Homo Sapiens o Homo Technologicus?
Restiamo Umani nell'Era dei Robot.

ZAC! ZONE ATTIVE DI CITTADINANZA

Ivrea, 9 Dicembre 02015

Norberto Patrignani

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Proceedings of the 1st ICT for Sustainability Conference, Zurich 14-16 February 2013
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2015: Ivrea

Co-Shaping Technology-Society

- post-Turing-ICT
- Fourth Industrial Revolution

Limits? Choices? Ethics?

- ICT & Climate Change
- Computer Ethics (Robotics)

Digital Wisdom

- Slow Tech
- Good News (Positive Expectations)

Co-Shaping

Values Embedded in Design

Robert Moses' New York Bridges

Do Artifacts Have Politics?

"Certain Technologies *in themselves* have political properties" (Winner, 1980)

Source: "The Whale and the Reactor - A search for Limits in an Age of High Technology", L.Winner, The University of Chicago Press, 1989

"Code is Law"

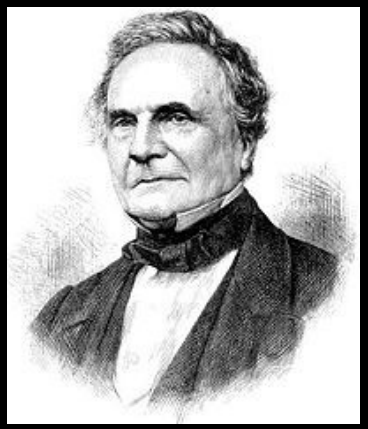
Lessig, L. (1999), *Code and other laws of cyberspace*, Basic Books.

1831: Calendario Meccanico Universale

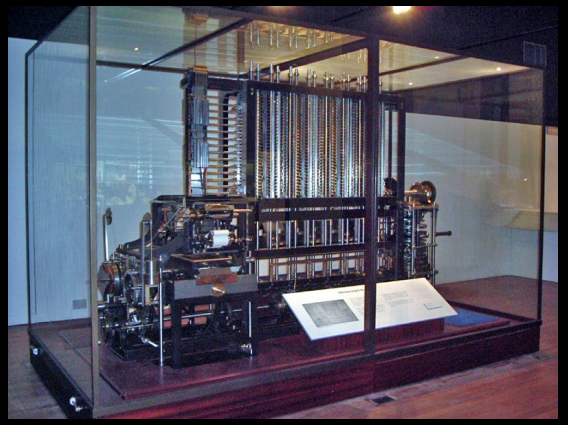
Giovanni Plana
(1781 - 1864)

Calendario Meccanico Universale, 1831-1835, Cappella dei Mercanti, Via Garibaldi 25, Torino
Studio dei 3 studenti del Politecnico di Torino: Cappato Roberto, Spano Sergio, Nasiri Meysam
http://www.cappelladeimercanti.it/calendariouniversale/

1834: The Analytical Engine



Charles Babbage
(1791 - 1871)



Difference Engine (replica), London Science Museum

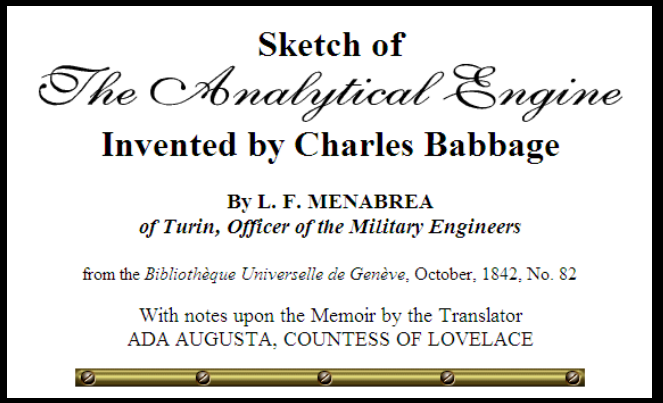
Computer

Latin origin: "*cum-putare*" (that is, "*together-cut*",
"*compare and extract a result*")

1842: Luigi Federico Menabrea

Giovanni Plana
(1781 - 1864)

Luigi Federico Menabrea
(1809-1896)


Sketch of
The Analytical Engine
Invented by Charles Babbage

By L. F. MENABREA
of Turin, Officer of the Military Engineers

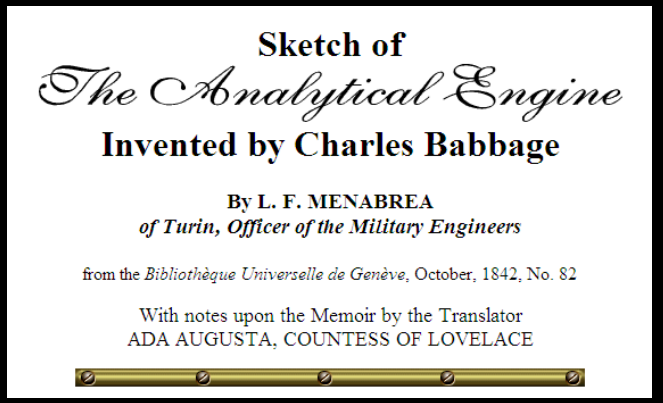
from the *Bibliothèque Universelle de Genève*, October, 1842, No. 82

With notes upon the Memoir by the Translator
ADA AUGUSTA, COUNTESS OF LOVELACE

1840, Torino
II Congresso Scienziati Italiani
invita Charles Babbage

1843: The 1st Programmer in History

Ada Byron
(1815 - 1852)
(daughter Anne Isabella Milbanke - George Gordon Byron)


Sketch of
The Analytical Engine
Invented by Charles Babbage

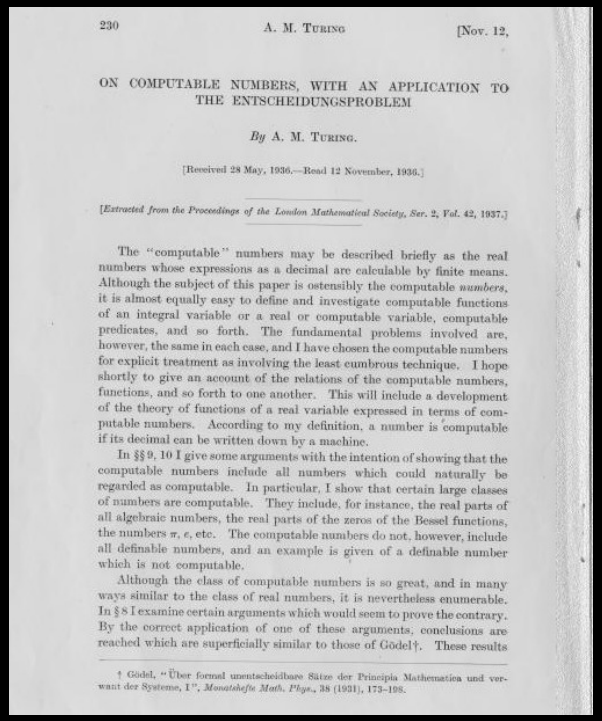
By L. F. MENABREA
of Turin, Officer of the Military Engineers

from the *Bibliothèque Universelle de Genève*, October, 1842, No. 82

With notes upon the Memoir by the Translator
ADA AUGUSTA, COUNTESS OF LOVELACE

Poetical Science: ability by using imagination and metaphor to evaluate accurately a concept or an idea
Babbage was focused on number crunching
She developed a **<u>vision of the capability of computers to go beyond mere calculating</u>**

Source: Ada Byron, Notes by the Translator on L. F. Menabrea's Sketch of the Analytical Engine Invented by Charles Babbage. 1842.



230 A. M. TURING [Nov. 12,

ON COMPUTABLE NUMBERS, WITH AN APPLICATION TO THE ENTSCHEIDUNGSPROBLEM

By A. M. TURING.

[Received 28 May, 1936.—Read 12 November, 1936.]

[*Extracted from the Proceedings of the London Mathematical Society, Ser.* 2, *Vol.* 42, 1937.]

The "computable" numbers may be described briefly as the real numbers whose expressions as a decimal are calculable by finite means. Although the subject of this paper is ostensibly the computable *numbers*, it is almost equally easy to define and investigate computable functions of an integral variable or a real or computable variable, computable predicates, and so forth. The fundamental problems involved are, however, the same in each case, and I have chosen the computable numbers for explicit treatment as involving the least cumbrous technique. I hope shortly to give an account of the relations of the computable numbers, functions, and so forth to one another. This will include a development of the theory of functions of a real variable expressed in terms of computable numbers. According to my definition, a number is computable if its decimal can be written down by a machine.

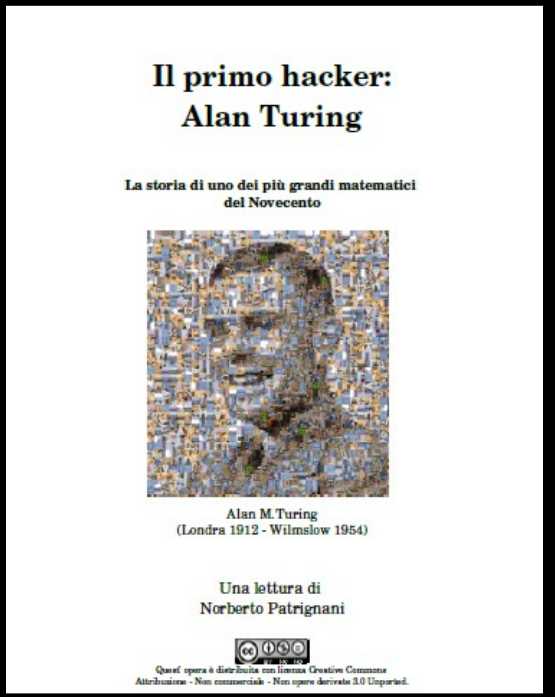
In §§ 9, 10 I give some arguments with the intention of showing that the computable numbers include all numbers which could naturally be regarded as computable. In particular, I show that certain large classes of numbers are computable. They include, for instance, the real parts of all algebraic numbers, the real parts of the zeros of the Bessel functions, the numbers π, e, etc. The computable numbers do not, however, include all definable numbers, and an example is given of a definable number which is not computable.

Although the class of computable numbers is so great, and in many ways similar to the class of real numbers, it is nevertheless enumerable. In § 8 I examine certain arguments which would seem to prove the contrary. By the correct application of one of these arguments, conclusions are reached which are superficially similar to those of Gödel†. These results

† Gödel, "Über formal unentscheidbare Sätze der Principia Mathematica und verwant der Systeme, I", *Monatshefte Math. Phys.*, 38 (1931), 173–198.

1937: Turing Machine

Alan Turing
(1912 -1954)



Il primo hacker:
Alan Turing

La storia di uno dei più grandi matematici del Novecento

Alan M.Turing
(Londra 1912 - Wilmslow 1954)

Una lettura di
Norberto Patrignani

www.bookliners.com

Source: Turing A., "On computable numbers, with an application to the Entscheidungsproblem" from Proceedings of the London Mathematical Society, (Ser. 2, Vol. 42, 1937)

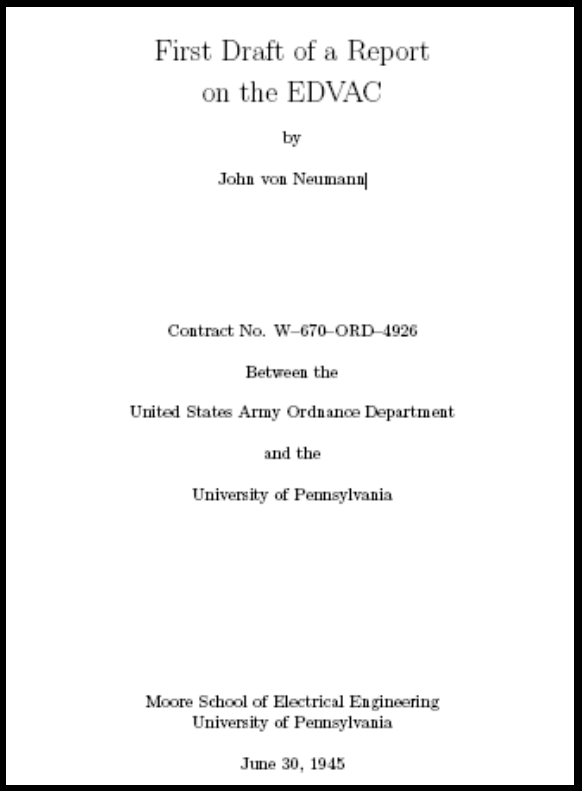
1943: ENIAC

1943, US Army Ballistic Research Lab commissioned ENIAC (Electronic Numerical Integrator Analyzer and Computer) Commissioned to University of Pennsylvania

Source: Edwards, Paul. The Closed World: Computers and the Politics of Discourse in Cold War America. Cambridge, MA: MIT Press, 1997

1945: Von Neumann Architecture

John Von Neumann
(1903 - 1957)



First Draft of a Report
on the EDVAC

by

John von Neumann

Contract No. W–670–ORD–4926

Between the

United States Army Ordnance Department

and the

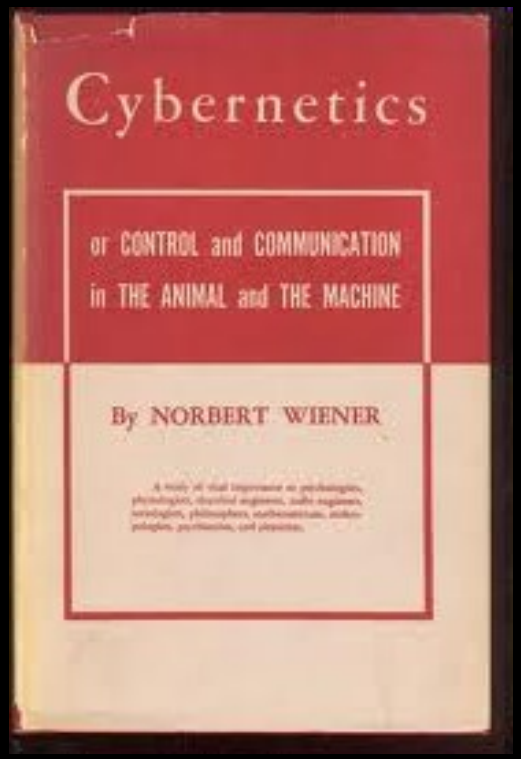
University of Pennsylvania

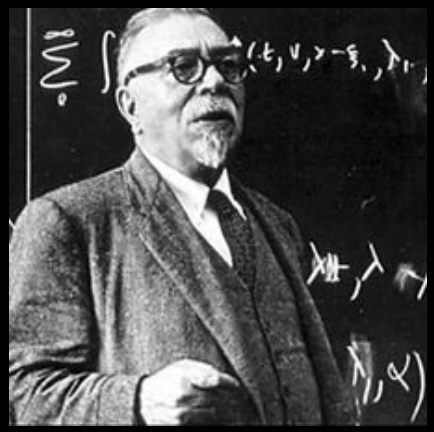
Moore School of Electrical Engineering
University of Pennsylvania

June 30, 1945

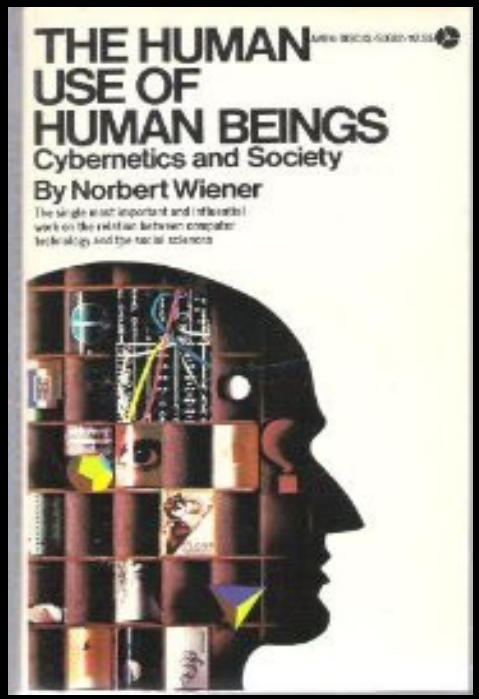
Source: "First Draft of a Report on the EDVAC", J.V.Neumann Moore School of Electrical Engineering, University of Pennsylvania, 1945

1950: Norbert Wiener
Founder of Computer Ethics





Norbert Wiener
(1894 - 1964)



"I do not expect to publish
any future work of mine
which may do damage
in the hands of irresponsible militarists..."

"A Scientist Rebels"
Atlantic Monthly, January, 1947

Source:
Wiener N., "Cybernetics: or Control and Communication in the Animal and the Machine", 2nd ed. Cambridge, MA: MIT Press, 1948
Wiener N., "The Human Use of Human Beings. The Riverside Press (Houghton Mifflin Co.), 1950

Deaf Prosthesis, Wiener, 1950

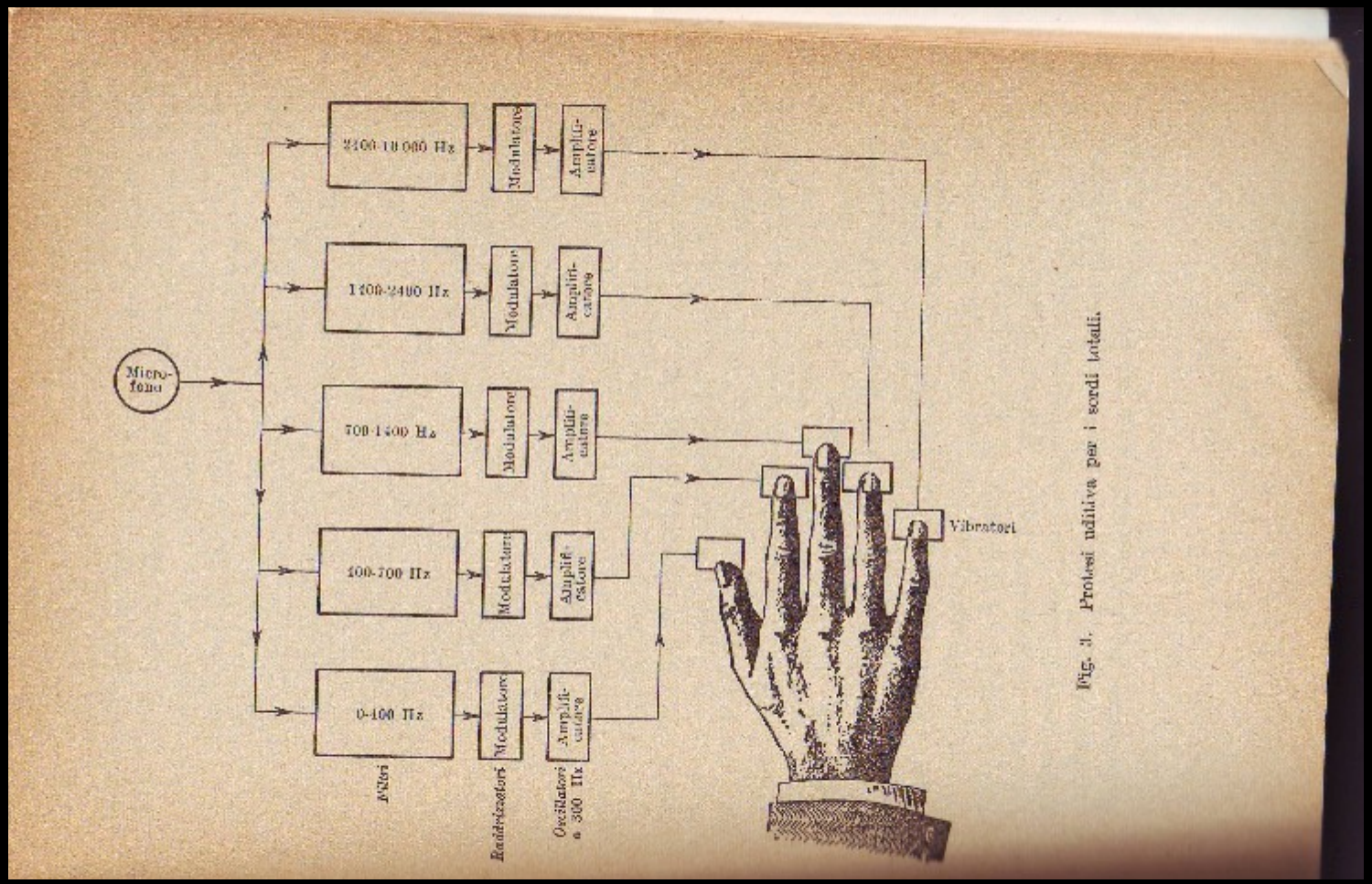


Fig. 3. Protesi uditiva per i sordi totali.

Source: Wiener N., "The Human Use of Human Beings. The Riverside Press (Houghton Mifflin Co.), 1950 (trad.it. "Introduzione alla cibernetica", Bollati-Boringhieri, 1966)

1951: UNIVAC-I

UNIVAC I (UNIVersal Automatic Computer I), First commercial computer made in the United States, Remington Rand

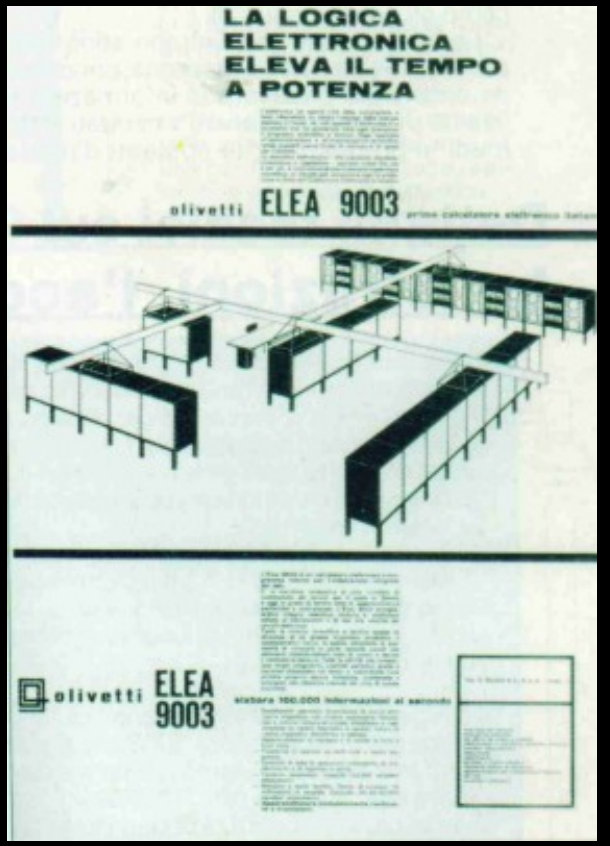
1954, Columbia University, New York

Roberto Olivetti, Mario Tchou

Source: matematica.unibocconi.it

1959: Olivetti Elea 9003

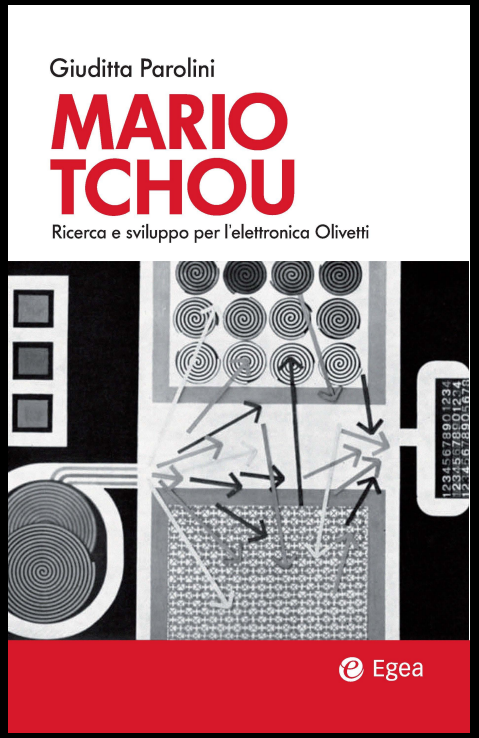
Adriano Olivetti
(1901 - **1960**)



Source: Archivio Storico Olivetti, www.acroliv.org

1959: Olivetti Elea 9003

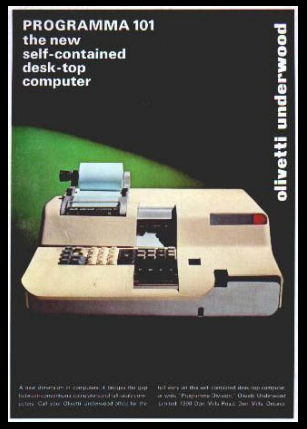
Mario Tchou
(1924 - **1961**)

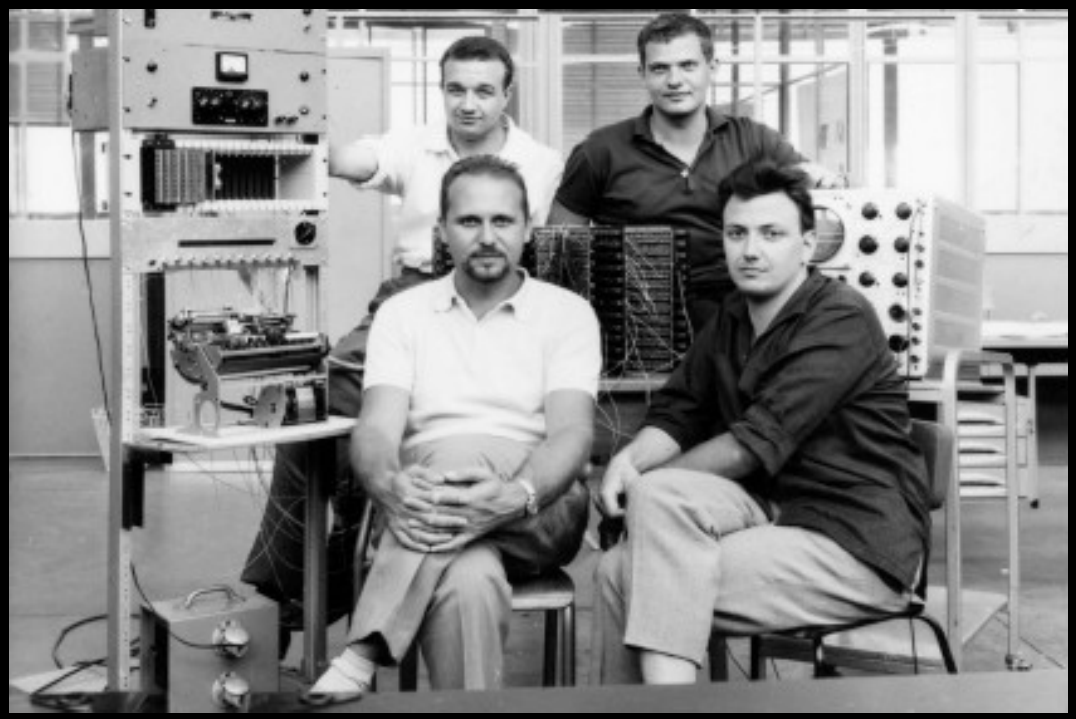


1965: Olivetti P101

olivetti

Gastone Garziera

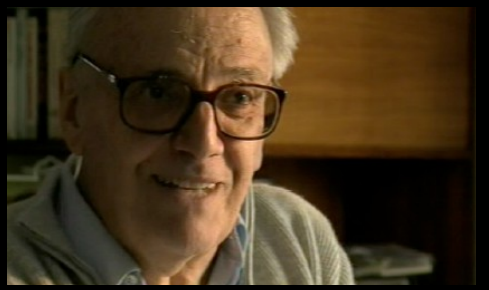




1963

Mario Bellini

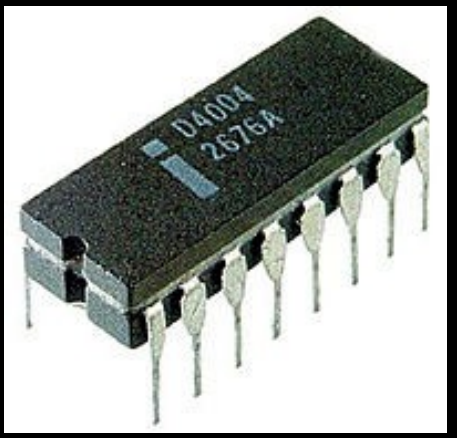
Piergiorgio Perotto



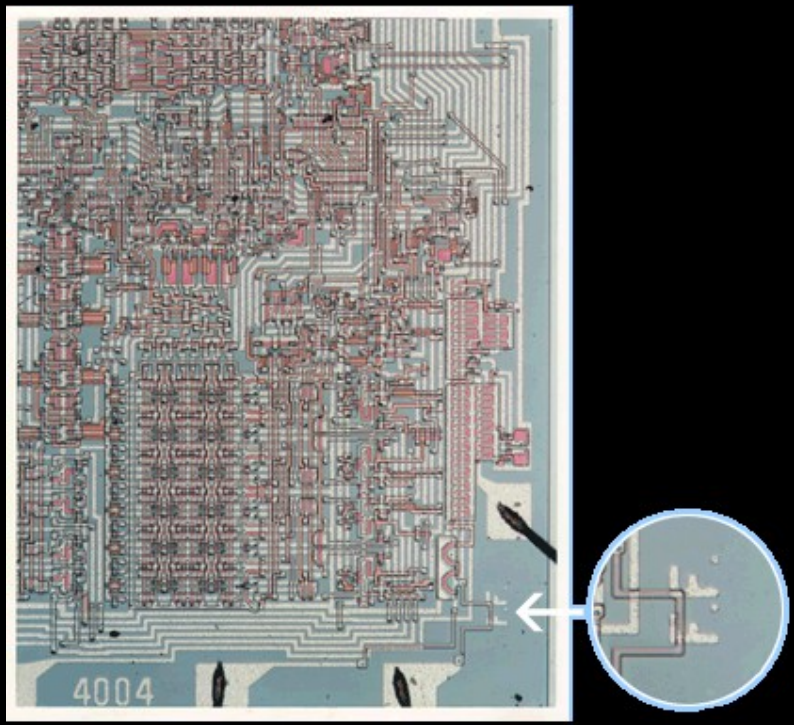
Giovanni De Sandre

Source: www.101project.eu

1971: Intel 4004



Federico Faggin
(Vicenza, 1941 -)



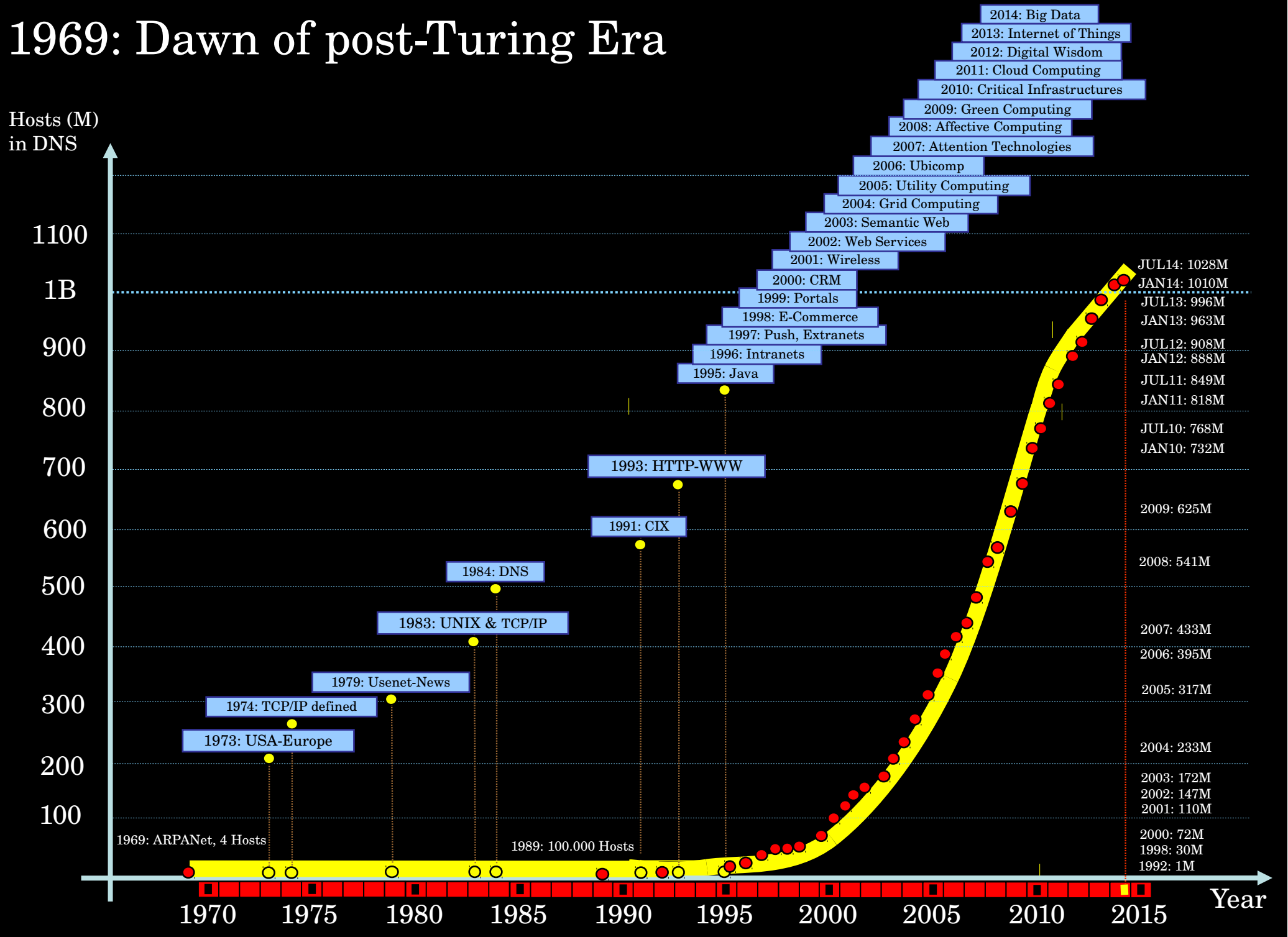
1981:

Xerox Star

IBM PC

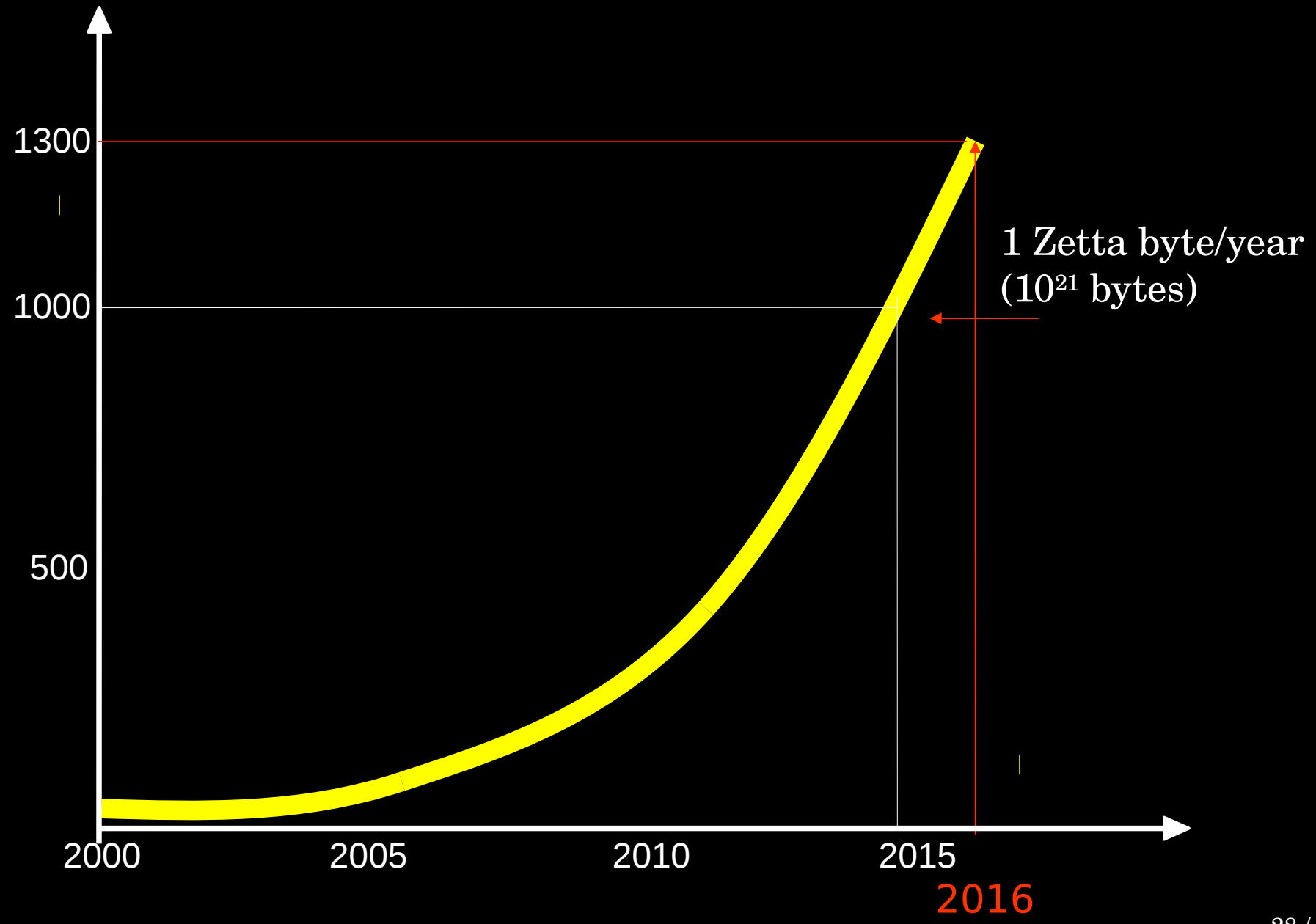
post-Turing ICT

1969: Dawn of post-Turing Era



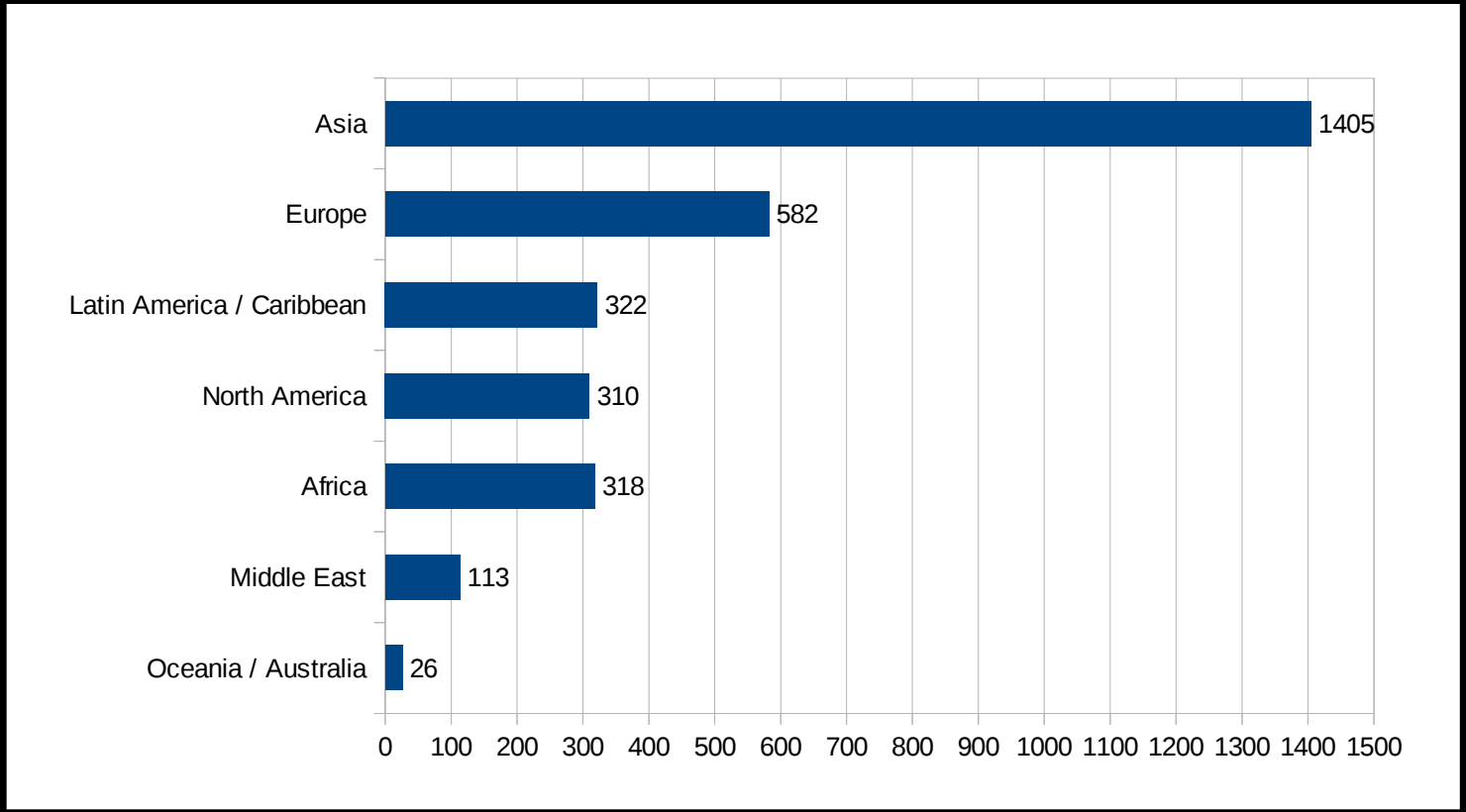
Source: Number of Hosts in DNS, Data from isc.org, Internet Domain Survey, Jul 2013

Internet Traffic (Exa bytes/year)



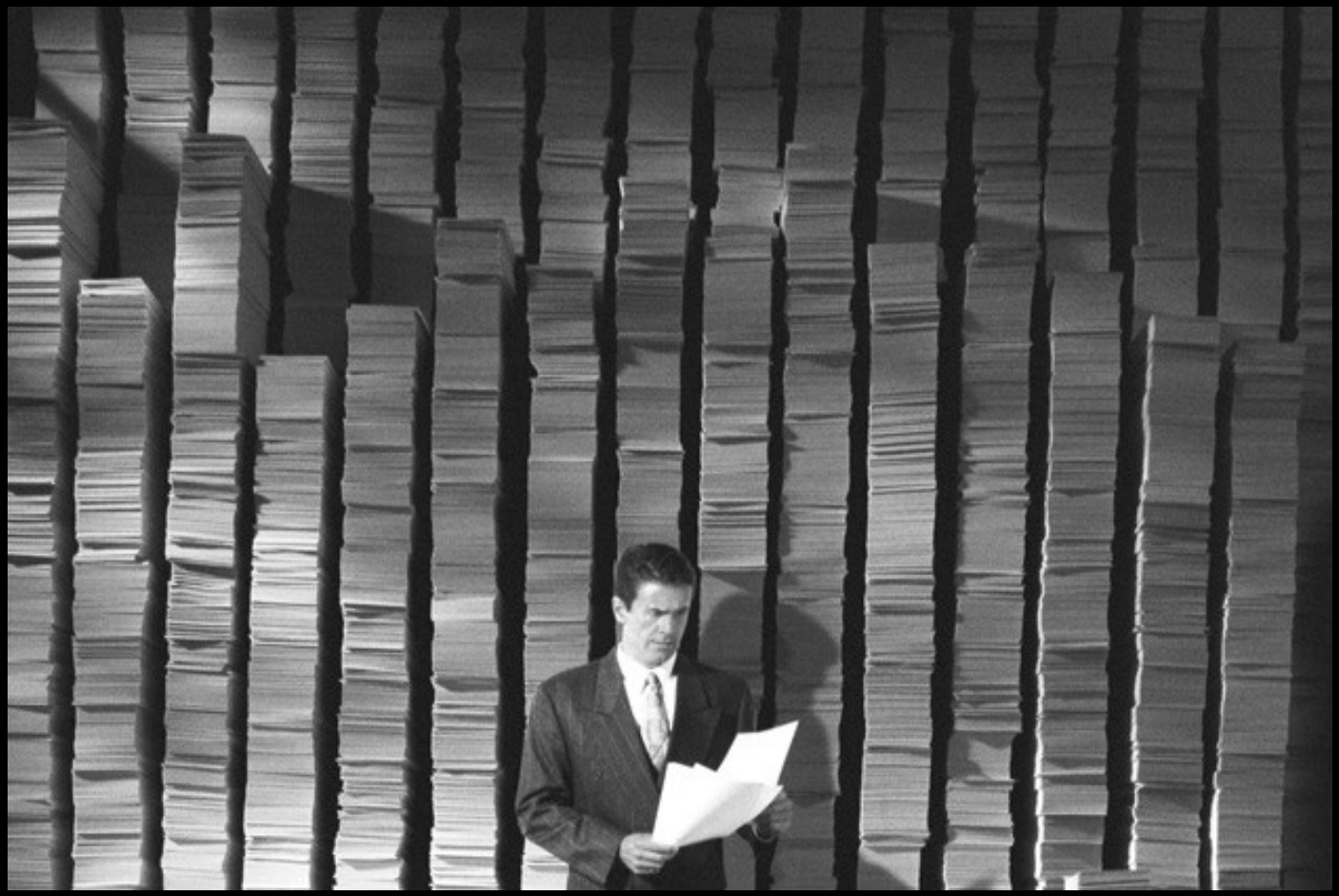
Source: Adapted from CISCO VNI, 2014

Internet Users
31 December 2014
3.079 B



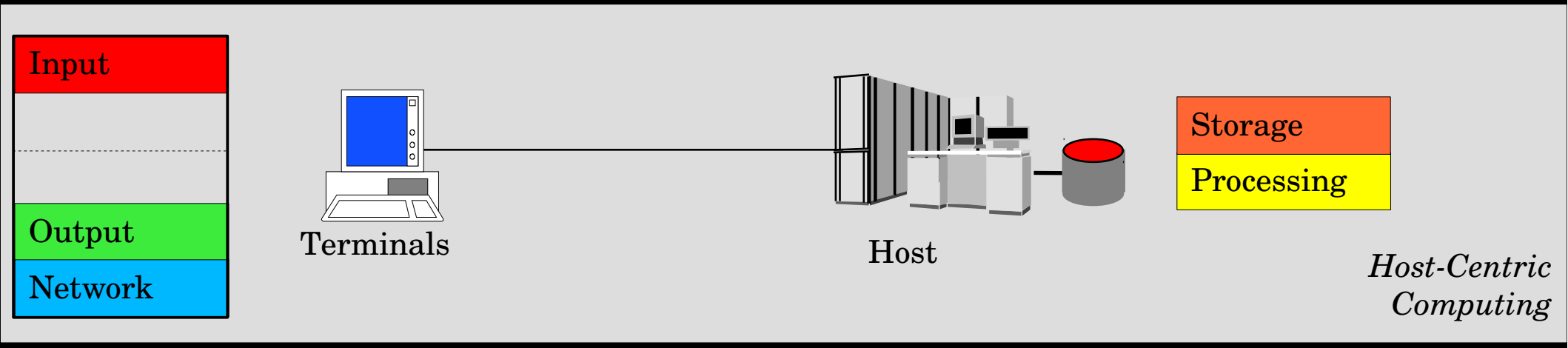
Source: internetworldstats.com, 2014

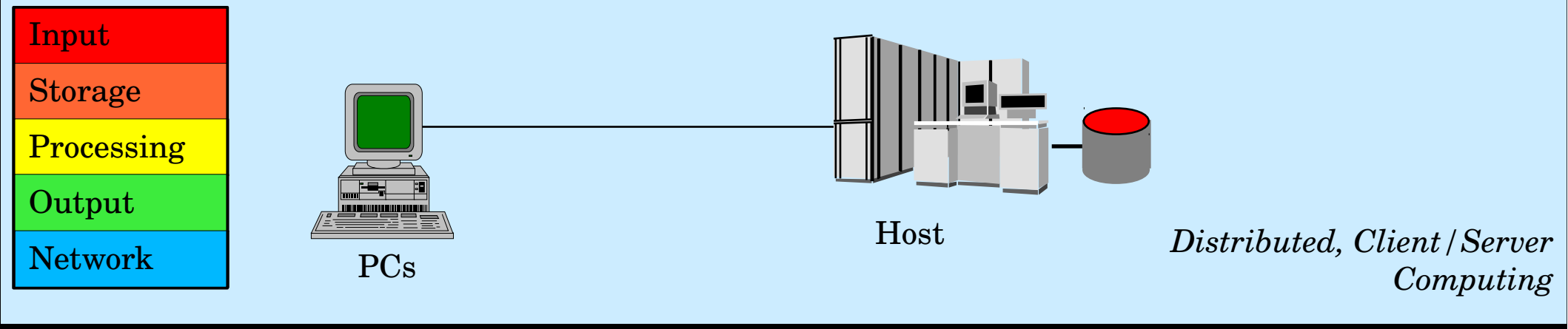
2012: BigData

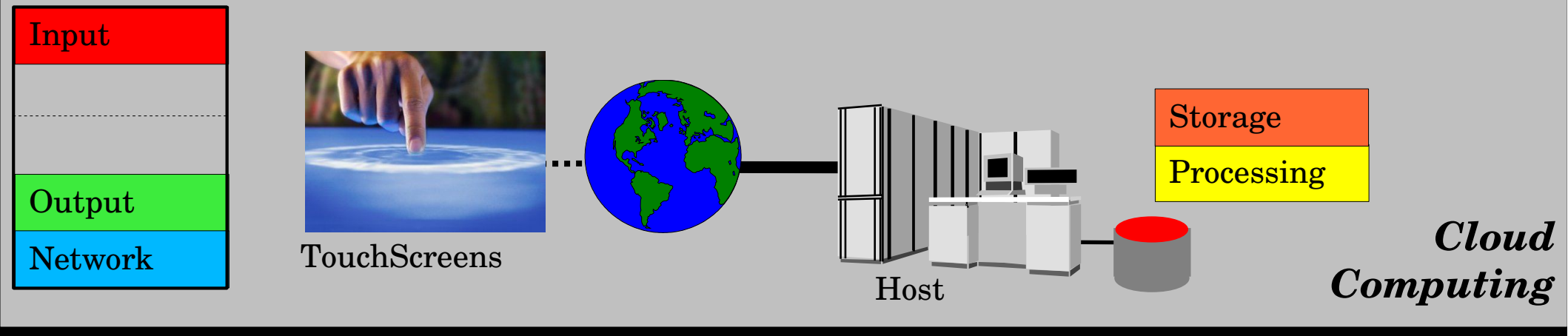


Source: marketingarena.it

Cloud Computing: Back to the Future







"... At the heart of the change,
the next 20 years will be
intelligence drawn from information
Information will be the 'oil of the 21st century'.
... It will be the resource running our economy
in ways not possible in the past."

Peter Sondergaard
Gartner Symposium/ITxpo 2010,
October 17-21, Orlando

2013: The 5 "Big-Clouds" (silos?)

1975: Microsoft

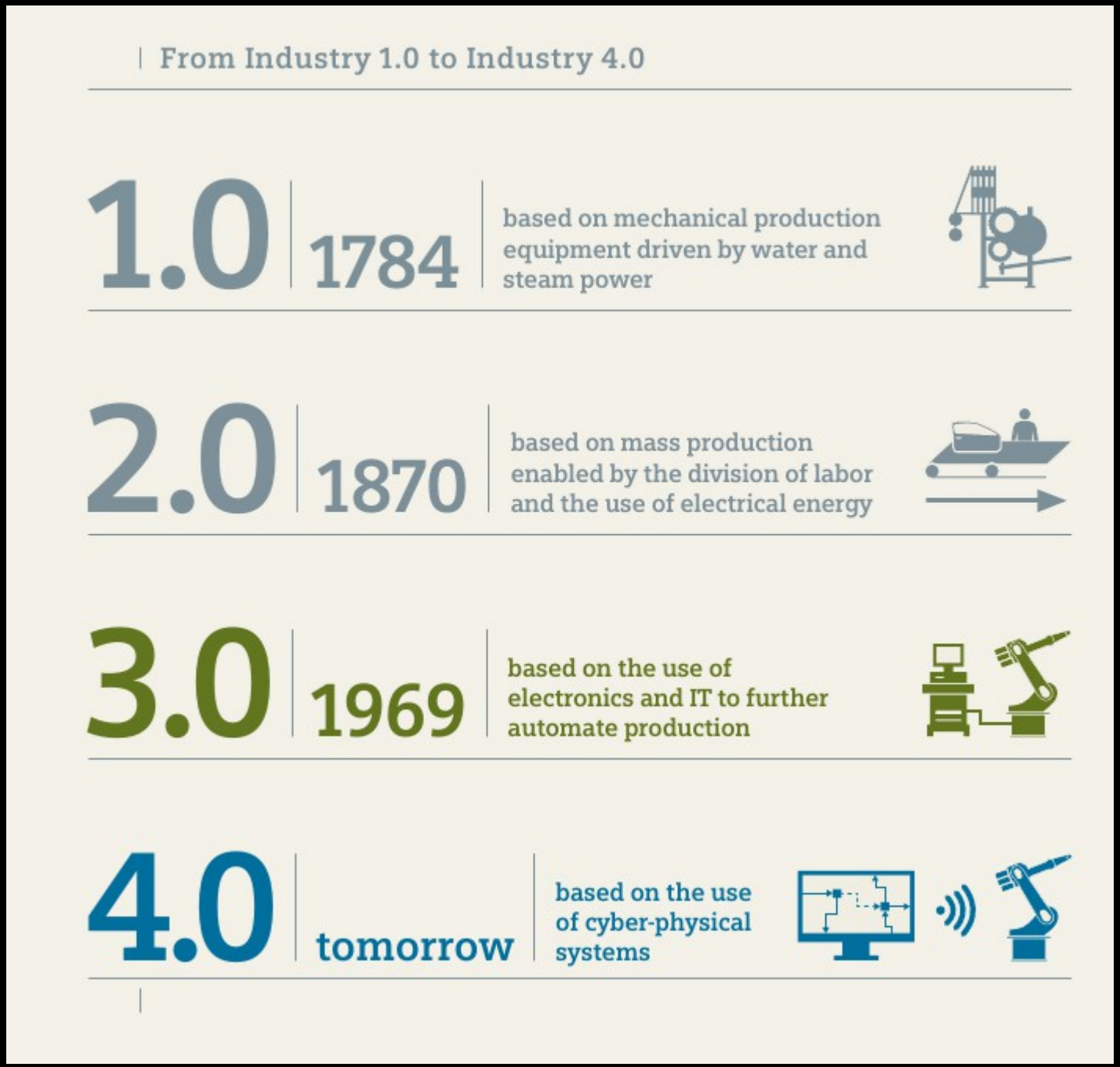
1976: Apple

1994: Amazon

1998: Google

2004: Facebook

On the road to the Fourth Industrial Revolution



Energy

Information

Source: Siemens, Annual Report 2013

Limits? Choices? Ethics?

1979: Hans Jonas

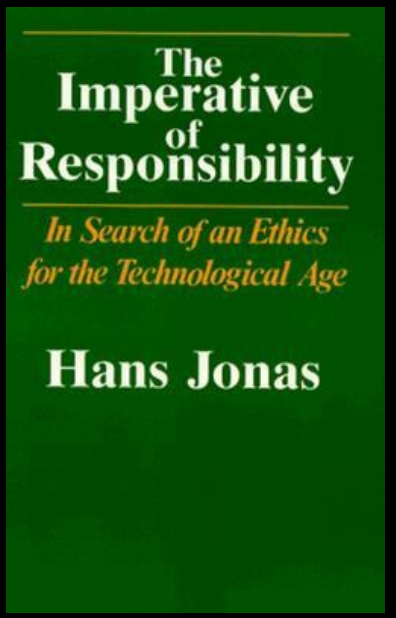
Suhrkamp Verlag Gmbh; Neuauflage (2012)

Hans Jonas

(Germany, 1903 - New York, USA, 1993)

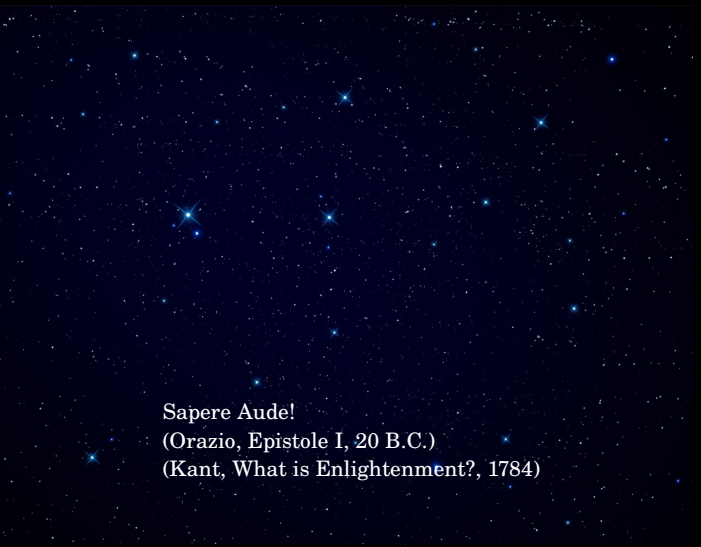
"Human survival
depends on our efforts
to care for our planet and its future"

H.Jonas

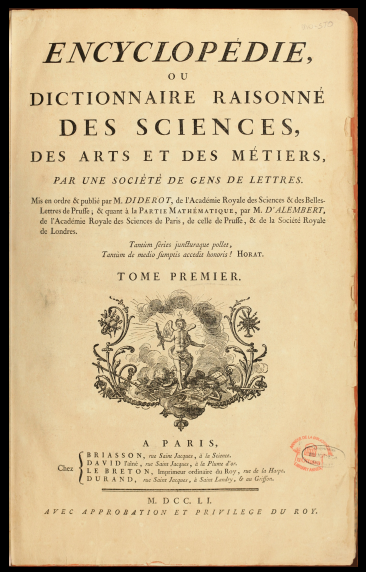


Hans Jonas, Chicago University Press; New edition edition (1 Oct 1985)

XVIII Century



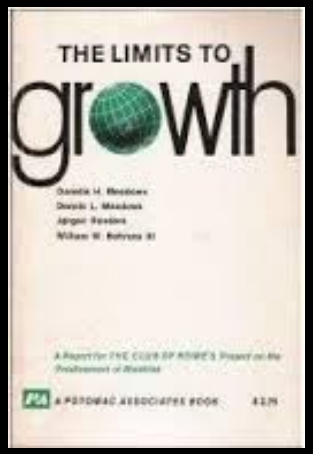
Enlightenment


ENCYCLOPEDIE,
OU
DICTIONNAIRE RAISONNÉ
DES SCIENCES,
DES ARTS ET DES MÉTIERS,
PAR UNE SOCIÉTÉ DE GENS DE LETTRES.
TOME PREMIER.
A PARIS,
M. DCC. LI.
AVEC APPROBATION ET PRIVILEGE DU ROY.

The Sky is the Limit

XX Century

Sustainability



The Earth is the Limit

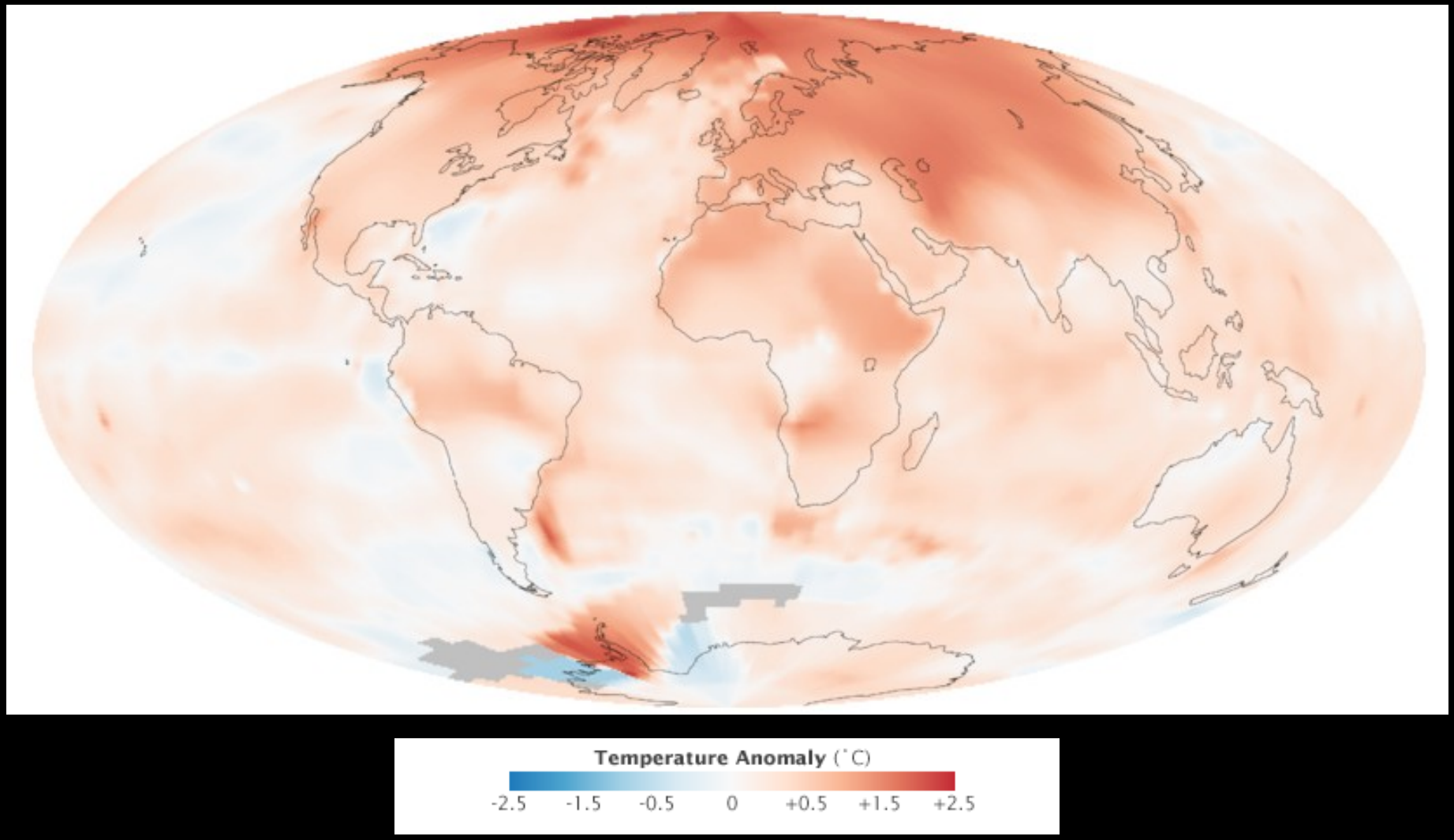
XXI Century

HyperConnectivity

The Self is the Limit

ICT & Climate Change

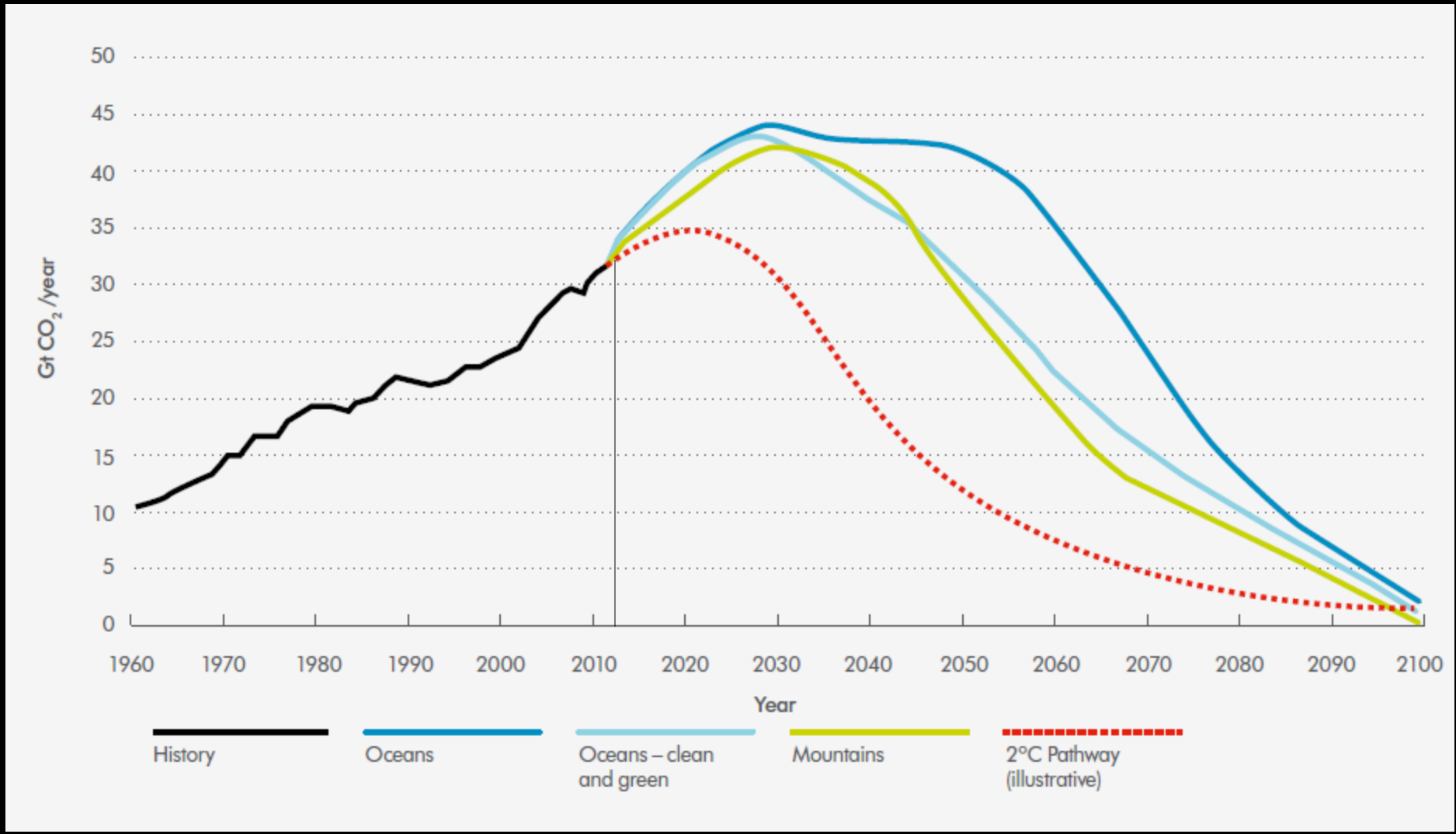
Global Warming



The largest temperature increases are in the Arctic and the Antarctic Peninsula

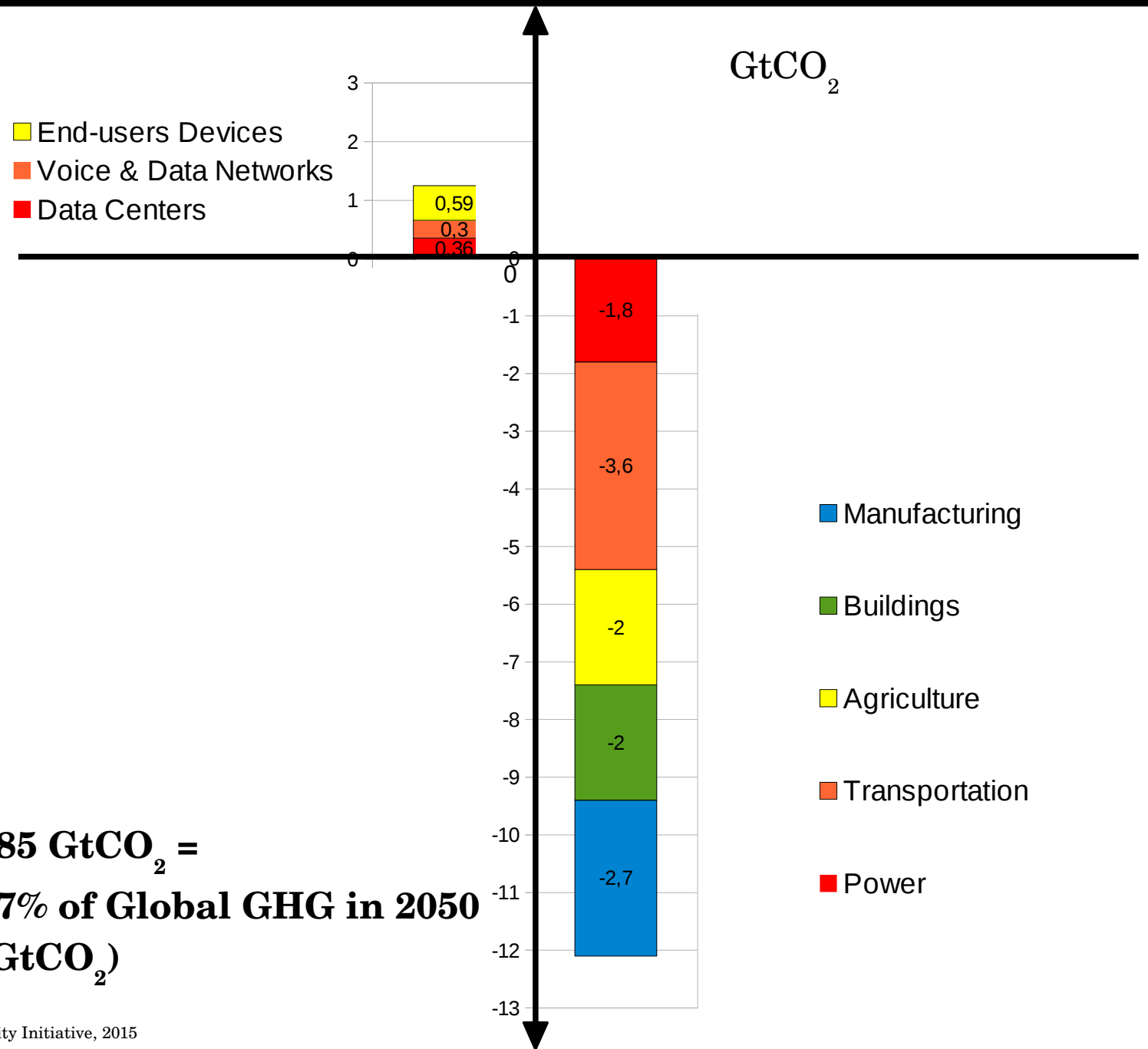
Source: NASA, 2010

Global CO_2 Emissions



Source. www.shell.com/scenairos, 2013

By 2030 ICT can reduce Global CO_2 Emissions: +1,25 -12,1 = -10,85 $GtCO_2$

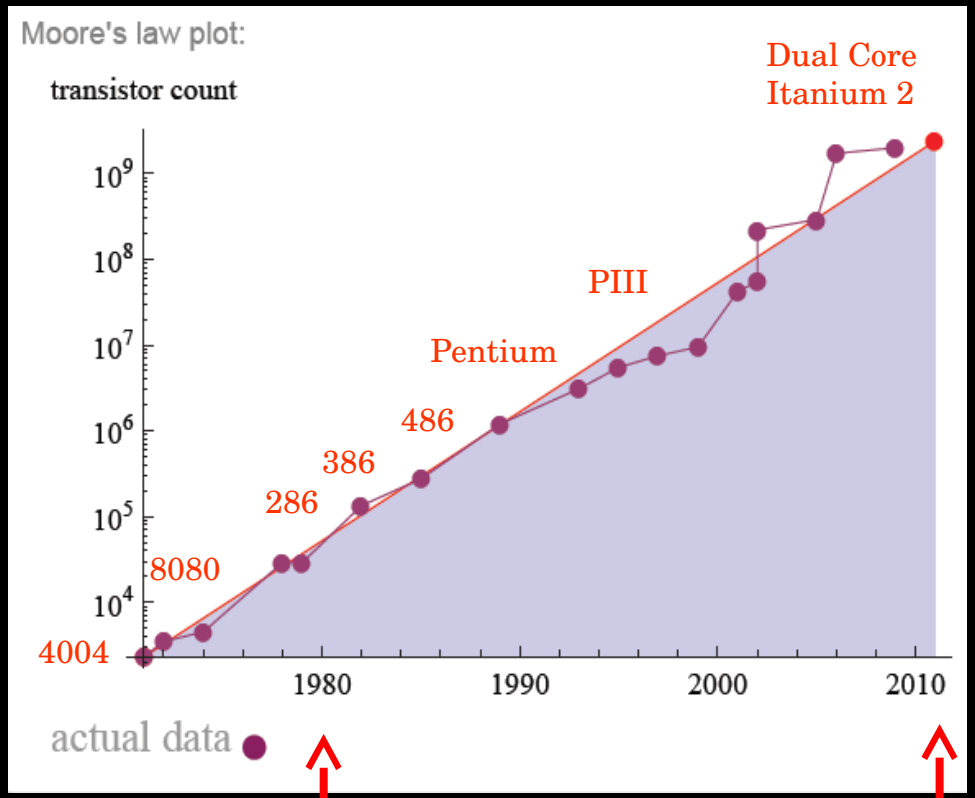


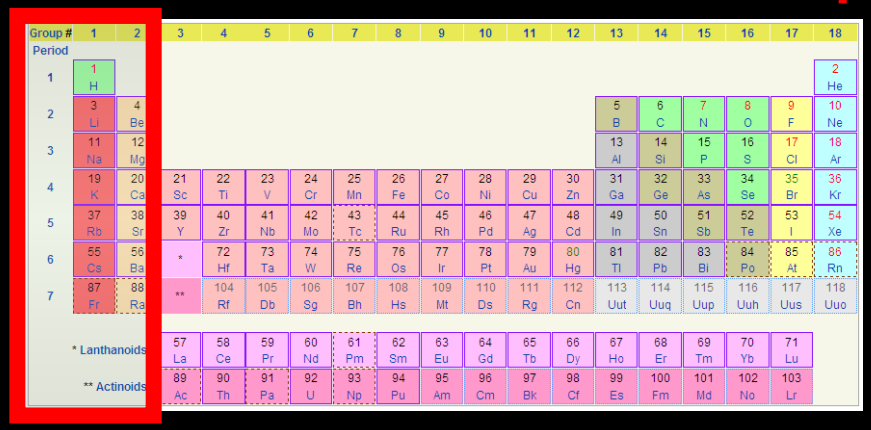
-10,85 $GtCO_2$ =

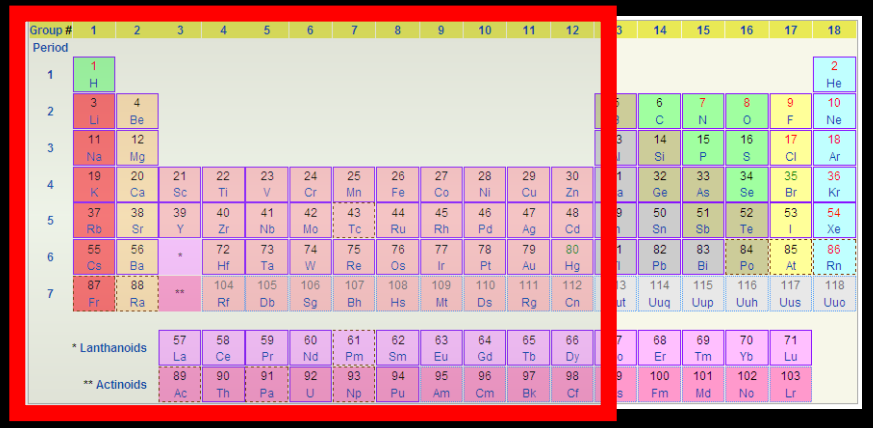
-19,7% of Global GHG in 2050 (55$GtCO_2$)

Source: Global eSustainability Initiative, 2015

Challenging Moore's Law



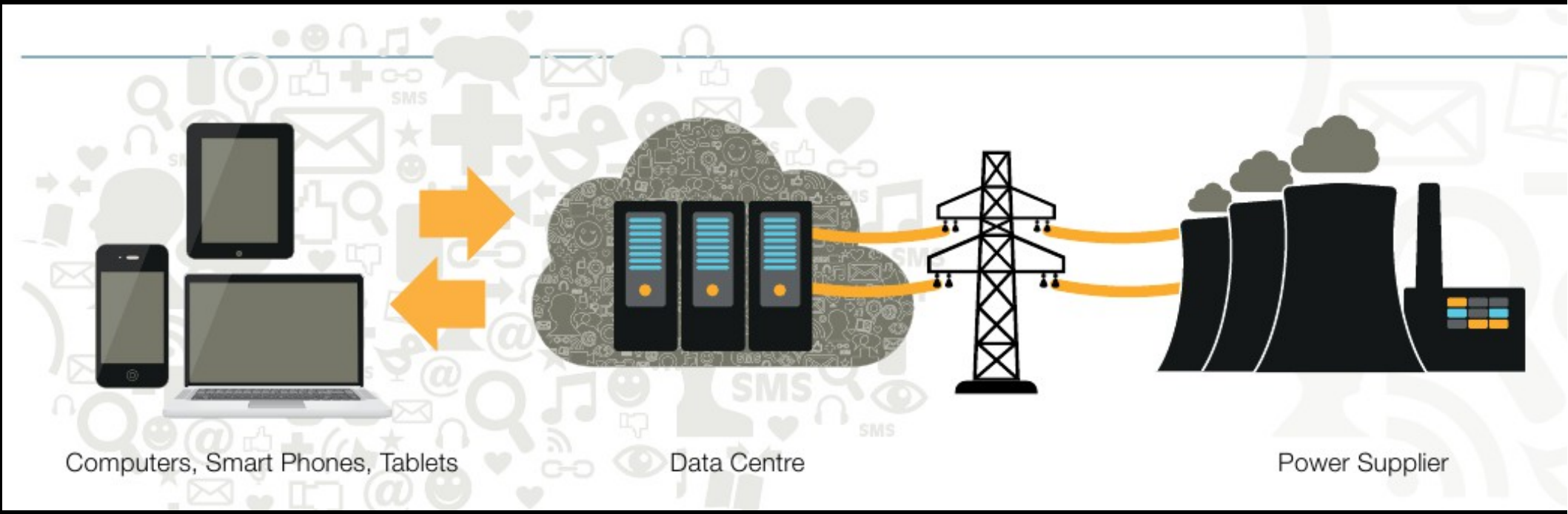




Computer chips made use of 11 major elements in the 1980s
but now use about 60 (two-thirds of the Periodic Table)

Source: "The Consumption Conundrum: Driving the Destruction Abroad", Oswald J. Schmitz, Thomas E. Graedel, April 2010, Yale University

How Clean Is Your Cloud?



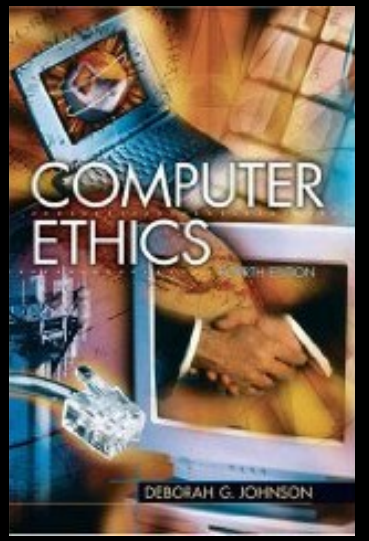
Source: How Clean Is Your Cloud?, Greenpeace, 2012

Agbogbloshie (Accra), Ghana, Africa

Source: Agbogbloshie: the world's largest e-waste dump, The Guardian, 2013

Computer Ethics (Robotics)

1985: Deborah Johnson
Computers as *Socio-Technical Systems*



*"Recognition that **technology is not just artifacts**,*
but rather artifacts embedded in social practices
and infused with social meaning,
is essential to understanding
*the connection between **Ethics and IT**"*

D.Johnson, 1985

Source: Johnson, D. (1985), *Computer Ethics*, First Edition, Englewood Cliffs, NJ: Prentice-Hall;

1985: David Parnas

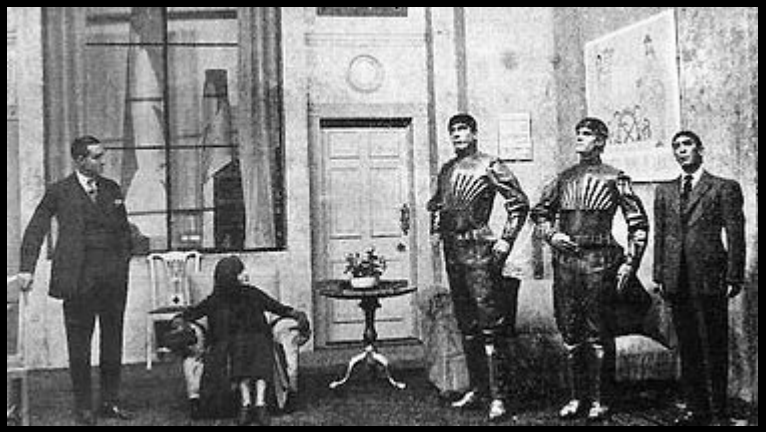
1984, SDI, Strategic Defense Initiative

"... an example of
<u>social, ethical and professional responsibility</u>
in refusing ... the work of the (SDI) panel ...
in his concern with public education ... for the public interest..."

Terry Winograd, 1987
CPSR President, Presents "1987-Norbert Wiener Award" to David Parnas

Source: Communications of the ACM, December 1985 (Vol. 28, No. 12)

1920: Robots



Karel Čapek
(1890-1938)

R.U.R.
(Rossumovi Univerzální Roboti, Rossum's Universal Robots)

"Roboti", from Slavanic "rabota": servitude (from "rabu": slave)

Source: R.U.R., A scene from the play, showing three robots, 25 Jaunary 1921, wikipedia.org

1942: 3 Laws of Robotics

Isaac Asimov
(1920 - 1992)

1st Law

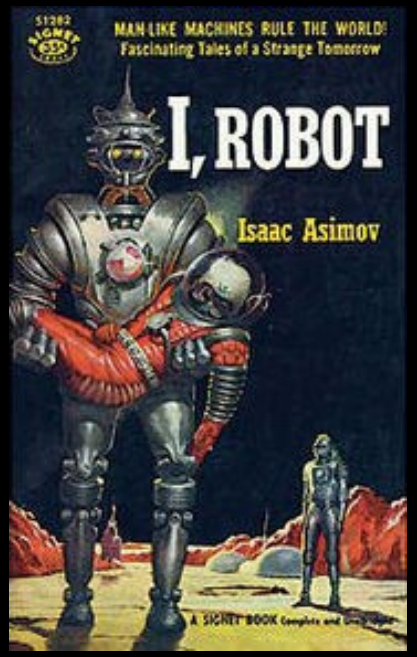
A robot may not injure a human being or,
through inaction,
allow a human being to come to harm.

2nd Law

A robot must obey orders given to it by human beings,
except where such orders
would conflict with the First Law.

3rd Law

A robot must protect its own existence
as long as such protection
does not conflict with the First or Second Law.

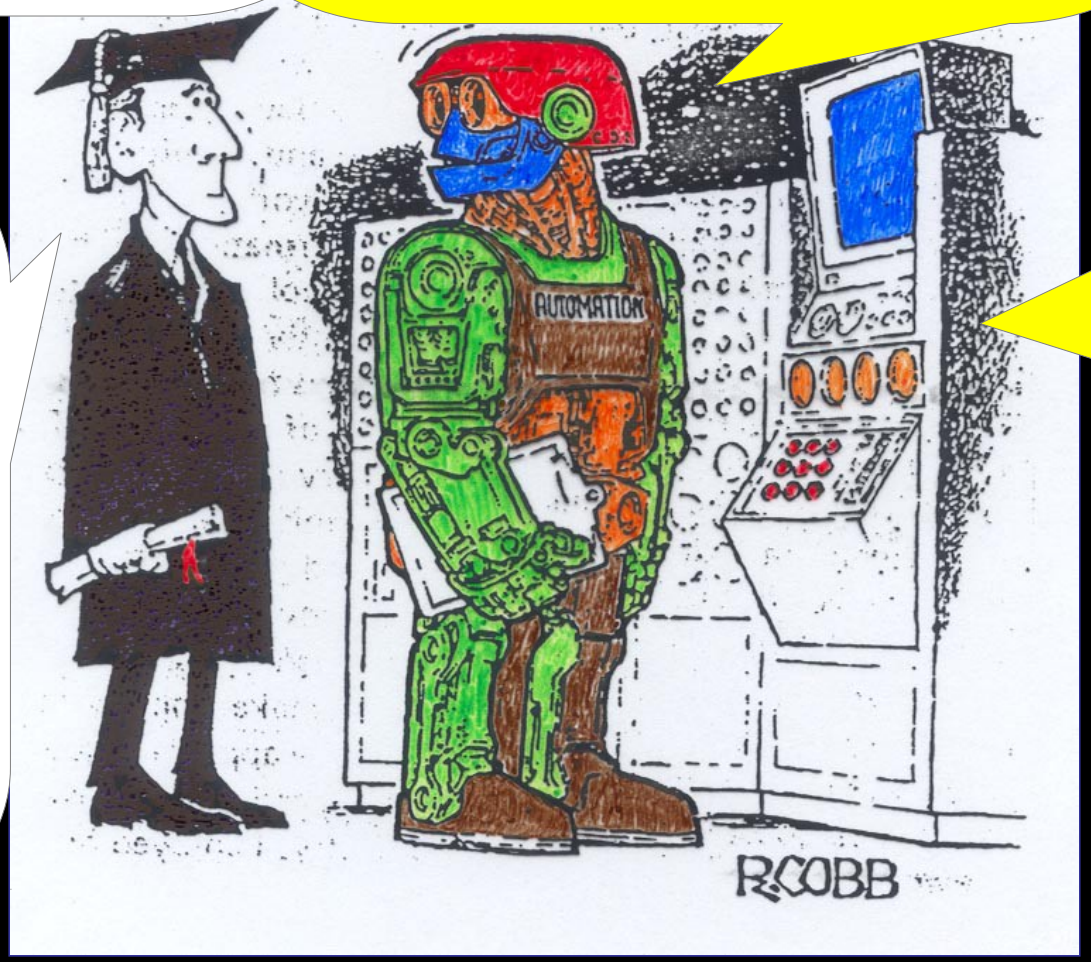


Isaac Asimov
"Runaround", 1942

Source: I. Asimov (1950), "I, Robot", Gnome Press

You are Dumb, Rigid, Insensitive to Change, Unimaginative, Constrained to make Consistent Decisions

We are precise, Orderly, Undistractible, Unemotional, Logical



You are Vague, Disorganized, Distractible, Emotional, Illogical

We are Creative, Compliant, Attentive to Change, Resourceful, Able to make Flexible Decisions based on Content

Human-Computer Interactions

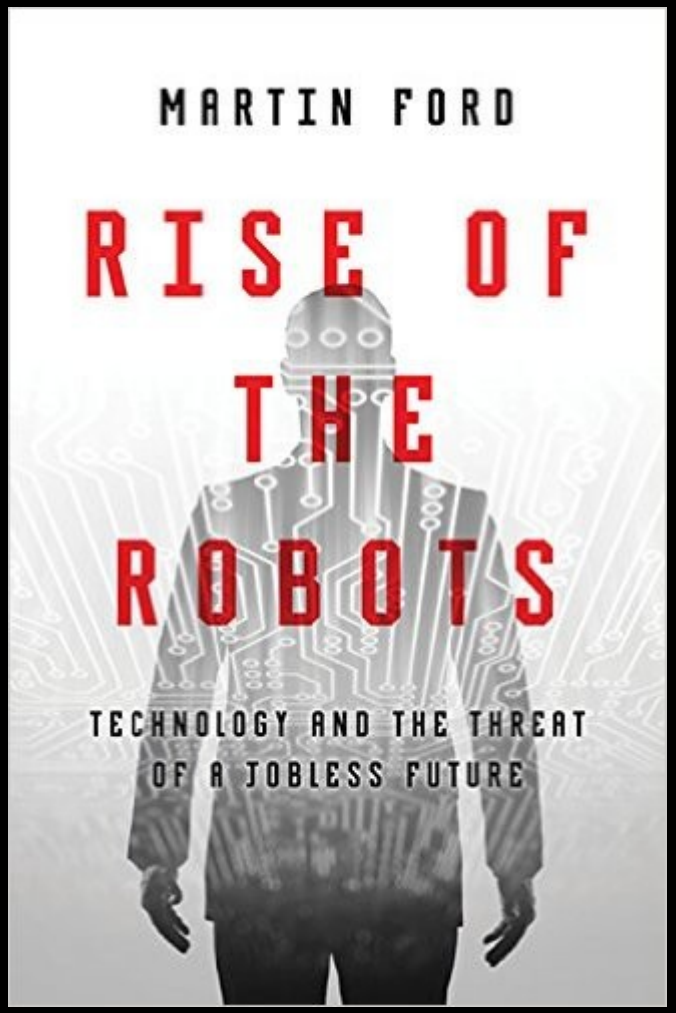
Robotics

Highly Mobile and Autonomous Robots
Humanoid Robots Living with Humans
Accomplish Tasks Beyond Human Capability

Ethical Issues

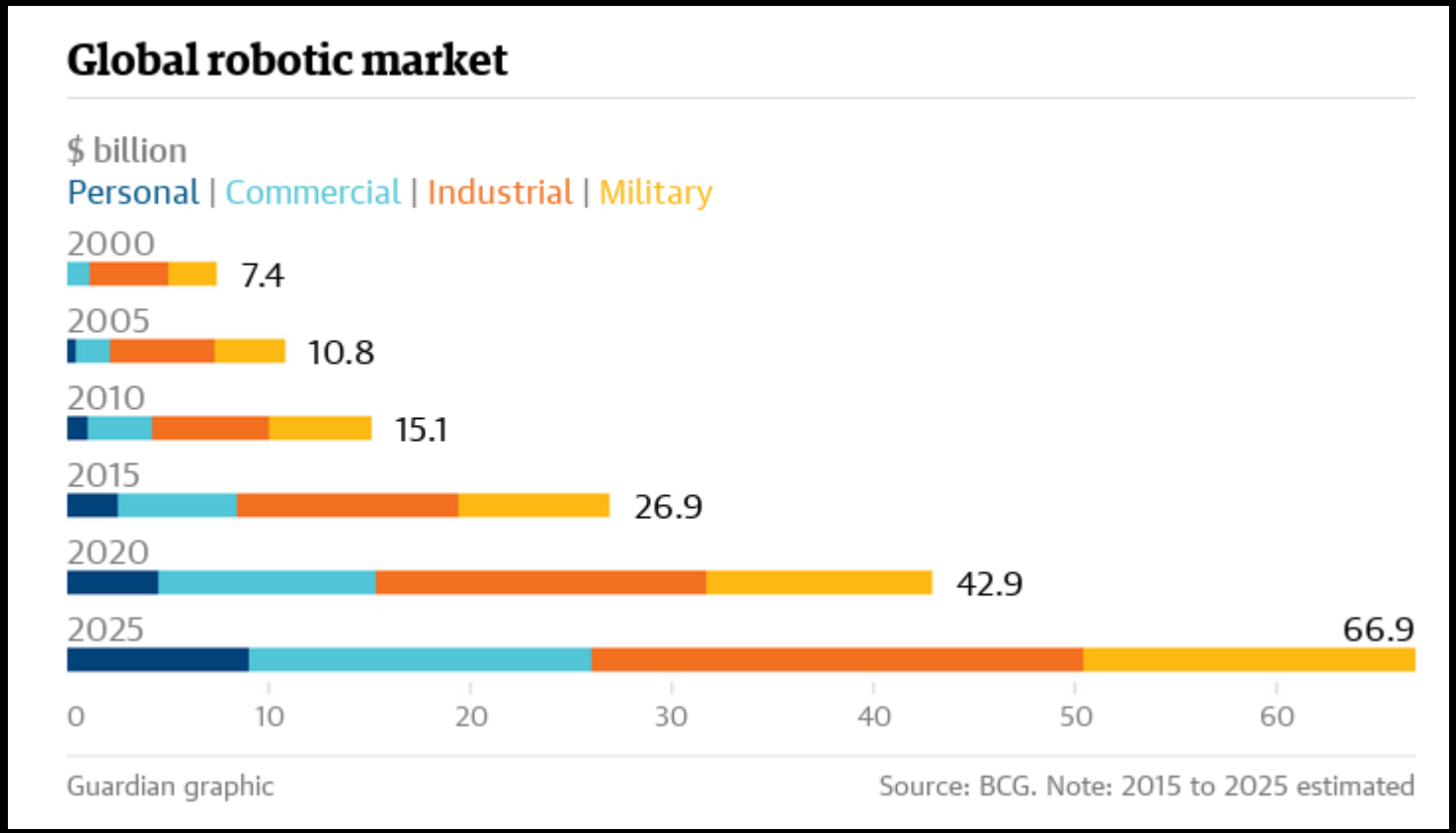
Sensory Perception
Privacy & Surveillance
Tele-presence
Robot Autonomy
Robot Responsibility
Moral Obligation
Privacy - Robotics
Overtaking Humankind
Robot Rights
Man-Machine Interaction

Rise of the Robots:
Technology and the Threat of a Jobless Future



Source: Martin Ford, Rise of the Robots: Technology and the Threat of a Jobless Future, Basic Books, May 2015

2025 Global Robotic Market: 66.9 $B



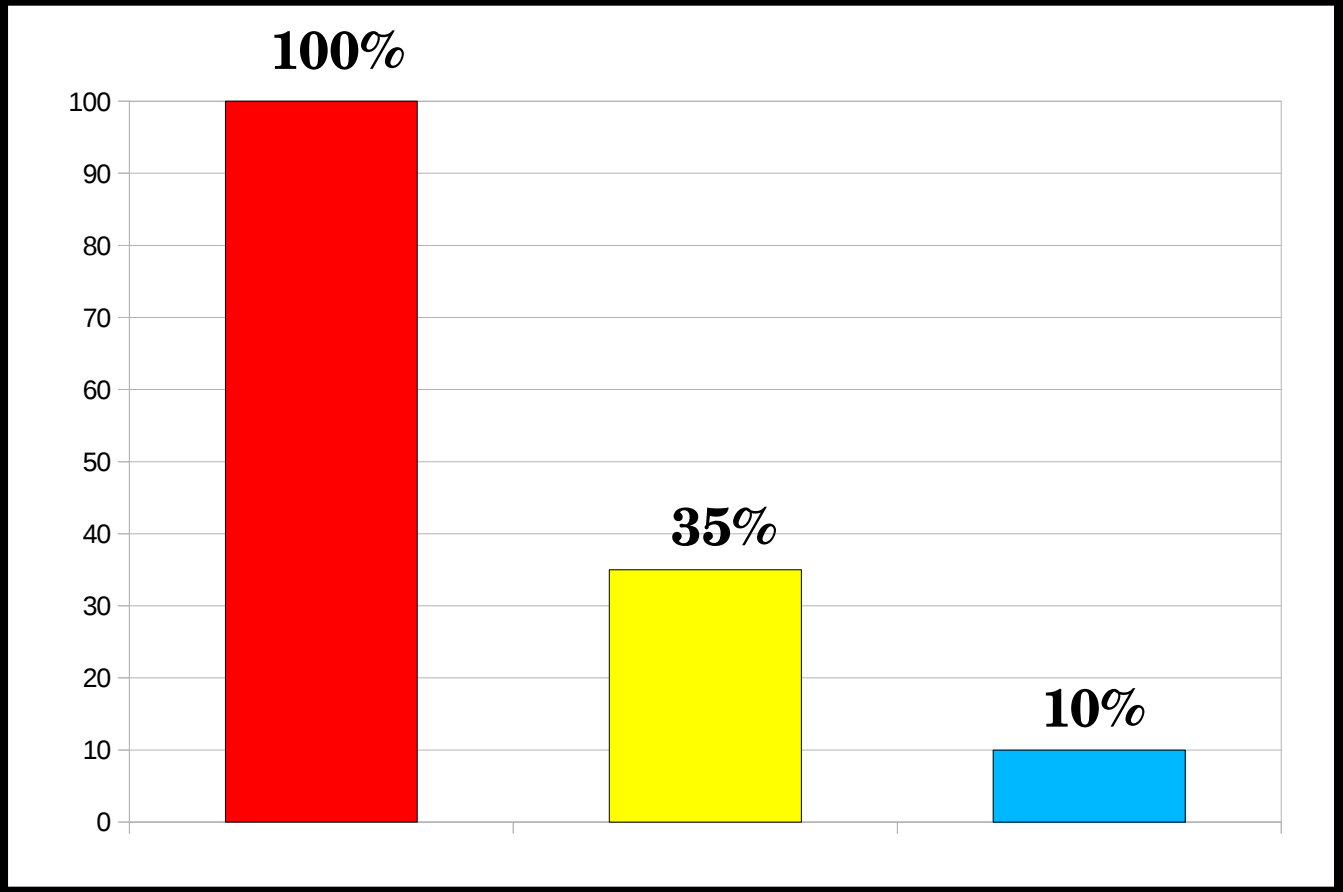
Robot Revolution: Rise of 'Thinking' Machines Could Exacerbate Inequality

theguardian

Source: Robot revolution: rise of 'thinking' machines could exacerbate inequality, The Guardian, 5 November 2015

Labour Cost Savings

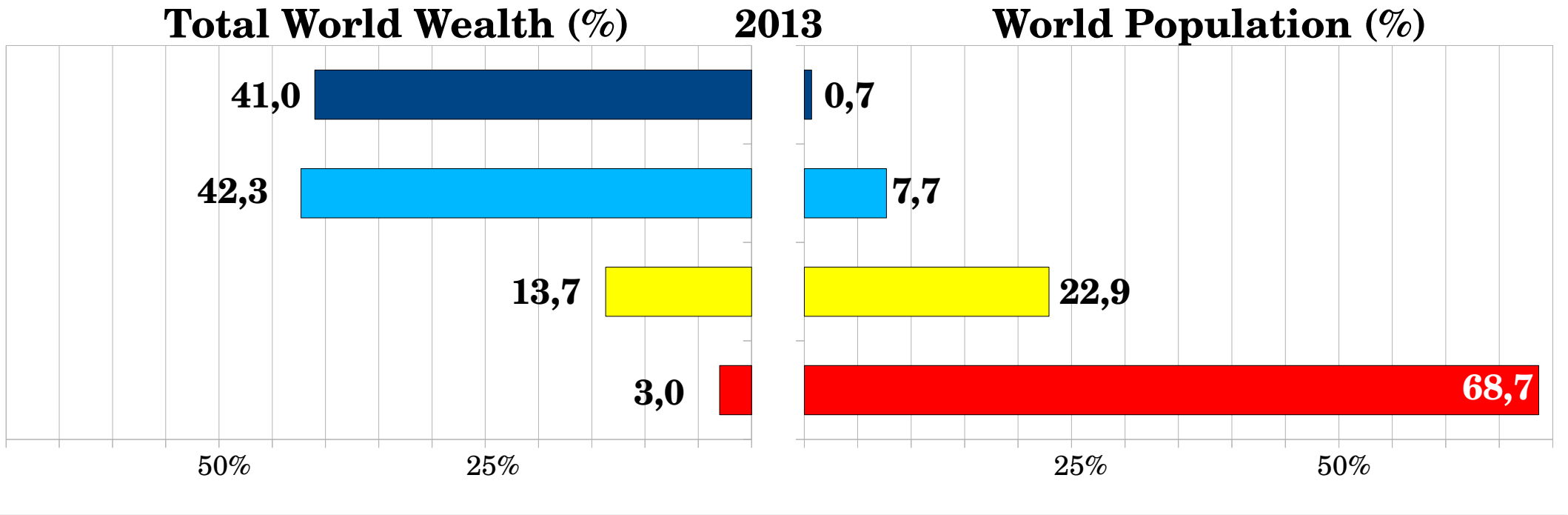
Manufacturers Could Save 90% of Wage Costs by Replacing Workers with Robots



Source: Robot revolution: rise of 'thinking' machines could exacerbate inequality, The Guardian, 5 November 2015

World (2013)

41,0% Wealth = 7% Population

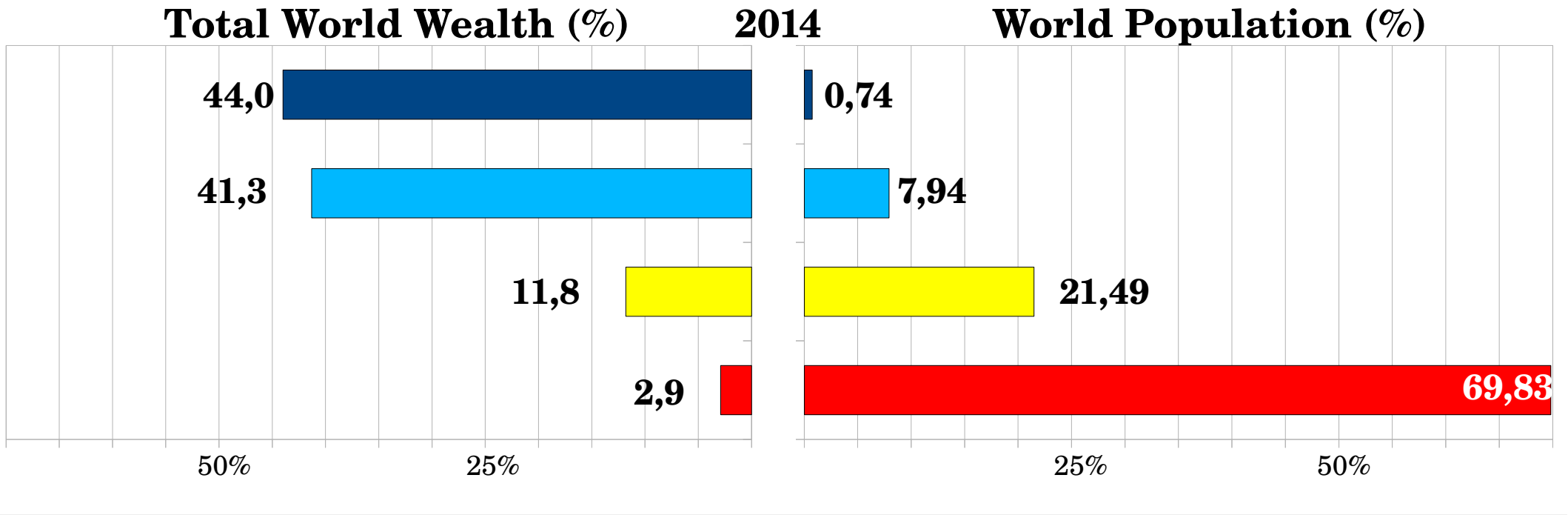


3,0% Wealth = 68,7% Population

Source: Credit Suisse Global Wealth Databook, 2013

World (2014)

44,0% Wealth = 7% Population

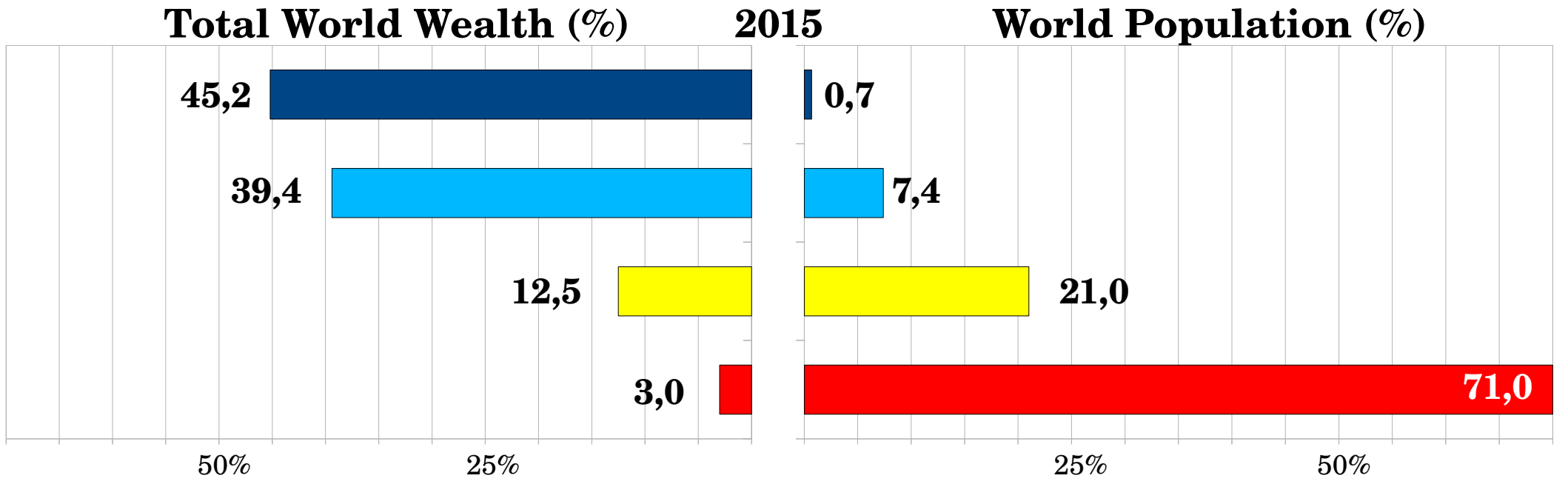


2,9% Wealth = 69,8% Population

Source: Credit Suisse Global Wealth Databook, 2014

World (2015)

45,2% Wealth = 7% Population



3,0% Wealth = 71,0% Population

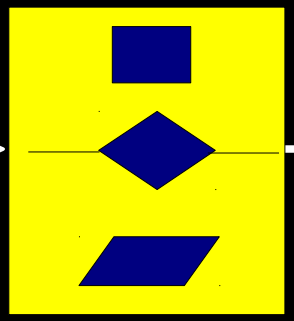
Source: Credit Suisse Global Wealth Databook, 2015

Software

P

Analista

Algoritmo
(Flow Chart)



Programmatrice

Programma
(espresso con un
Linguaggio di Programmazione
es. Pascal, C++, Java, etc.)

```
begin
read (X)
if ( X < = 0)
   then goto begin
   else Y = SQRT (X)
write (Y)
end
```

Com
pila
tore

```
01101101
11001101
01101111
11110000
```

Programma
ESEGUIBILE
(espresso in
BINARIO)

The Limits of Software Testing

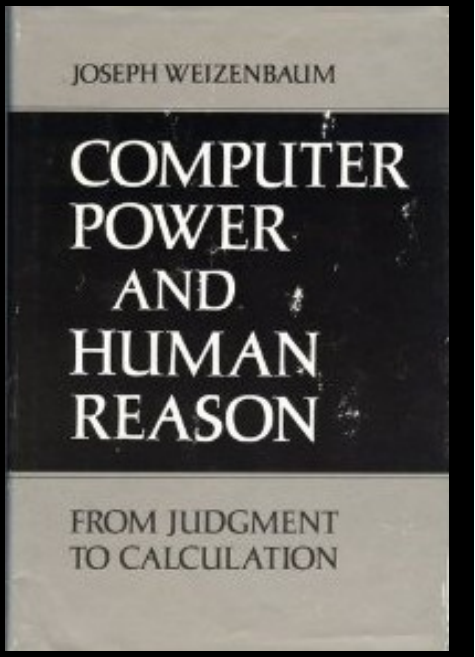
Edsger W. Dijkstra
(1930 - 2002)

"Program testing
can be used
to show the presence of bugs,
but never
to show their absence"

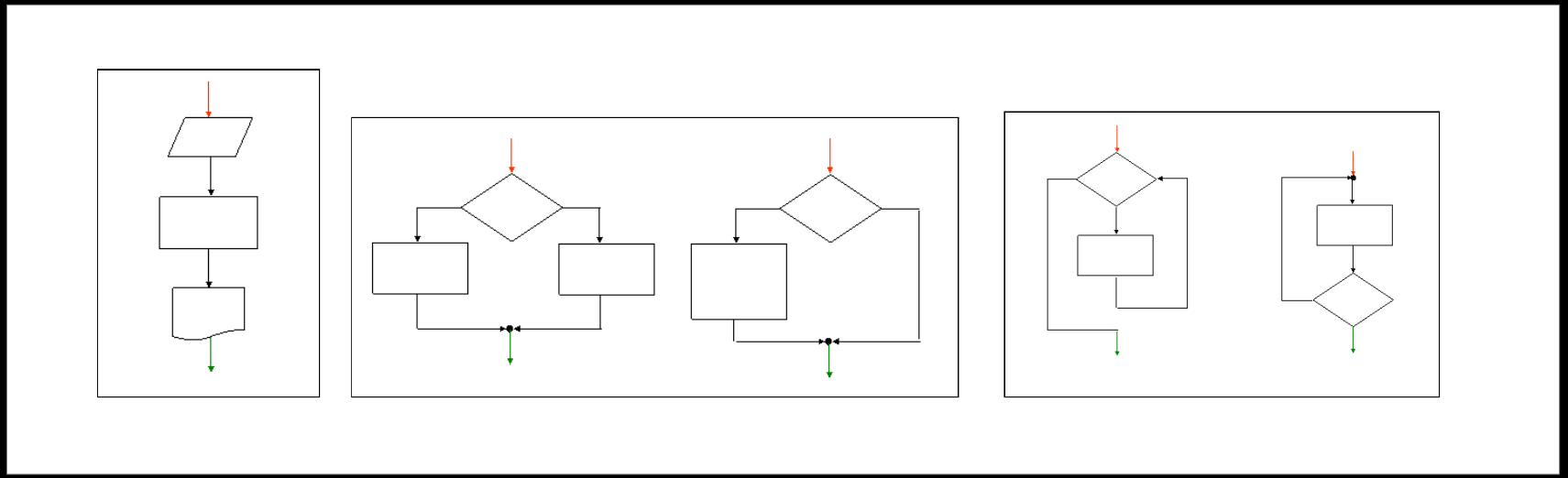
Edsger W. Dijkstra (1972)
Computer Scientist
Winner of Turing Award (1972)

Dijkstra Algorithms, Structured Programming, Semaphores and against GOTO

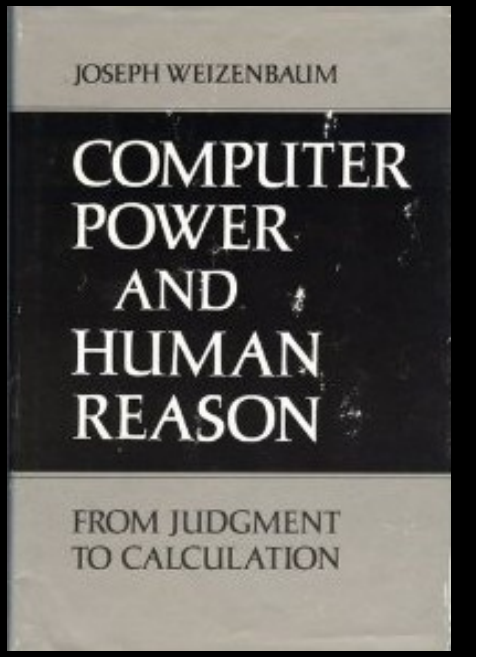
Source: E.W.Dijkstra, "Notes On Structured Programming", Tech.University of Eindhoven, The Netherlands,1972



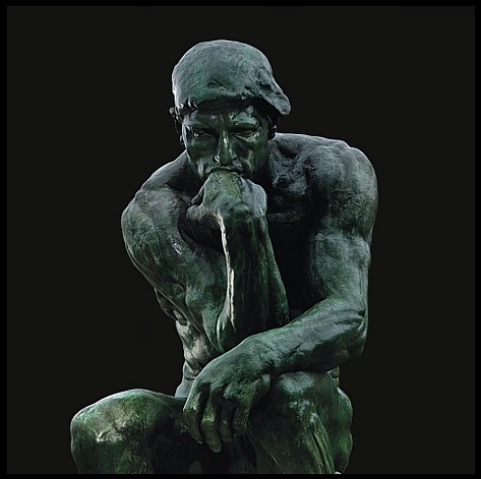
Deciding
is a Computational activity,
something that can ultimately be programmed.



Source: Weizenbaum J., "Computer Power and Human Reason: From Judgment To Calculation", Freeman, 1976



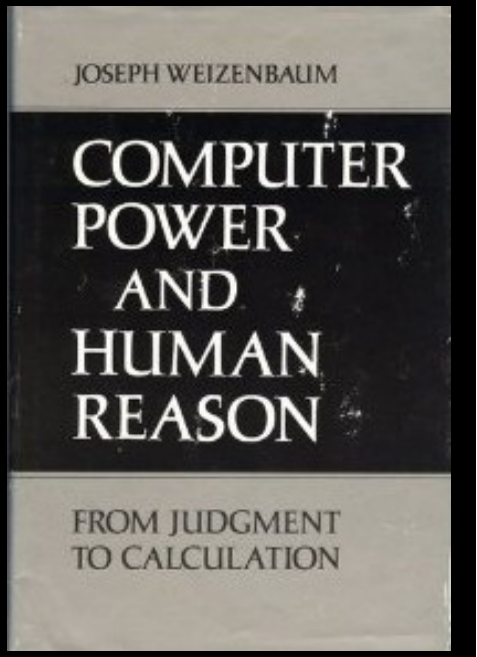
Choosing
is the product of Judgment, not Calculation.
It is the capacity to Choose that ultimately makes us Human.



Source: Weizenbaum J., "Computer Power and Human Reason: From Judgment To Calculation", Freeman, 1976

1976: Joseph Weizenbaum

Joseph Weizenbaum
(Berlin, 1923 - Berlin, 2008)



Weizenbaum's 3 Moral Laws of the Information Society

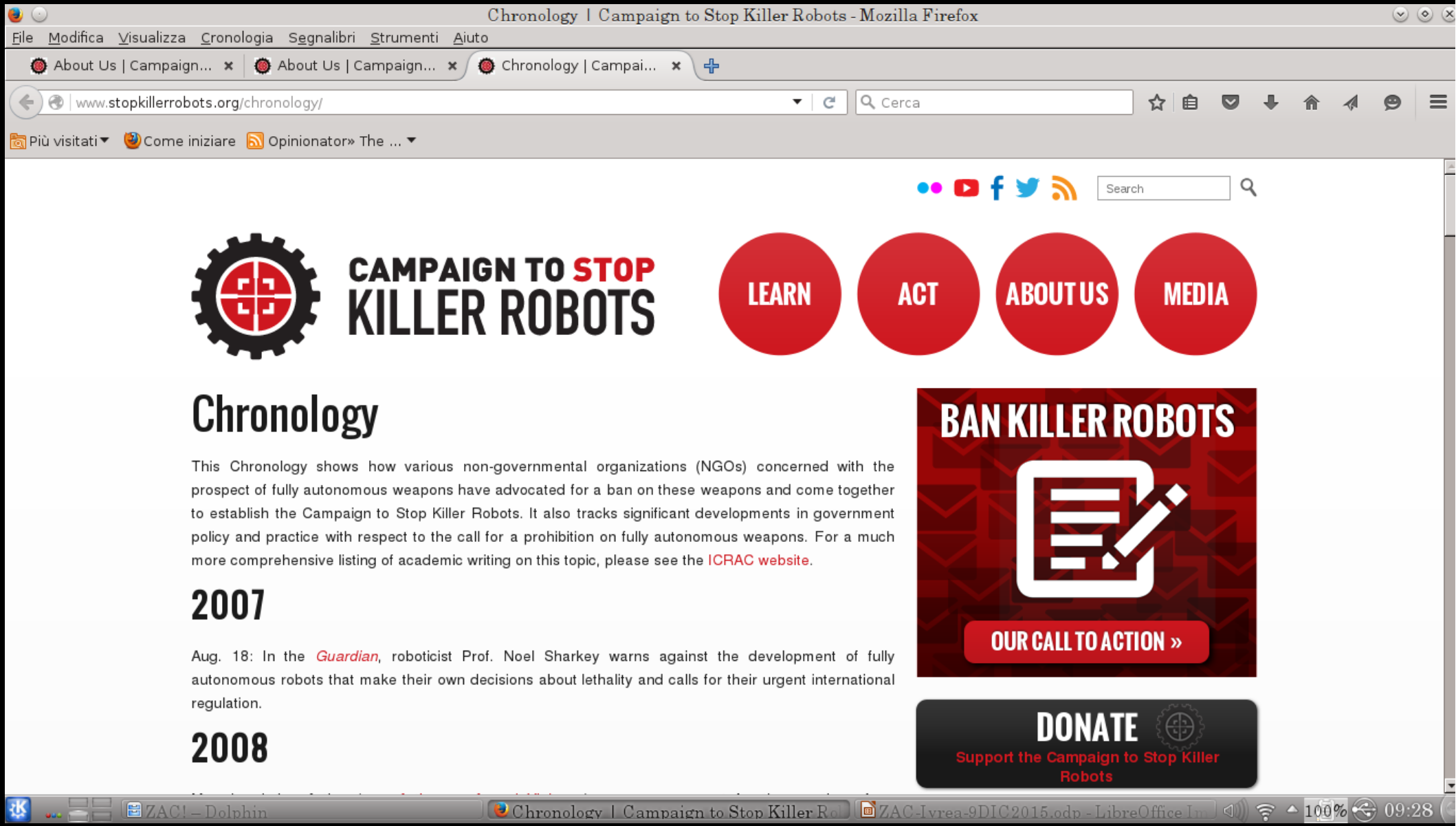
1. Human functions that require
judgement, respect, understanding, caring and love
ought not to be substituted by computers

2. Applications which have irreversible and not entirely foreseeable side effects,
that do not meet pressing human needs,
ought not to be undertaken without very careful forethought.

3. IT is a matter of human choice and responsibility.

Source: Weizenbaum J., "Computer Power and Human Reason: From Judgment To Calculation", Freeman, 1976

Robot Warriors?



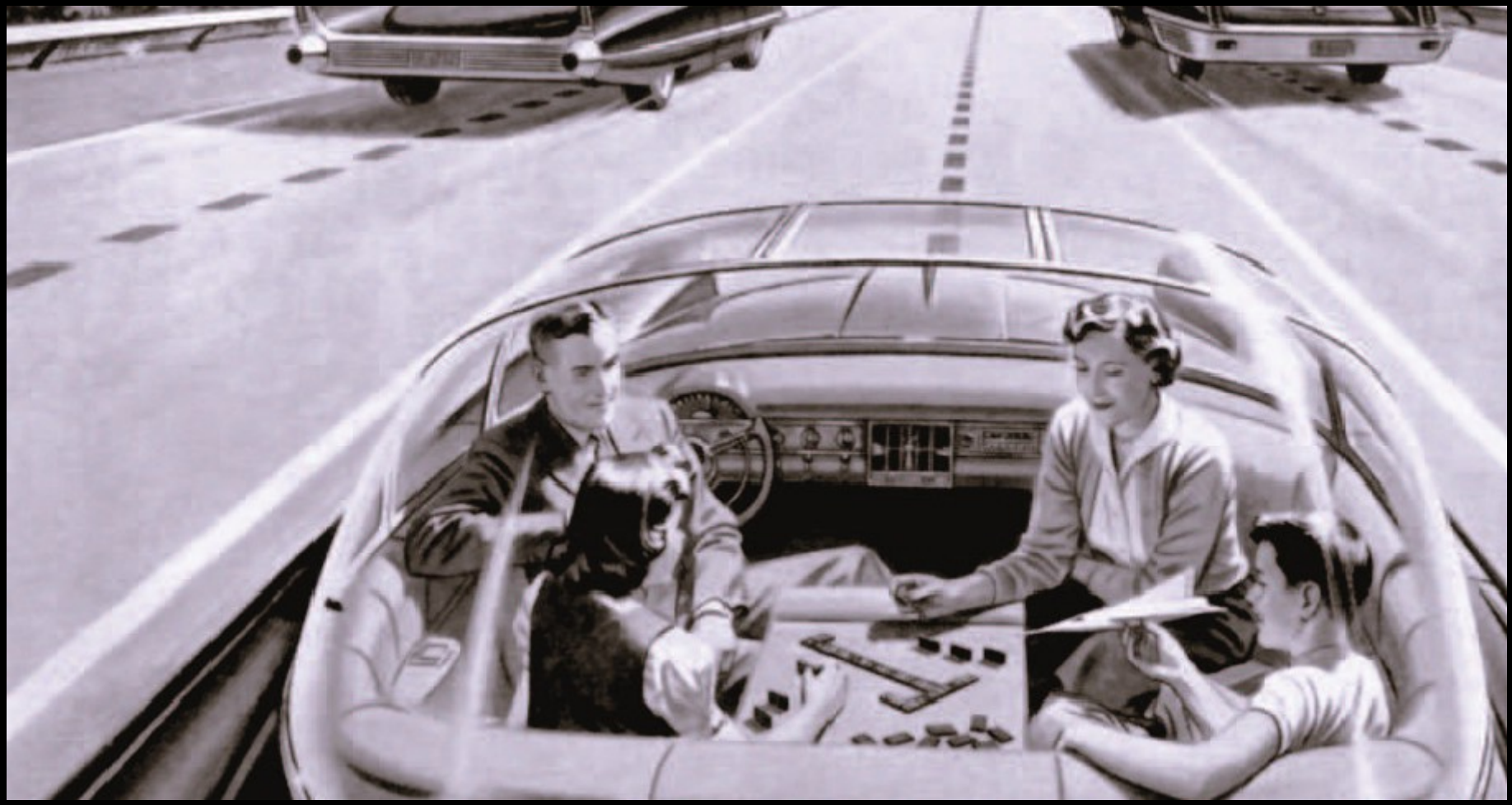
AI Weapon Moratorium?

"The key question for humanity today is
whether to start a global AI arms race
or to prevent it from starting.
*If any major military power pushes ahead with **AI weapon** development,*
a global arms race is virtually inevitable ..."

From the letter presented at the
International Joint Conferences on Artificial Intelligence (IJCAI)
Buenos Aires, 28 July 2015

Source: Sebastian Anthony, 27 July 2015, ArsTechnicaUK

Autonomous Vehicles (1957)



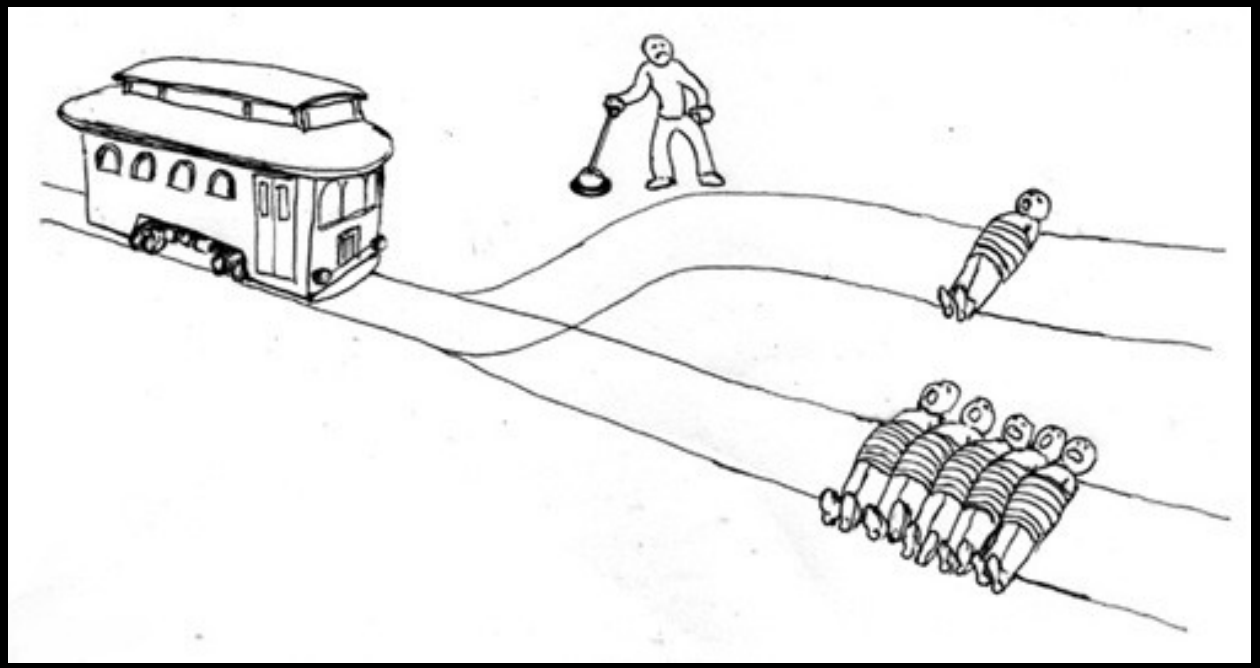
“ELECTRICITY MAY BE THE DRIVER.
One day your car may speed along an electric super-highway,
its speed and steering automatically controlled by electronic devices embedded in the road.
Highways will be made safe - by electricity!
No traffic jams...no collisions...no driver fatigue."

Advertisement from 1957 for "America ’s Independent Electric Light and Power Companies" (art by H. Miller).

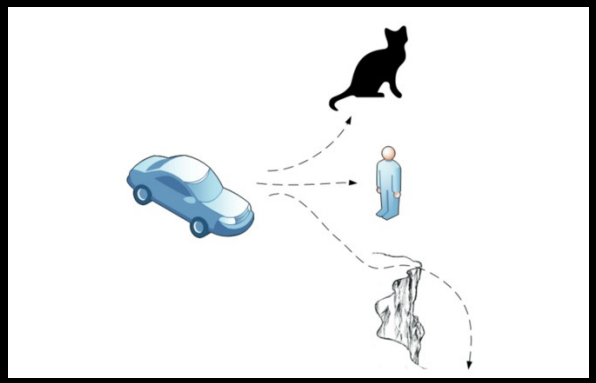
Source: Autonomous Vehicle Technology, RAND Corp., 2014

Robot Ethics?

Judith J.Thomson
(1929 -)
Philosopher



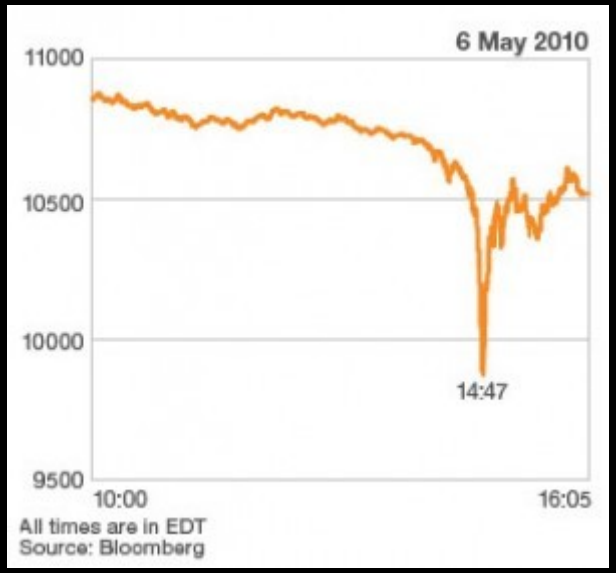
Trolleys, Philosophers and Engineers
Consequentialism?



The Ethics of Autonomous Cars?

Source: "The Trolley Problem", Judith J. Thomson, *The Yale Law Journal*, Vol. 94, No. 6, May, 1985

2010: Algorithms Take Control of Wall Street



"... Humans may need to recall back
some kind of control from computers
... automated trading systems will follow their coded logic
regardless of outcome"

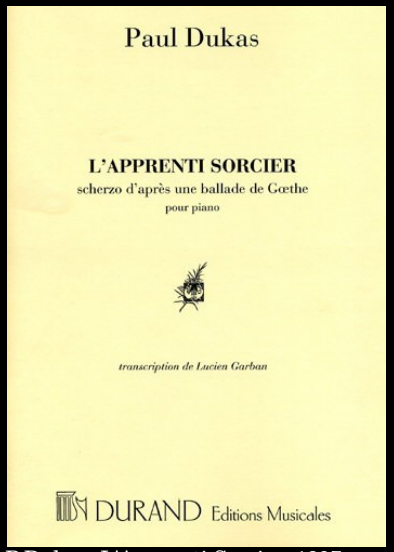
Mary Schapiro
Chairwoman of the Security and Exchange Commission

Source: Salmon F., Stokes J., (2011), Algorithms Take Control of Wall Street, *Wired*, January 2011.

1797: Der Zauberlehrling (The Sorcerer's Apprentice)

Johann Wolfgang von Goethe
(1749-1832)

F.Barth, Der Zauberlehrling, 1882



P.Dukas, L'Apprenti Sorcier, 1897

W.Disney, Fantasia, 1940

Source: Josef Raabe - Portrait of Goethe, Wallraf-Richartz-Museum, Cologne

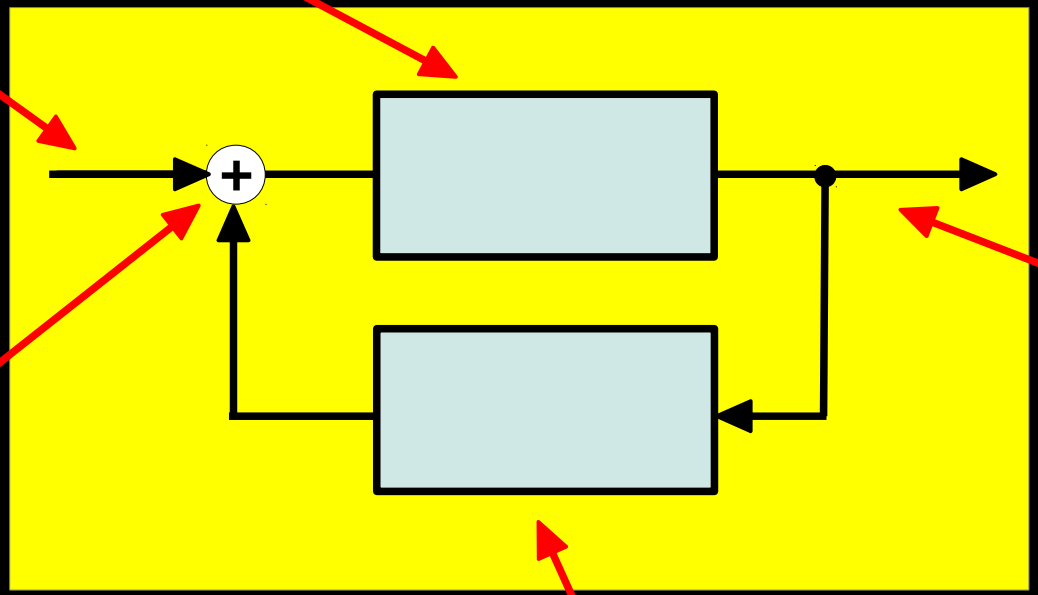
Digital Wisdom

A Model for Responsible Research & Innovation

1. Identify
all Stakeholders and design the Stakehokders' Network

6. Act & Respond
(change Direction of R&I Processes in response to Stakeholders feedback)

5. Anticipate
Social, Environmental, and Ethical Effects



2. Engage
with all Stakeholders

4. Include
considerations on all dimensions of Innovation in Research & Innovation Processes

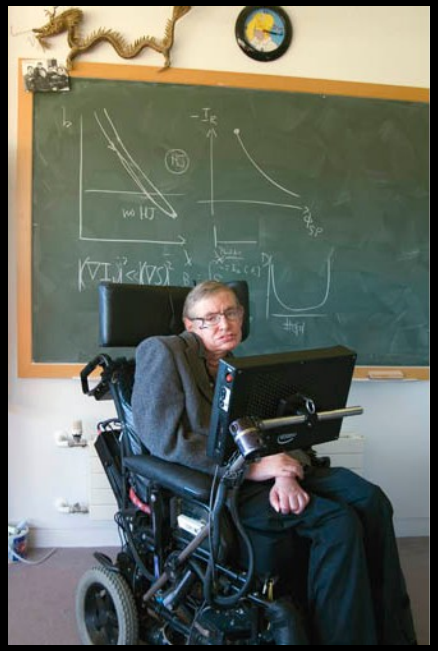
3. Reflect
with involved Stakeholders on all dimensions of Innovation

Source: Adapted from Framework for Responsible Research and Innovation in ICT, responsible-innovation.org.uk, 2014
Stilgoe et al. (2013), Developing a framework for responsible innovation. Research Policy 42

Informatici Senza Frontiere
Open Hospital - IT4Africa

Source: www.informaticisenza frontiere.org

e-Accessibility



Stephen Hawking
(Oxford, 1942 -)

make ICT accessible to all
meeting a wide spectrum of people's needs
in particular any special needs.

Source: http://www. howardguest.co.uk

Socio-Cultural e-Inclusion

enable minorities, migrants and marginalised young people
to fully integrate into communities and participate in society by using ICT.

Source: "Iran stocks up on censorship tools", MinnPost.com, Photo REUTERS

Geographical e-Inclusion

increase the social and economic well being of people in
rural, remote and economically disadvantaged areas
with the help of ICT.

Source: http://www.socialf5.com/blog/2011/05/social-media-in-rural-india/

Ageing

empower <u>older people</u> to fully participate in the economy and society,
continue <u>independent lifestyles</u> and
enhance their <u>quality of life</u>.

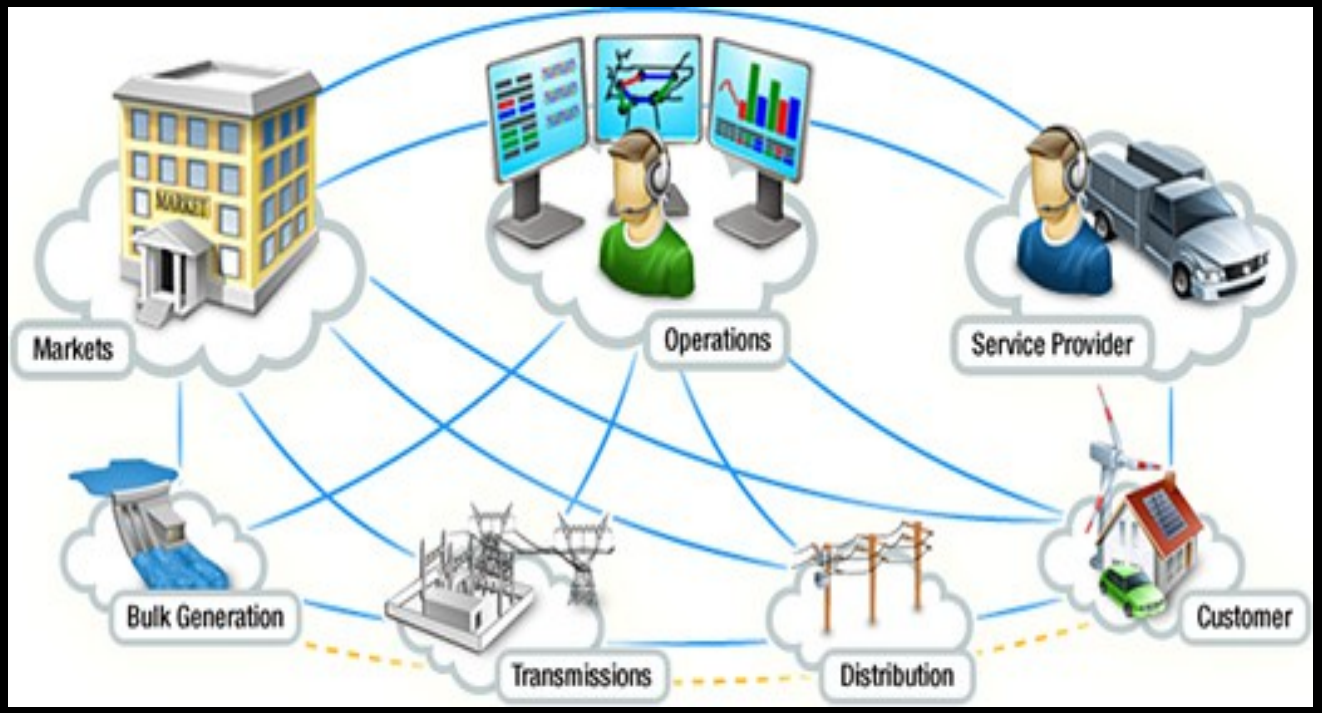
Source: http://www.seniornet.org/

e-Competences

equip citizens with the knowledge, skills and lifelong learning approach needed to increase social inclusion, employability and enrich their lives.

Source: http://www.netcrumbs.opencons.net/

Smart Grid: a Complex System based on Energy + Information!



Source: nist.gov, 2012

Slow Tech

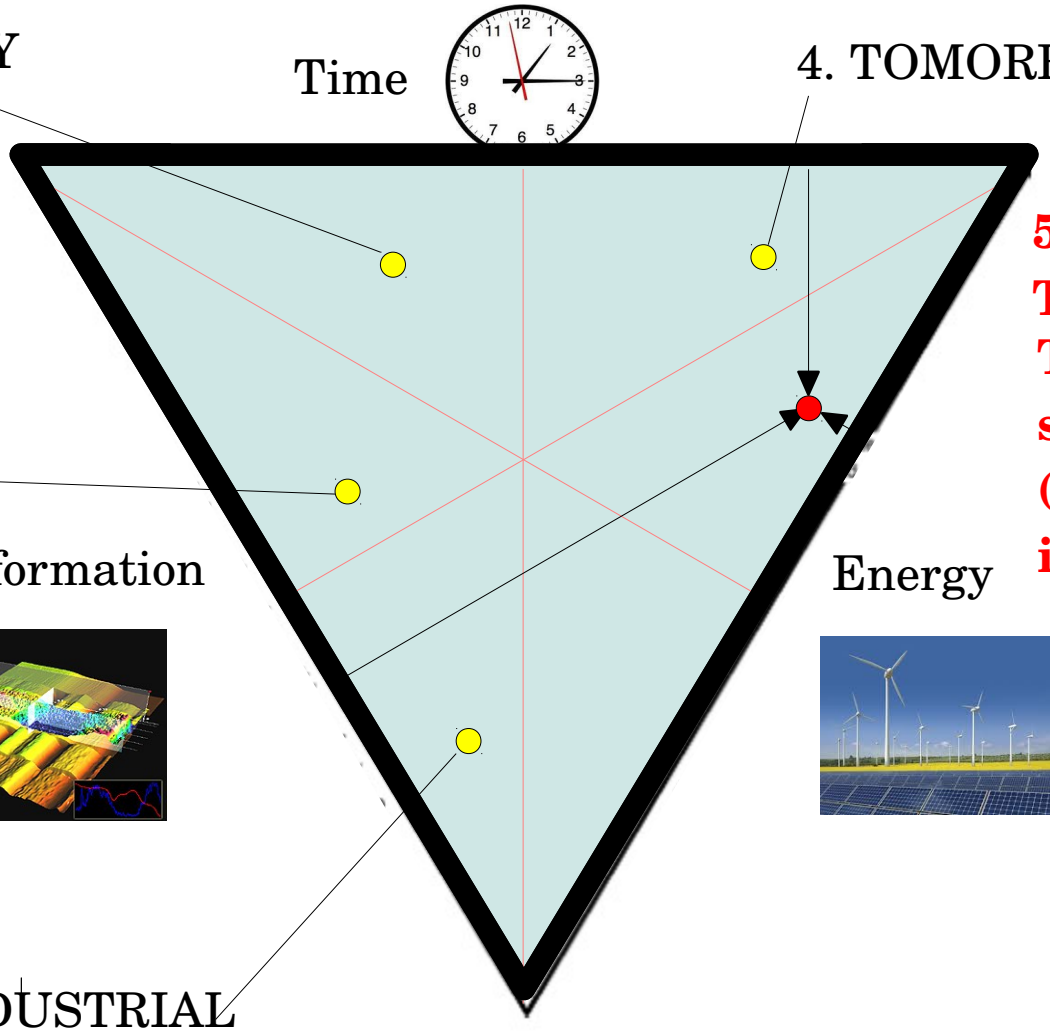
Energy, Time, and Information

Daniel Spreng
Physics (Prof.Emeritus)
Swiss Federal Institute of Technology
ETH Zurich

"ICT greatly amplifies the potential
for both increases and decreases in energy consumption
... on the level of the Economy as a whole
the effect is more likely to be a
Speeding-up of Industrial Production, Travel and Consumption
and thus an overall increase in economic activity and energy demand...
... ICT will likely be applied to save Time rather than Energy.
The Time saved may be labor on the production side or it may be time saved,
i.e. greater convenience, on the consumer side.
Economic growth is often regarded as the remedy for unemployment.
However, promoting ICT applications indiscriminately
is not a good way to combat unemployment."

Daniel Spreng
Interactions between Energy, Information and Growth
Proceedings of the 1st ICT for Sustainability Conference, Zurich 14-16 February 2013

Energy, Time, and Information



Source: Patrignani N., Whitehouse D. (2016, forthcoming), *Slow Tech,* adapted from
Spreng Daniel T. (1978), *On Time, Information, and Energy Conservation*, Technical Report, Institute for Energy Analysis, Oak Ridge, TN (USA),
Spreng D. (1993). *Possibility for Substitution between Energy, Time and Information*, Energy Policy, Vol. 21, Nr. 1, January.

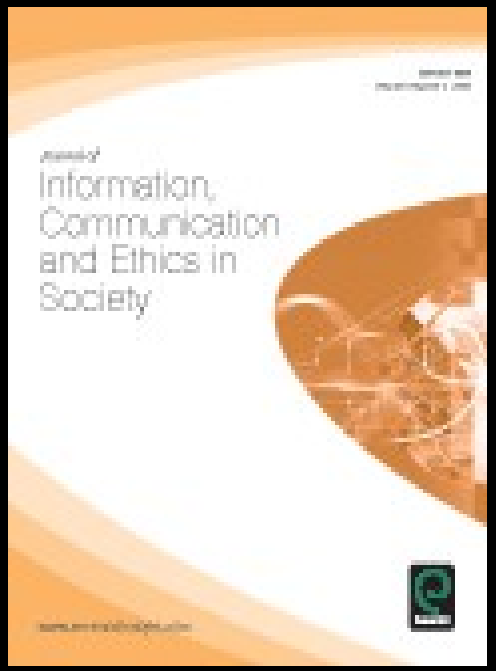
Rallentare

Hartmut Rosa

H.Rosa,
"*Accelerazione e alienazione.*
Per una teoria critica del tempo nella tarda modernità",
Piccola Biblioteca Einaudi, 2015

La vita moderna è in costante accelerazione.
Gli strumenti che ci permettono di risparmiare tempo
hanno ormai raggiunto un enorme livello di sviluppo
grazie alle tecnologie *di produzione e comunicazione,*
eppure l'impressione di non avere abbastanza tempo
non è mai stata cosí diffusa.
In tutte le società occidentali,
le persone soffrono della mancanza di tempo
e si sentono in dovere di correre ancora piú in fretta,
non tanto per raggiungere un obiettivo,
ma per non perdere posizioni...

Slow Tech



The current issue and full text archive of this journal is available at
www.emeraldinsight.com/1477-996X.htm

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12,2

78

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Accepted 20 December 2013

Slow Tech: a quest for good, clean and fair ICT

Norberto Patrignani
Politecnico of Torino, Torino, Italy, and
Diane Whitehouse
The Castlegate Consultancy, Malton, UK

Abstract

Purpose – The purpose of this paper is to introduce the term Slow Tech as a way of describing information and communication technology (ICT) that is good, clean and fair. These are technologies that are human centred, environmentally sustainable and socially desirable.

Design/methodology/approach – The paper's approach is based on a qualitative discourse that justifies the introduction of Slow Tech as a new design paradigm.

Findings – The limits of the human body, and the need to take into account human wellbeing, the limits of the planet and stakeholders' interests in decision making, all suggest the need for a new paradigm, Slow Tech, in the design of ICT and ICT systems. Three scenarios are described as case studies.

Practical implications – In order to prepare the next generation of researchers and computer professionals, many different actions need to be taken. Universities and colleges need to redesign education programmes for computer scientists and engineers by introducing subjects related to the social and ethical implications of computing (currently, only few countries, like the UK, have already done this), and computer professionals' associations need to introduce a code of ethics or ethical analysis into their members' career development. As a result, future computer professionals who are familiar with the Slow Tech approach will be able to collaborate much more easily across the kind of cross disciplinary teams suited to design human centred, sustainable and desirable technologies.

Social implications – Rather than simply focusing on the role of computer professionals, all members of society are called to play a new role in the design of future ICT scenarios. Starting a societal dialogue that involves computer professionals, users, researchers, designers, ICT industrialists, and policy makers is very much needed.

Originality/value – The value of this paper is in its call for reflection followed by action. Based on an holistic approach to the design of new ICT systems, the paper advocates a new starting point for systems design: it should be based on a long-term view of the desirability and social importance of technologies, their environmental impact and sustainability, and the fairness and equity of the conditions of workers involved in the computing manufacturing processes.

Keywords Cleant ICT, Environmentally sustainable, Ethically acceptable, Fair ICT, Good ICT, Slow Tech

Paper type Conceptual paper

1. Introduction

We are returning to a set of observations, made in some cases a 150 years ago, but which started to reach mainstream awareness some 50 years ago.

The concept of the limits to growth were first applied to the planetary environment, whereas today questions are being posed about continuing information and communication technologies (ICT) development. ICT, and the encouragement of the rapid expansion of technologies, have always been the most dramatic, technical representation of the Olympic motto, "citius, altius, fortius" (faster, higher, stronger).

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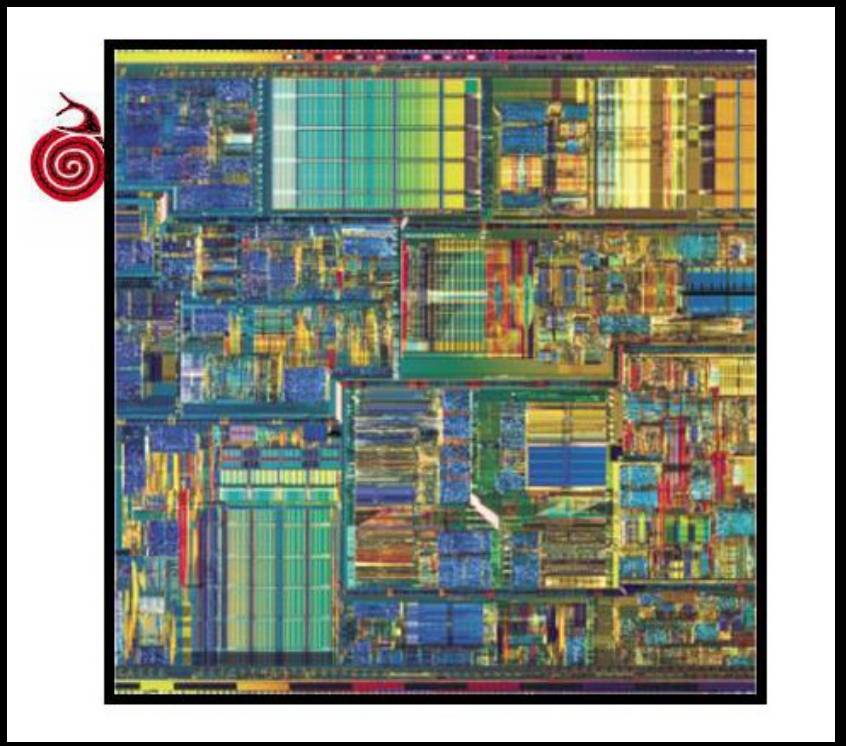
Slow Tech: Designing and Developing Technologies that are Good, Clean, and Fair

Towards
Good, Clean and Fair ICT.

A new kind of
Information and
Communication
Technologies.

ICT that is Human-Centred.
ICT that takes into account
both
the Limits of the Planet and
those of Human Beings.

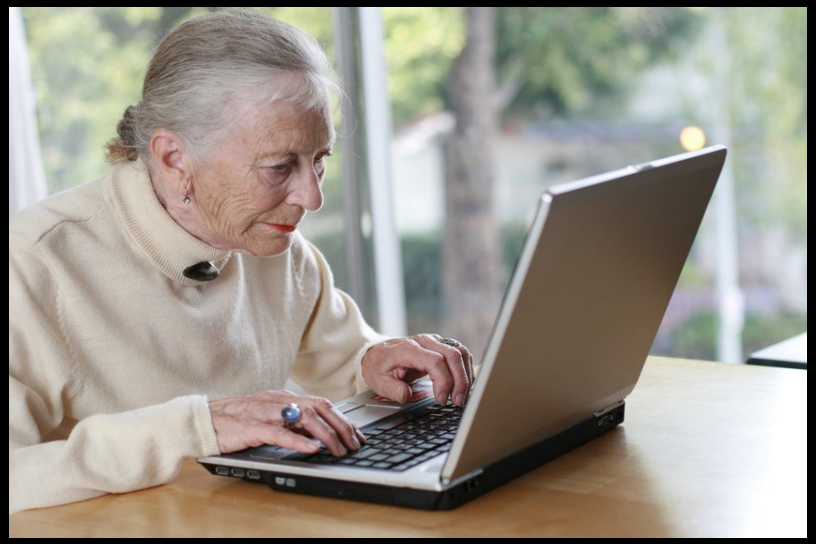


A bridge with the Italian (and now worldwide)
Slow Food movement.

Source: Patrignani N., Whitehouse D. (2014). Slow Tech: a Quest for Good, Clean, and Fair ICT. *Journal of Information, Communication & Ethics in Society*, vol. 12, ISSN: 1477-996X.

Good ICT

ICT can be **Good for Human Beings**
When the Systems are Designed using a Human-Centred approach

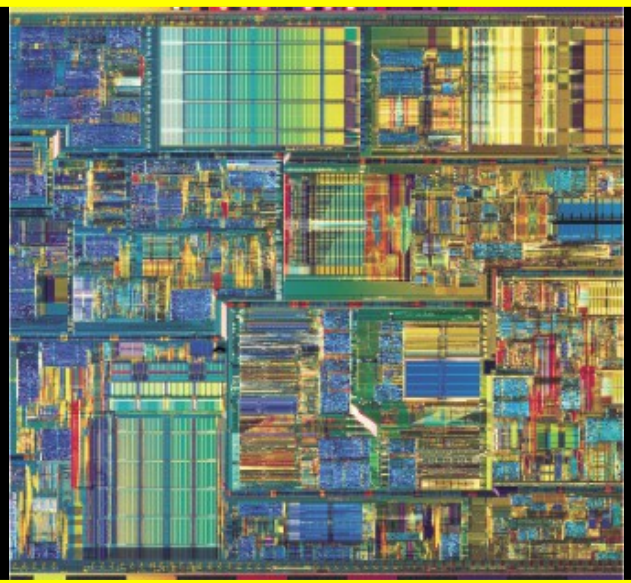


Complex Interactions of the Human Being and ICT.
Experiences can be enjoyable only if
the System and the Human-Computer Interfaces are
designed taking into account **Human Limits**.

Competences Needed: Human-Computer Interaction, Design-for-All,
e-Inclusion and Methods such as Participatory Design.

Clean ICT

High Tech generates Toxic Hazards throughout its entire lifecycle
(including Design, Production, Consumption and Disposal)


Consider the **Environmental impact** (the Materials involved,
Chip Manufacturing, Power Consumption of Data Centres and Devices,
ICT Applications, e-Waste Management and Recycling)

Is ICT Exponential Growth Sustainable?
Maybe we need Paradigms based on Cycles? "Circular Economy"?

Fair ICT

HOME PAGE | TODAY'S PAPER | VIDEO | MOST POPULAR | U.S. Edition

The New York Times

Business Day
Technology

WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEALTH | SPORTS | OPINION

Foxconn Plant Closed After Riot, Company Says

Reuters

Workers cleaned up glass from the broken windows of a security room at an entrance of the Foxconn Technology plant in Taiyuan on Monday.

By DAVID BARBOZA and KEITH BRADSHER
Published: September 24, 2012 | 241 Comments

The Low-Cost features of ICT are possible at the price of the increasing costs paid by Workers.
The **entire ICT Value-Chain** is indeed quite long and complex ... transparent?

Good News (Positive Expectations)

2015: Definition for the Computing Professional

"... Revised Definition for the Computing Professional:
Given the reach of ICT in our lives, it is important for an ICT Professional to be:

- Technically Strong
(in order **to use the Right Technology for the Relevant Problem**)

- Ethically Grounded
(to ensure that Technology is put to the Right Use),

- Socially Conscious
(so that the technical solution takes into consideration elements of Sustainability)

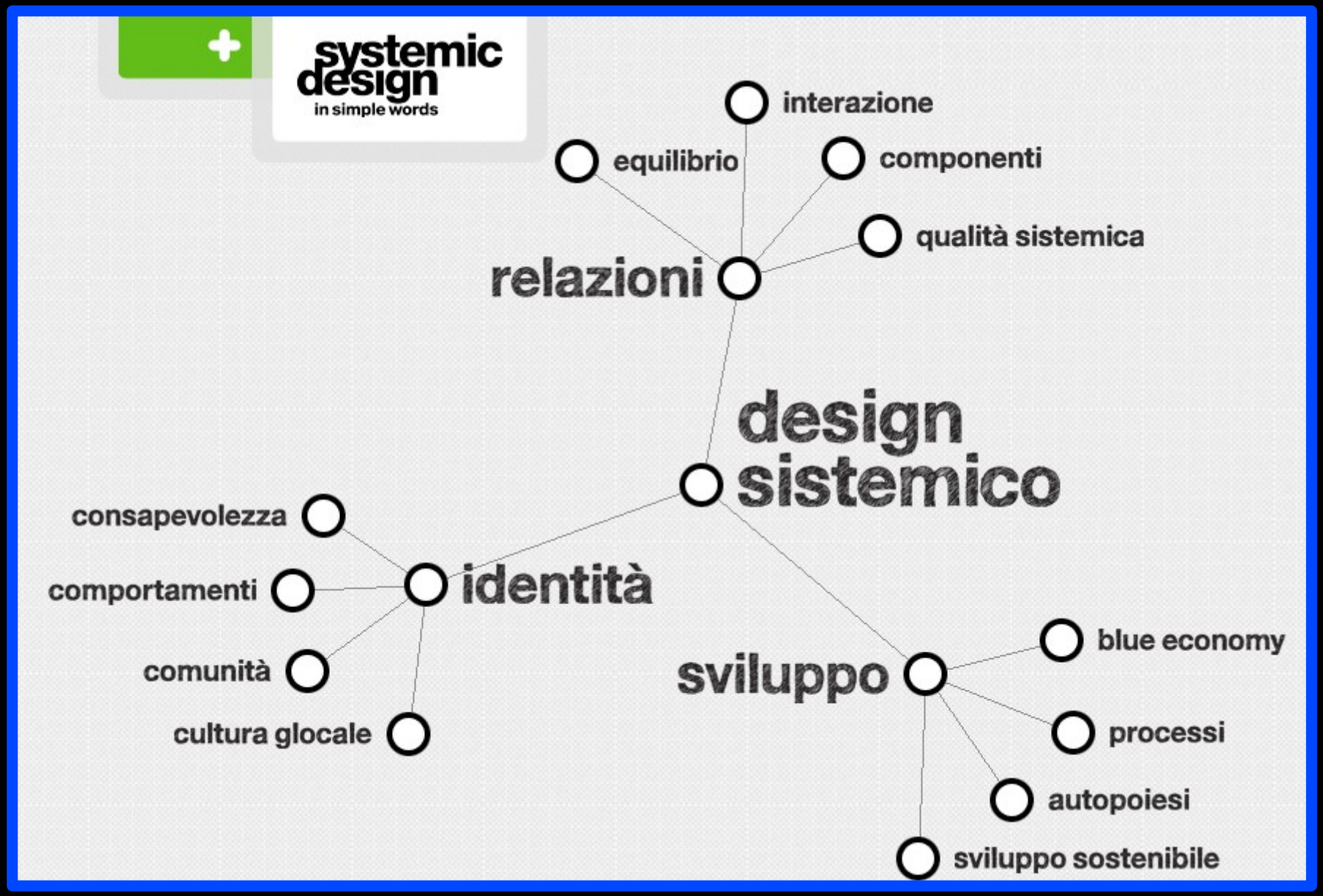
- Business Savvy
(to ensure commercial viability which is required for Social Prosperity and Funding of new Developments)" (pag.47).

IFIP (International Federation for Information Processing)
"Global Industry Council (GIC) 2020 - Skill Assessment Report
August 2015

Systemic Design

("*System Thinking*")
An Holistic approach to Engineering / Design of the System, considering its Context, Stakeholders, the Interrelationships and Interconnections (Stakeholders' Network)

2015, Systemic Design

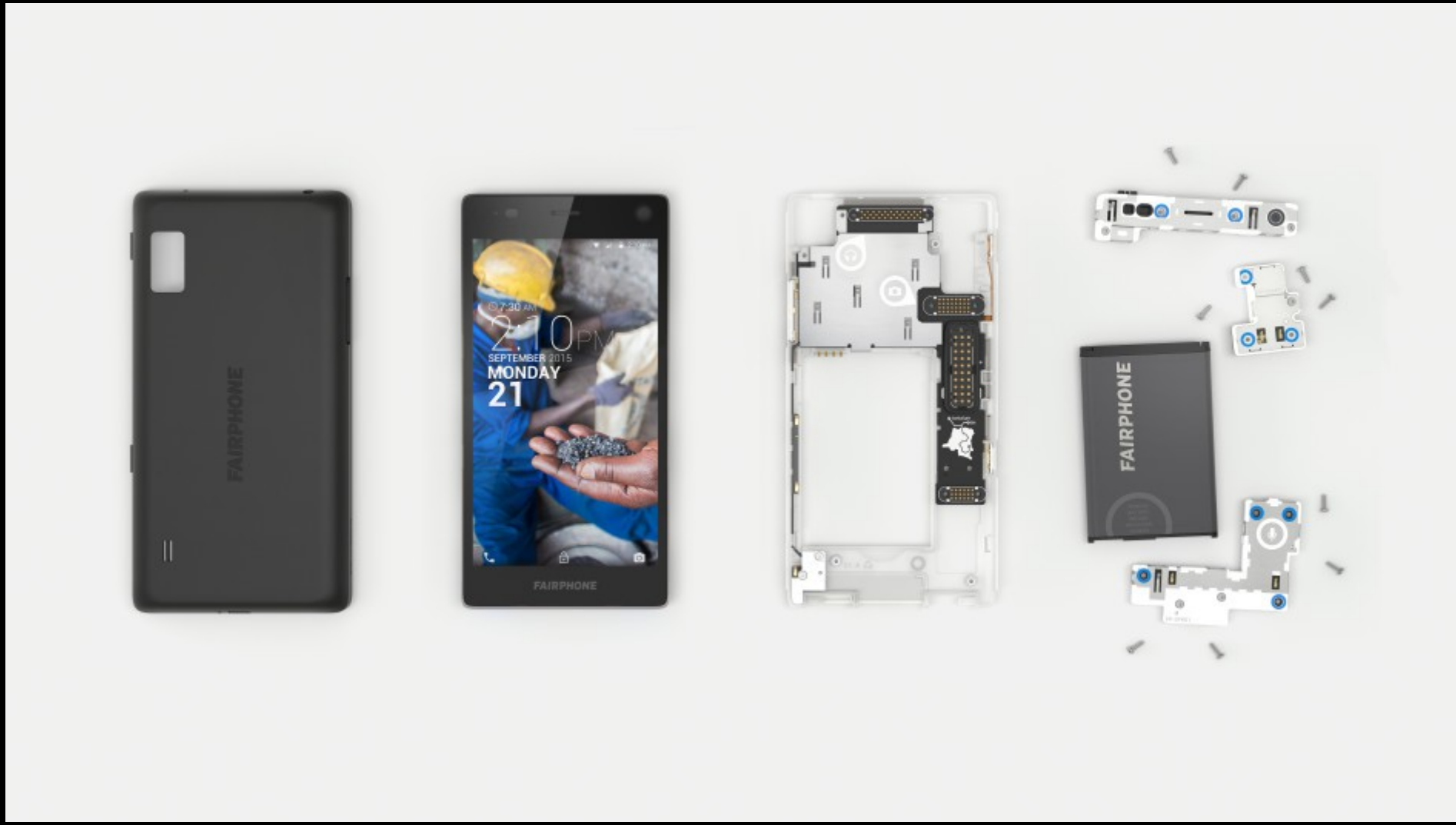


Laurea Magistrale "Aurelio Peccei" in Design Sistemico, Politecnico di Torino

Scource: www.systemicdesign.org

FAIRPHONE

Slow-Tech Case Study
Fairphone.com

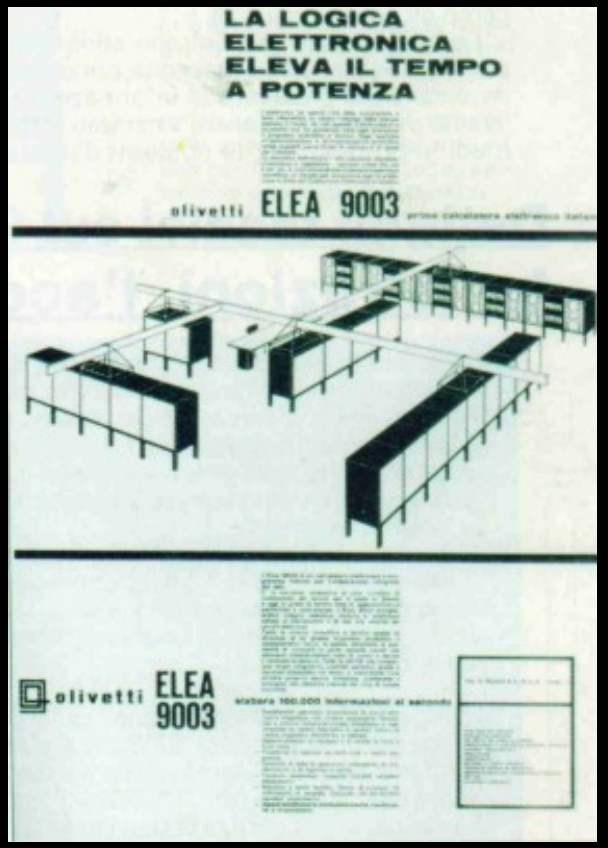


A Smartphone with Social Values:
Mining, Design, Manufacturing, Lifecycle

Source: www.fairphone.com

1959: Olivetti Elea 9003

Adriano Olivetti
(Ivrea, 1901 - Aigle, 1960)



Olivetti Elea 9003
Primo Mainframe a Transistor

"***<u>Con la realizzazione dell'Elea</u>***,
la nostra Società non estende semplicemente la sua tradizionale produzione
a un nuovo settore di vastissime possibilità,
ma tocca una meta in cui direttamente ***<u>si invera</u>***
quello che penso sia l'inalienabile, ***<u>più alto fine che un'industria deve porsi</u>*** *di operare, ...*
<u>per il progresso comune - economico, sociale, etico - della intera collettività</u>"

Adriano Olivetti, 8 Novembre 1959
Discorso in occasione della presentazione del calcolatore Olivetti Elea 9003, in "Il mondo che nasce", Edizioni di Comunità, 2013

Source: Archivio Storico Olivetti, www.acroliv.org

Homo Sapiens o Homo Technologicus?
Restiamo Umani nell'Era dei Robot.

GRAZIE!

Norberto Patrignani