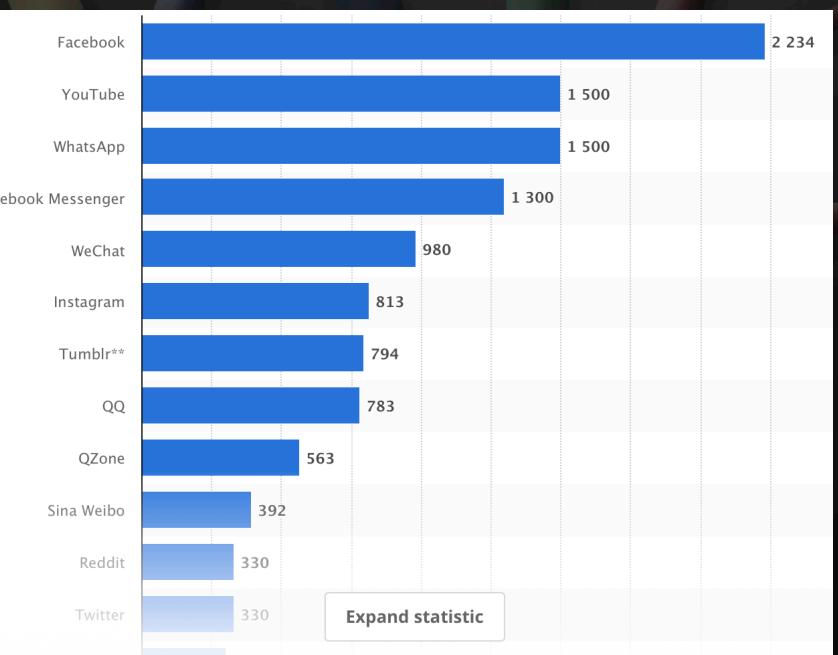
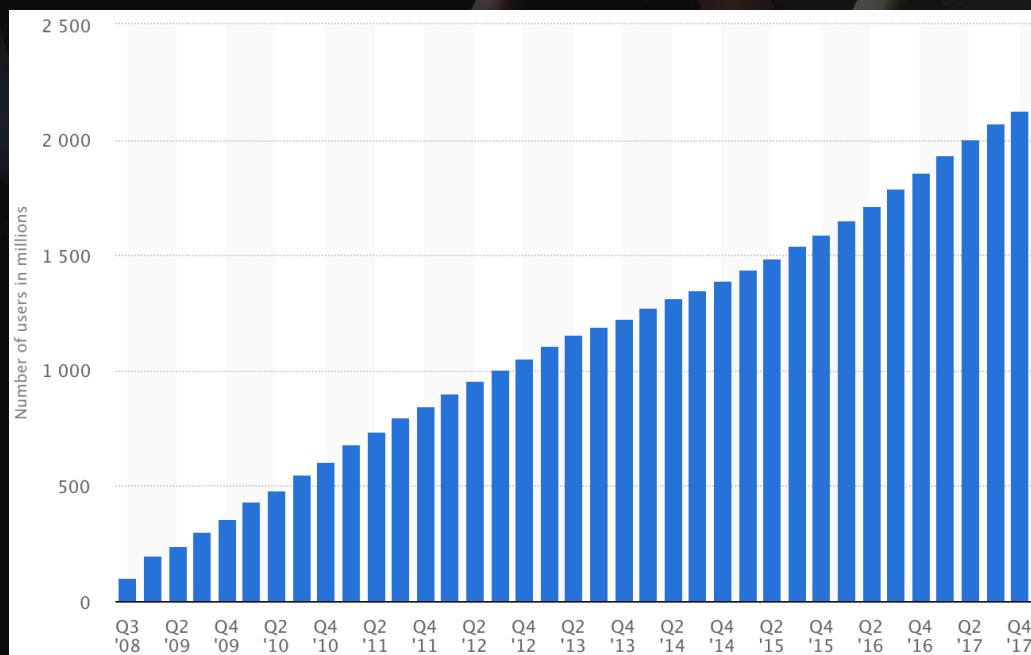
NeXT

iPhone

Jean-Marie Hullot

4 - Social networks

- youtube (2004),facebook (2005), IG, twitter, ...
- whatsapp, viber, wechat, skype
- wikipedia



Impact on economy

- online shops (Amazon, eBay, Taobao, ..)
- Apple = Netherlands, Google = Belgium, ..
- management of companies
- engineering
- medical apps
- computational sciences
- banking (applepay, alipay, wechatpay, bitcoin)
- (distributed) games

Networks – Distribution

- security (secrecy, authentication, integrity)
- distribution of data (public Clouds)
- distribution of computing
- sensors
- energy

FUTURE

(2019- ??)

Future?

- computers may disappear
- software will be still present
- sensors everywhere
- medical apps
- programming bio cells
- computer science and environment
- working AI
- ???

Computer Science
is
THE invention
of
20th century