

History of the IEEE Electron Devices Society

Prof. Cor Claeys
President EDS

Outline

Situation of Field of Interest

History of the Society

Highlights and Best Practices

Future Directions

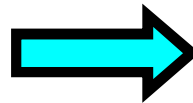
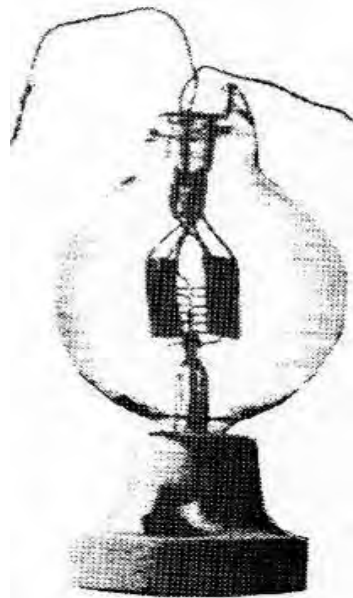
Integrated Electronic Circuit

Integrated Circuits or Electronic Circuits

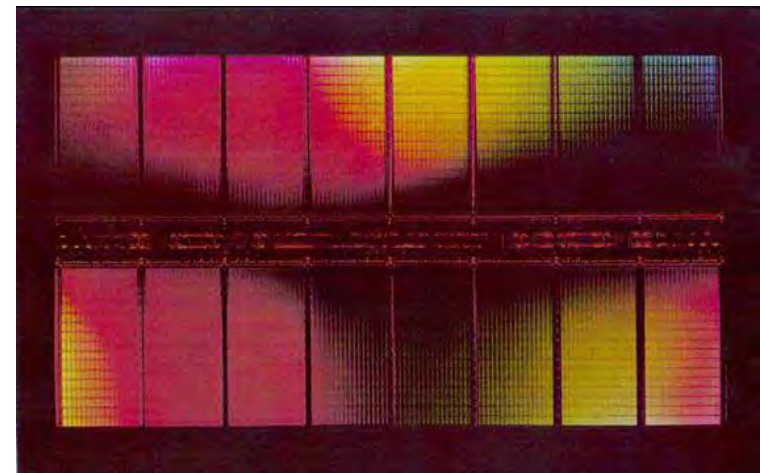
 Most important invention in the 20th century

Electronic Circuits in 100 years

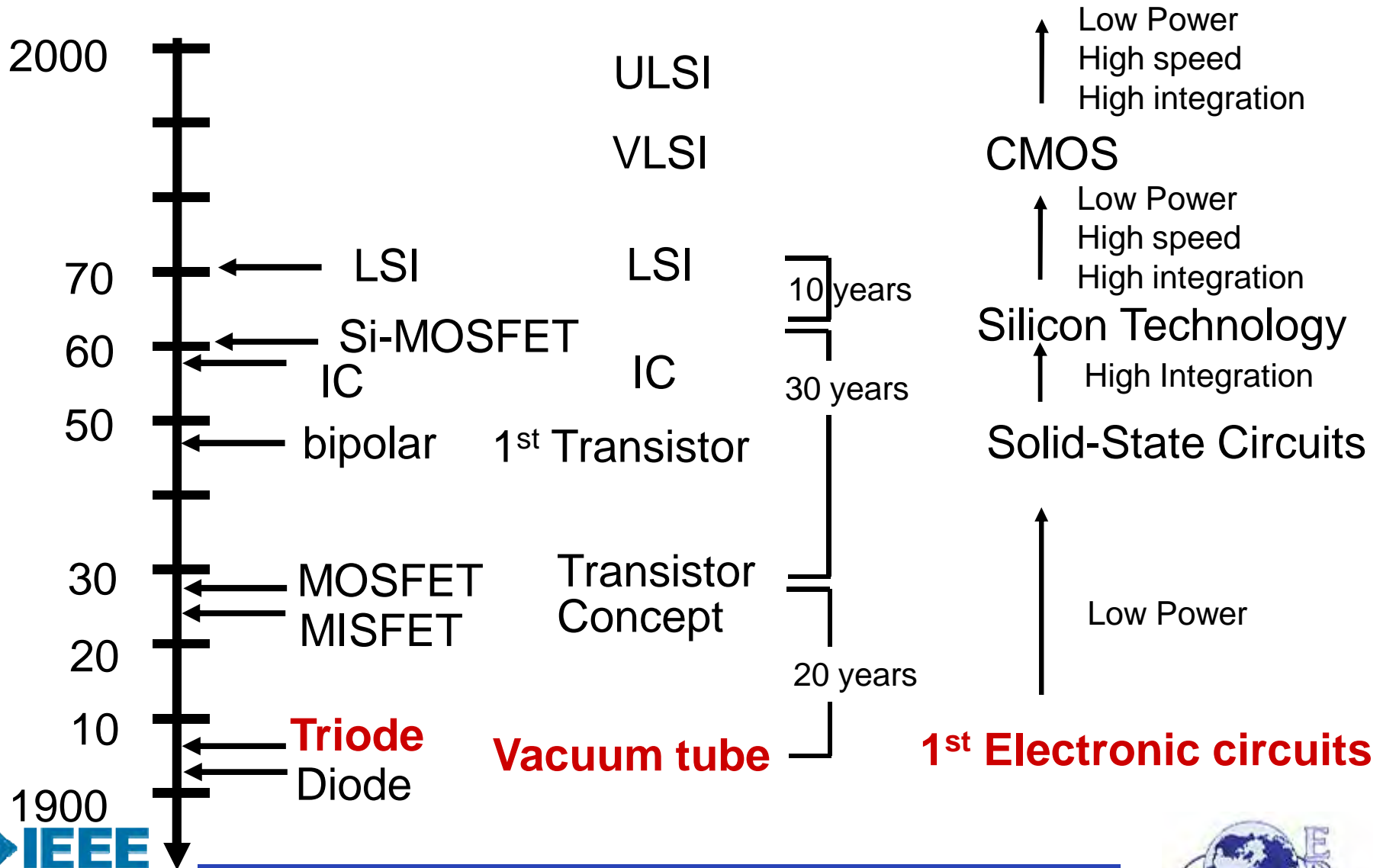
Vacuum tube



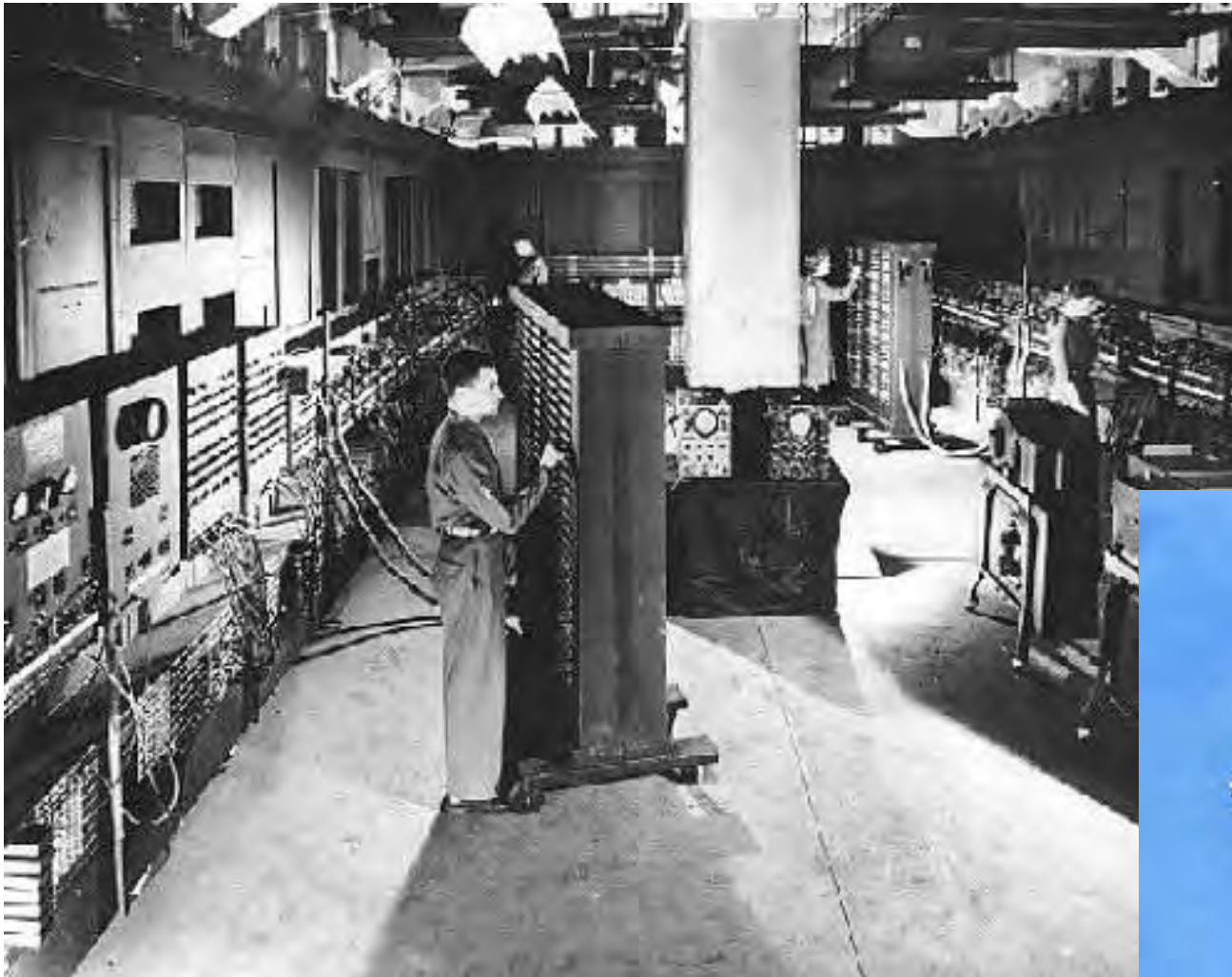
ULSI



History of Electronic Devices



First Computer Eniac: made of huge number of vacuum tubes 1946
Big size, huge power, short life time filament



Today's pocket PC has much higher performance with extremely low power consumption



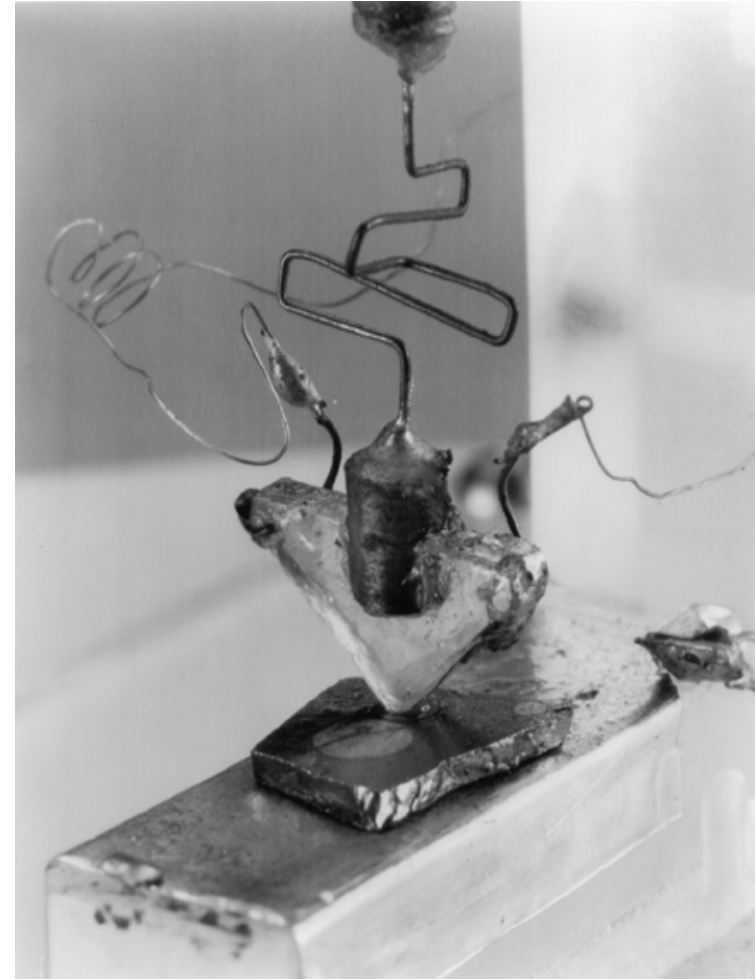
First Transistor: Bell Labs, December 23, 1947.

Brattain and Bardeen's pnp point-contact Germanium transistor.

Amplifier w/ gain of 18.

Shared 1956 Nobel Prize in
Physics with William
Shockley.

Germanium transistors dominated
industry through 1950s and early
1960s.



Ge used in first transistor radios

On October 18, 1954, the U.S. company I.D.E.A. announced Regency TR1.

Used 4 germanium transistors.

Sony's first radio, TR-55, in 1955

Used 5 germanium transistors.

Sony TR-55



Regency TR1

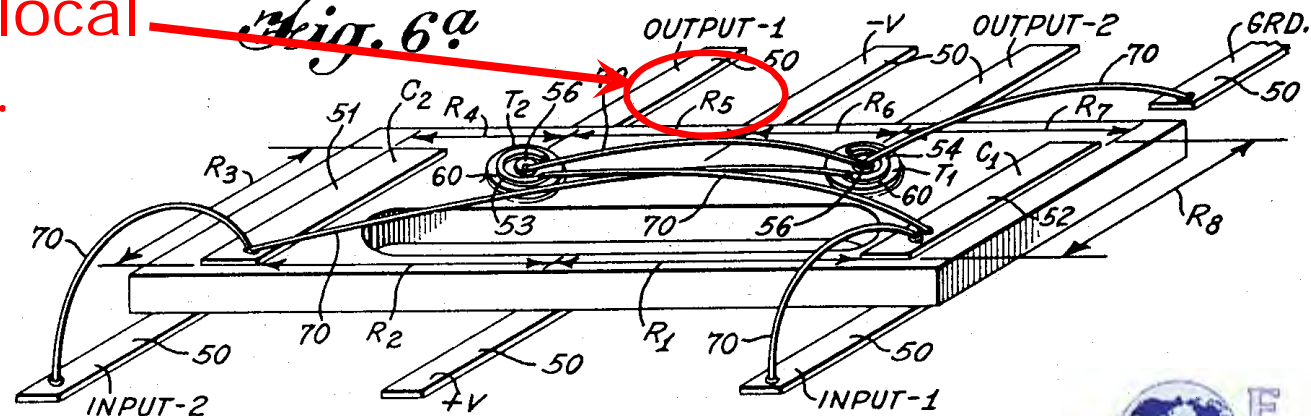


Jack S. Kilby, US Patent 3,138,743 “Miniaturized Electronic Circuits”

Filed Feb 6, 1959. Granted June 23, 1964.

20 ployed. First, a semiconducting wafer, preferably silicon
or germanium, of the proper resistivity is lapped and
polished on one side. For this design, 3 ohm-cm. p-type
germanium was used. The wafer was then subjected to
an antimony diffusion process which produced an n-type
25 layer on the surface about 0.7 mil deep. The wafer was
then cut to the proper size, 0.200 inch x 0.080 inch and
the unpolished surface was lapped to give a wafer thick-
ness of 0.0025 inch.

Wire-bonded local
interconnects.



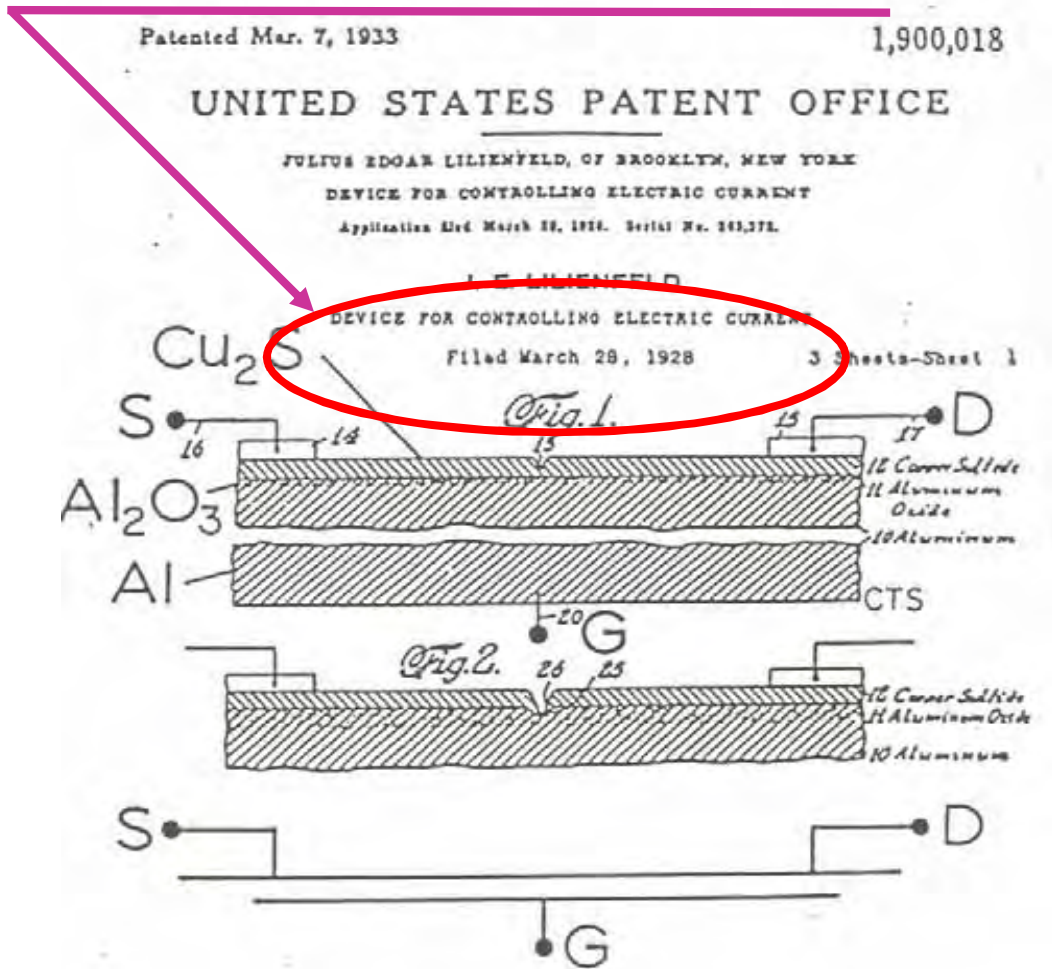
J. E. LILIENFELD

DEVICES FOR CONTROLLED ELECTRIC CURRENT

Filed March 28, 1928

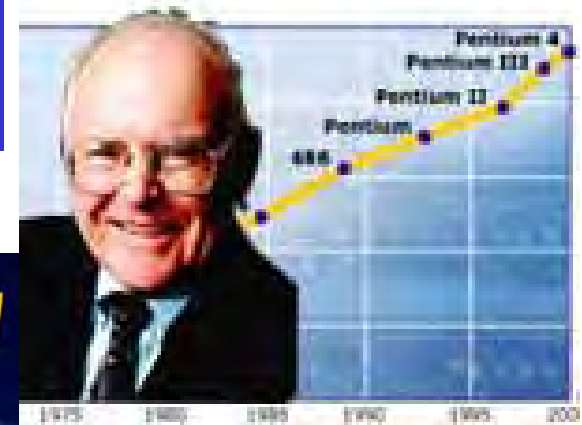
MOS Principle

J.E.LILIENFELD



Transistor count in ICs

(Source: Intel)

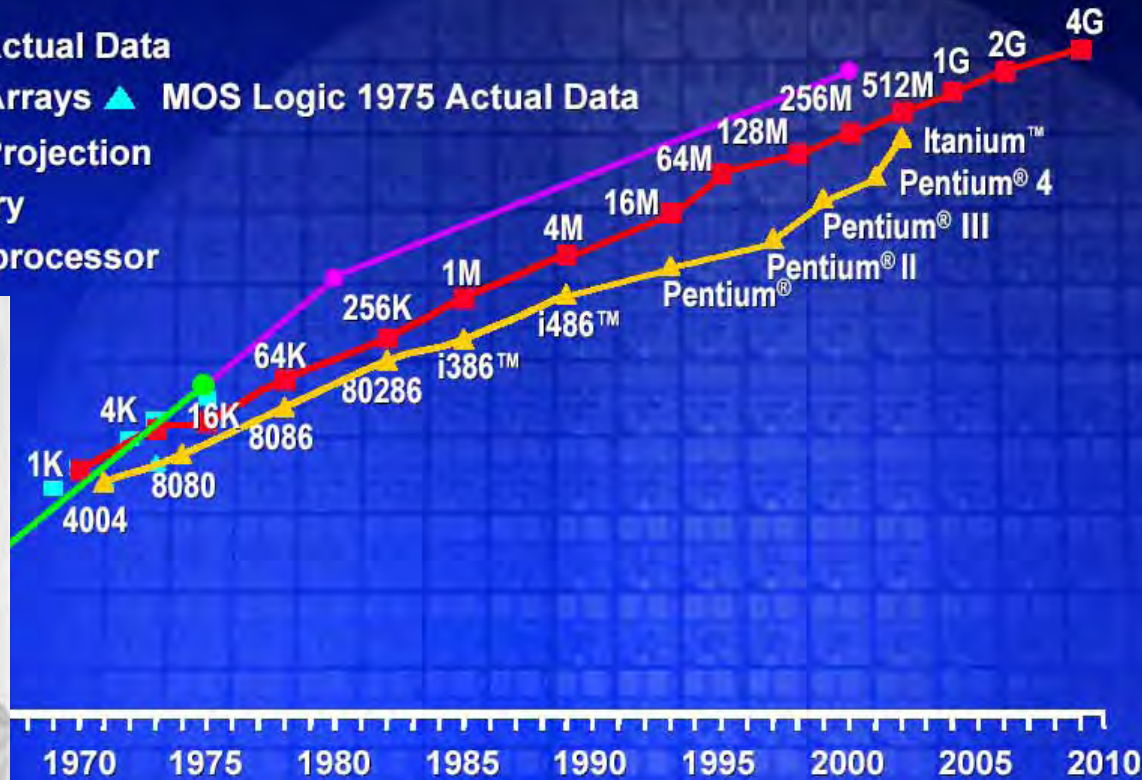


Integrated Circuit Complexity

Transistors Per Die

10^{10}
 10^9
 10^8
 10^7
 10^6

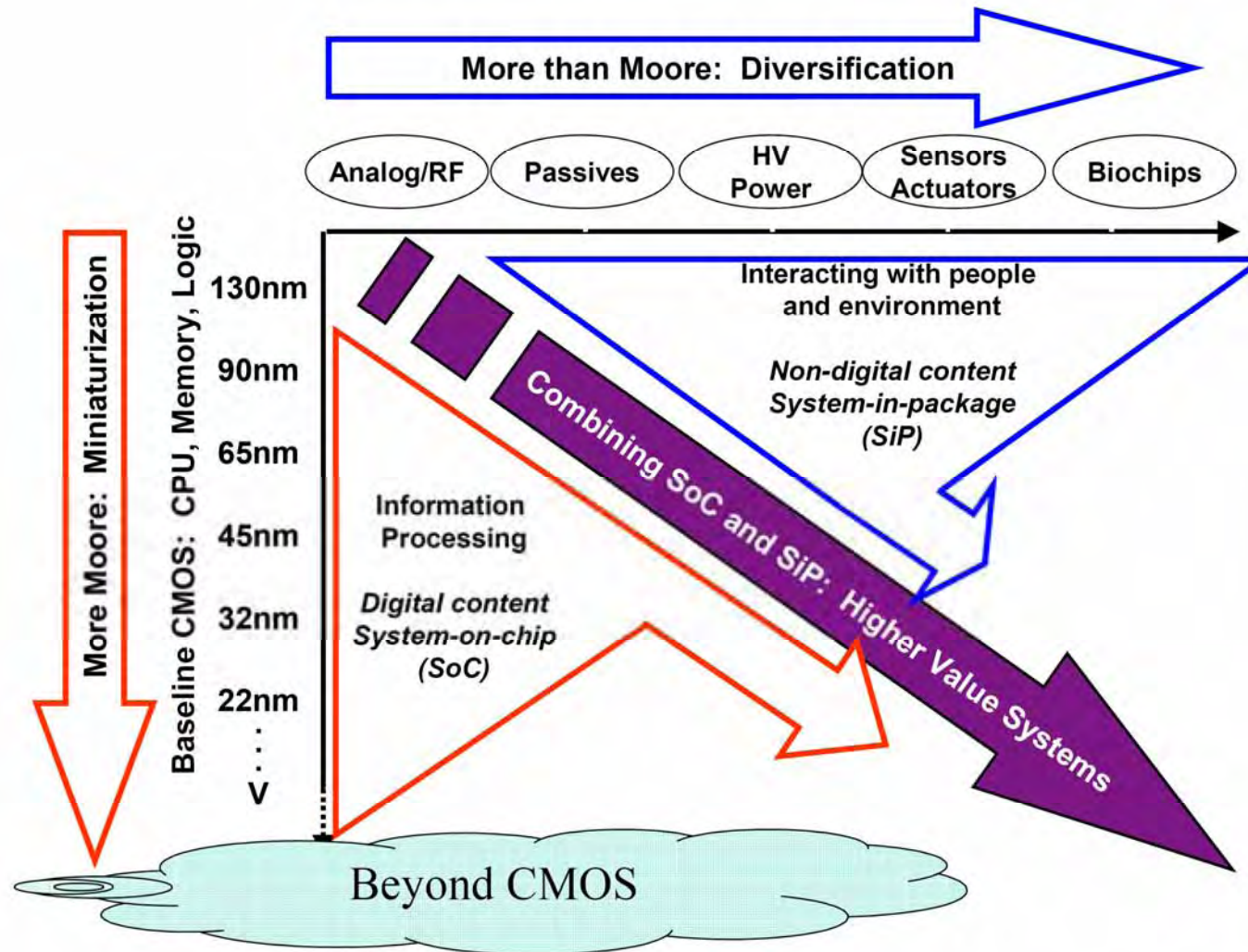
- ◆ 1965 Actual Data
- MOS Arrays ▲ MOS Logic 1975 Actual Data
- 1975 Projection
- Memory
- ▲ Microprocessor



Celebrating 125 Years
 of Engineering the Future



Technology Roadmap: Strategic Agenda



Society Needs Micro-Nanoelectronics

No innovation without micro-nano electronics

Health & wellness

Transport & mobility

Security & safety



Energy & environment

Communication

Infotainment

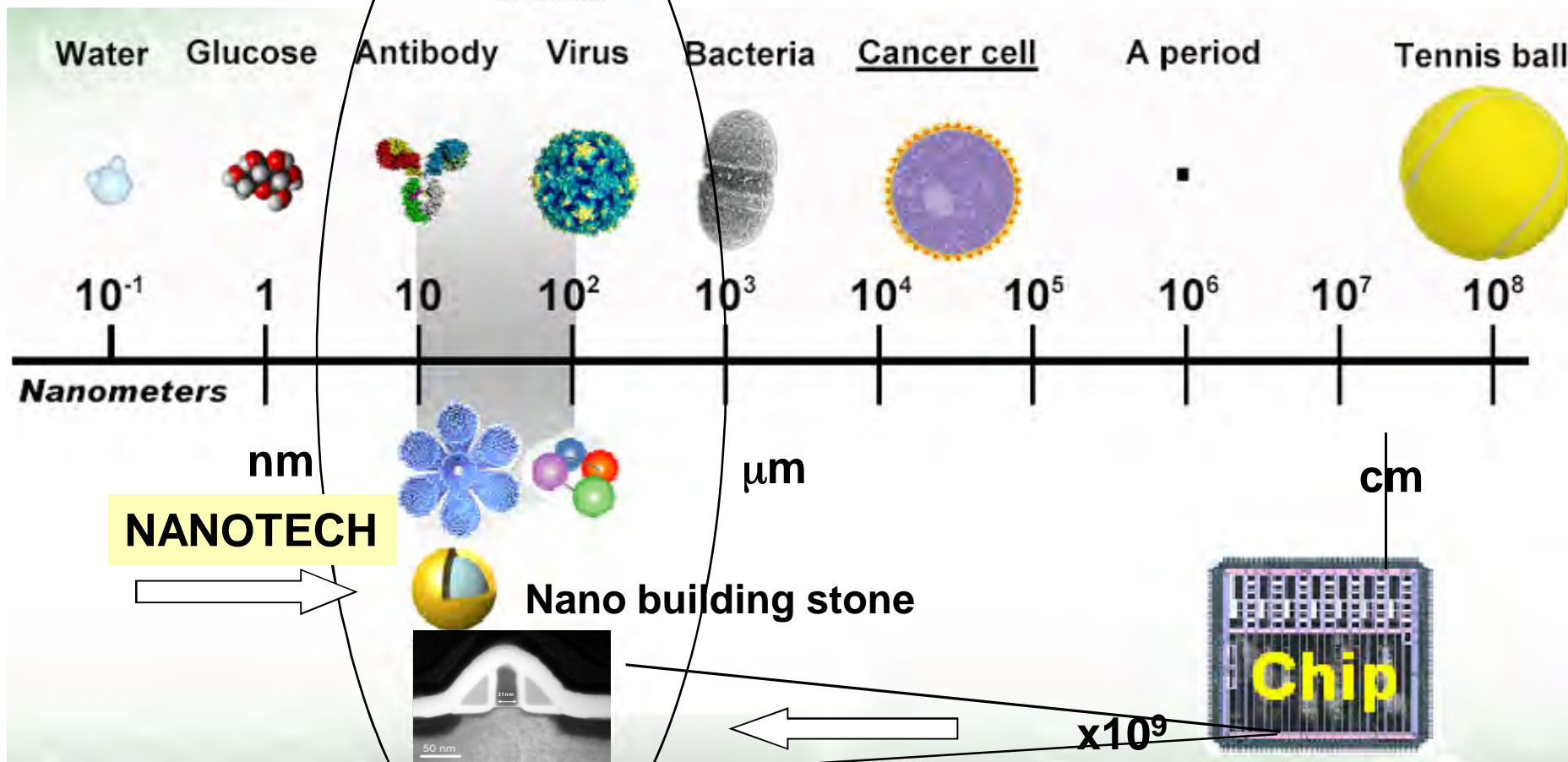
Cell Phone as Powerful Nomadic Tool



Nano-bio vision :Bio & ICT meet at the nanoscale

BIOTECH

NCI Alliance for
Nanotechnology
in Cancer



Electron Devices Society

Origin in both AIEE and IRE

1884: First article in Trans. AIEE – Notes on Phenomena in Incandescent Lamps

1938: First IRE sponsored Conference on Electron Tubes, New York

1949: IRE Committee on Electron Tubes and Solid State Devices

1951: IRE Professional Group on Electron Devices

1952: Special issue of Proc. of the IRE on Transistors

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1960: First International Electron Devices Meeting (IEDM), previously Washington Meetings

Foundation of IEEE by merging AIEE and IRE

1963: IEEE Professional Technical Group on Electron Device

IEEE Transactions on Electron Devices

1965: IEEE Electron Devices Group

1966: Newsletter of the Electron Devices

Electron Devices Society

1971: J.J. Ebers Award for ‘outstanding technical contributions to electron devices’”

1974: Jack A Morton Award – Andrew S. Grove award in 2000 (IEEE Level technical award for electron device contributions)

1976: IEEE Electron Devices Society

1980: IEEE Electron Device Letters

1981: First Symposium on VLSI Technology

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1988: IEEE Transactions on Semiconductor Manufacturing Science

1990: First European member to EDS Adcom

Start of a strong globalization action

2004: First EDS President from R10 (Hiroshi Iwai)

2008: First EDS President from R8

Electron Devices Society Today

About 11,000 members

**28 AdCom members – 2 meetings/year (1 outside USA)
Total : 647 volunteers**

Strong EDS Distinguished Lecture program with 129 DLs. In 2008 about 200 presentations were given

Increasing interest in Mini-Colloquia to support the Chapters: 16 MQ's organized in 2008

166 EDS supported conferences, of which 26 financially sponsored ones, in 2008

EDS Distinguished Lecturers 2008

IEEE Regions	Total Numbers of Lecturers
Regions 1-6	60
Region 7	2
Region 8	23
Region 9	9
Region 10	35
Total	129

EDS Membership Statistics

<u>Region</u>	<u>As of 12/31/07</u>		<u>As of 12/31/08</u>	
	<u>Count</u>	<u>%</u>	<u>Count</u>	<u>%</u>
1-6	5,721	54.0%	5,693	52.5%
7	191	1.8%	213	2.0%
8	1,914	18.0%	1,964	18.1%
9	176	1.7%	242	2.2%
10	2,604	24.5%	2,733	25.2%
Total	10,640*	100%	10,845	100%



* The 2007 membership count of 10,640 was calculated from the new IEEE Business Management System which counts memberships differently than the previous IEEE system. Based on the previous system rules, the 2007 membership count was actually about 10,420. Also the sum of the regional statistics does not correctly total to the 2007 year end count of 10,640.

EDS Chapters

REGION	COUNT			
	ED ONLY	JOINT	TOTAL	STUDENT
1 – Northeastern USA	4	8	12	1
2 – Eastern USA	2	4	6	0
3 – Southeastern USA	1	4	5	0
4 – Central USA	1	3	4	1
5 – Southwestern USA	3	2	5	0
6 – Western USA	4	9	13	2
7 – Canada	2	3	5	0
8 – Europe, Middle East & Africa	9	34	43	5
9 – Latin America	10	4	14	5
10 – Asia and Pacific	26	11	37	6
Total	62	82	*144	20

76,464 k\$ subsidy to Chapters in 2009 (+ DL + MQ)

Technical Meetings

EDS is the principal 100% financial sponsor (some on an alternating basis) for the following meetings: **17 in 2009**

- * Bipolar/BiCMOS Circuits and Technology Meeting
- * Compound Semiconductor IC Symposium
- * **Electron Devices Meeting**
- * Interconnect Technology Conference
- * Microelectronic Test Structures Conference
- * Non-Volatile Semiconductor Memory Workshop
- * **Photovoltaic Energy Conversion World Conference**
- * Photovoltaic Specialists Conference
- * Power Semiconductor Devices and ICs Symposium
- * Semiconductor Interface Specialists Conference
- * Silicon Nanoelectronics Workshop
- * SOI Conference
- * TRANSDUCERS- Solid-State Sensors & Actuators Conference
- * Vacuum Electron Sources Conference
- * Vacuum Electronics Conference
- * Vacuum Nanoelectronics Conference
- * VLSI Technology Symposium

Electron Devices Society Today

Fellowship Program for both Master and PhD students

Dedicated actions towards GOLD

- **Elected AdCom Position**
- **GOLD representatives in all society committees**
- **GOLD committee (20 members)**
- **GOLD Lecture linked to a key conference**
- **GOLD Ambassadors Program**
- **GOLD Early Career Award**

Electron Devices Society Today

Increased Membership Benefits

- EDS Archival collection on DVD and annual EDS DVD update package
- QuestEDS
- IEDM short-course DVD

EDS ARCHIVAL COLLECTION ON DVD AND ANNUAL EDS DVD UPDATE PACKAGE

The Archival Collection includes:

IEDM Tech. Digests (1955 to 2004)

Transactions on Electron Devices (1954 to Aug. 2004)

Electron Device Letters (1980 to 2004)

Only **IEEE EDS members** are eligible to purchase the EDS Archival Collection on DVD. Available at the low price of \$30 and only \$9.95 for student members.

A fully compatible EDS DVD Update Package is now available to EDS members for \$30 (\$15 for students) which includes 2004 - 2008 T-ED, EDL and the IEDM.

got a question?



www.ieee.org/go/questeds



Exciting challenges on the horizon

Increased functionality through scaling:

approaching physical, technological and financial limits: the pendulum of Moore's clock will slow down, ***innovative solutions needed!***

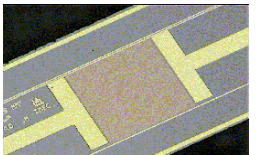
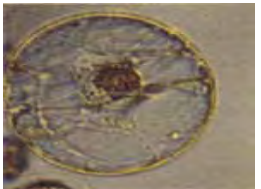
Technology in the human sphere:

man-machine interactions, enhancement & replacement of senses – ***engineering for the body***

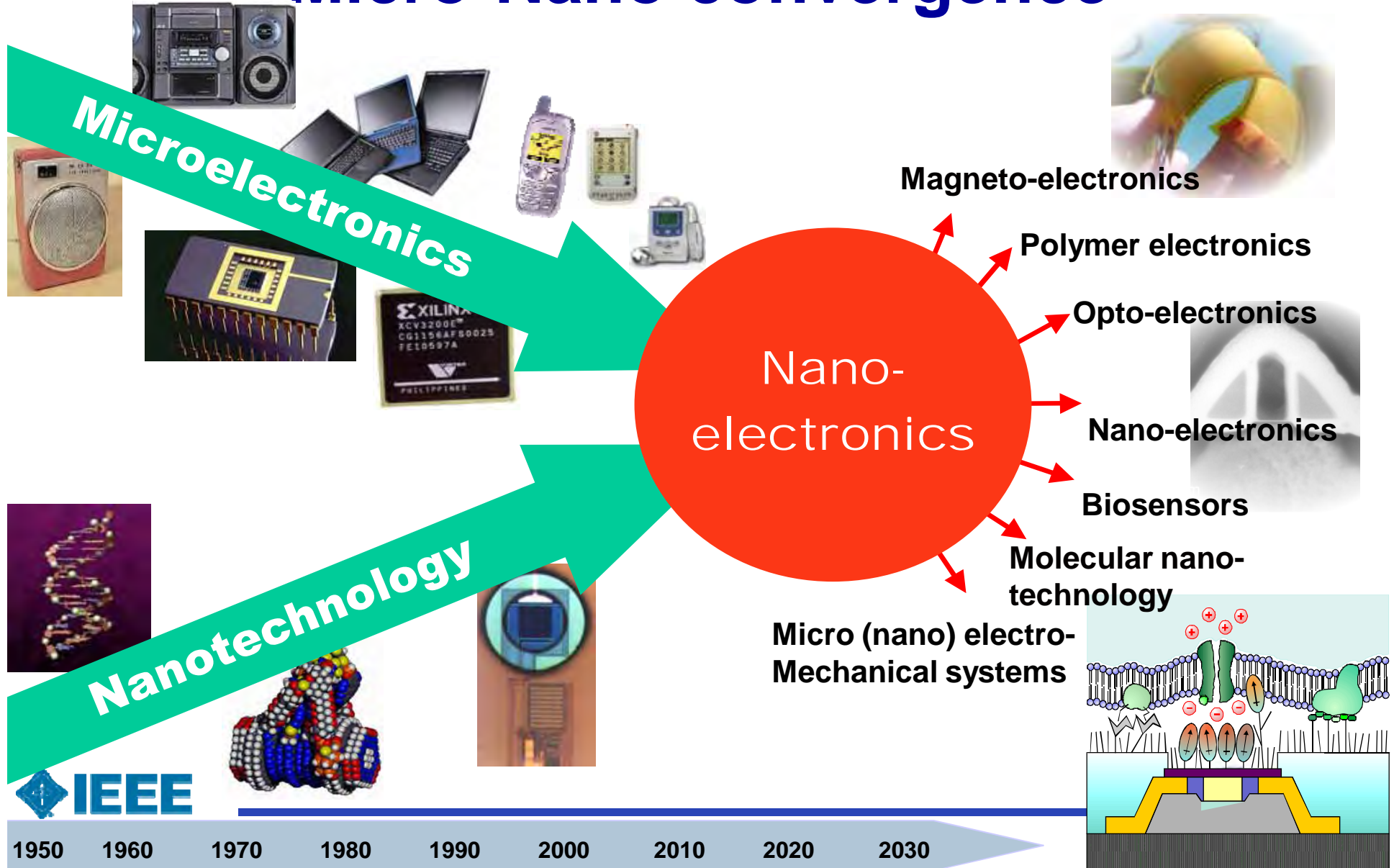
Converging technologies:

Nanotechnology, biotechnology, information and cognitive sciences – ***engineering for the mind ...***

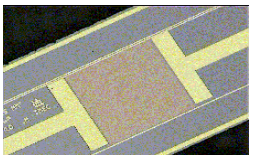
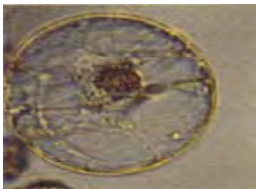
Entering a transdisciplinary world ...



Micro-Nano convergence



Needed: Renaissance Engineers, Scientists...



Converging Technologies require:

Wo(men) driven by socio-eco challenges

Teamplayers, system architects
tech nerds

With **cross-disciplinary communication skills**

Trained in **creative thinking** at system level

Co-architects of society

Putting a **societal vision** into a solution

With economic value: **entrepreneurial spirit**

Hence need for:

“Sociology for Future Engineers”

Conclusions

Society will have to take into account the fast changing **Field of Interest** of the multi-disciplinary trained engineer

Continued effort for **globalization** is a must

New Unique **Membership Benefits** needed

Student members and **GOLD** are important assets