

The Electronic (R)evolution

Eugenio Culurciello
e-Lab, October 10th 2009

Changed life?



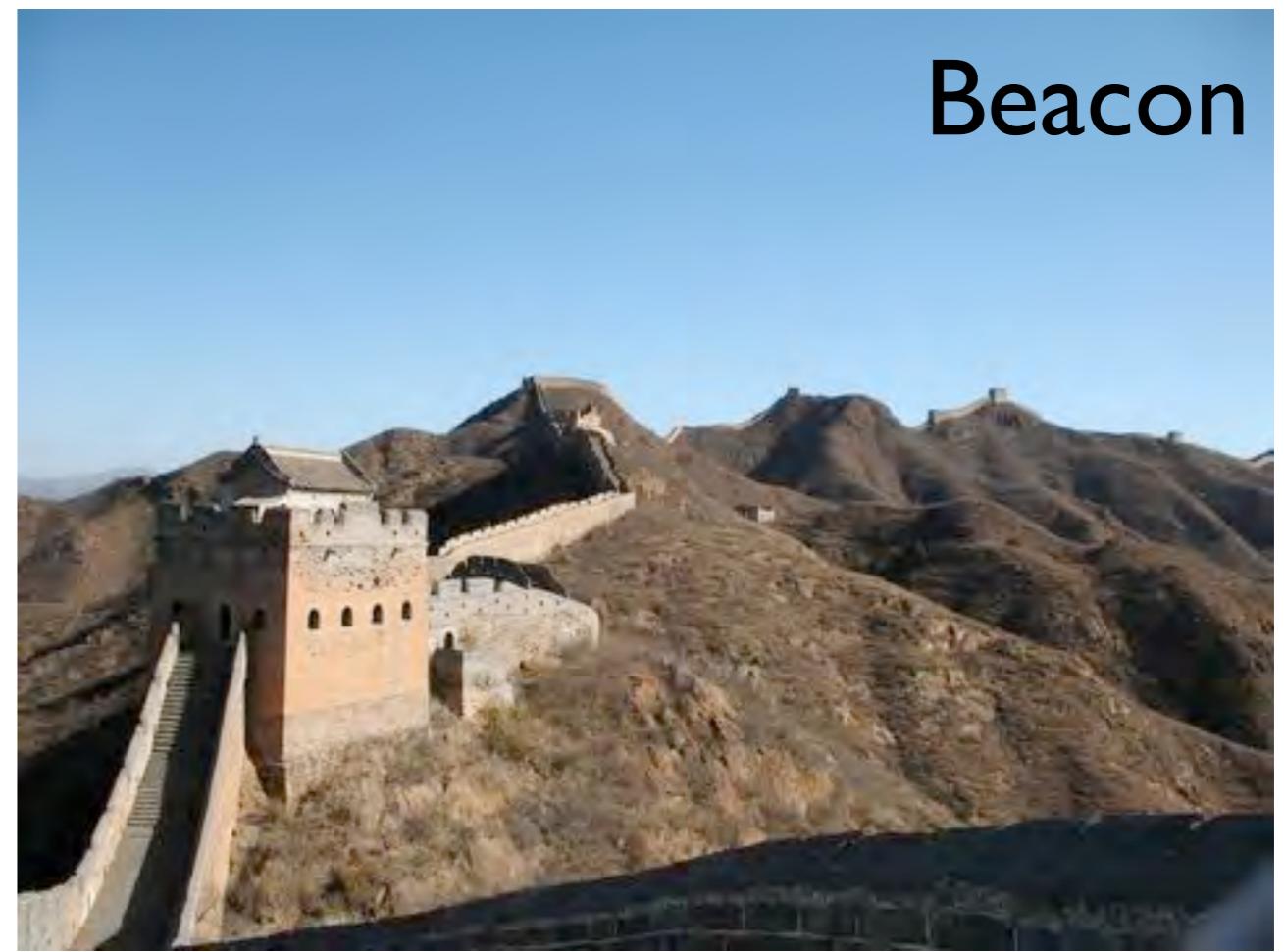
Communication 100 years ago





Town meeting

or even before...





Today



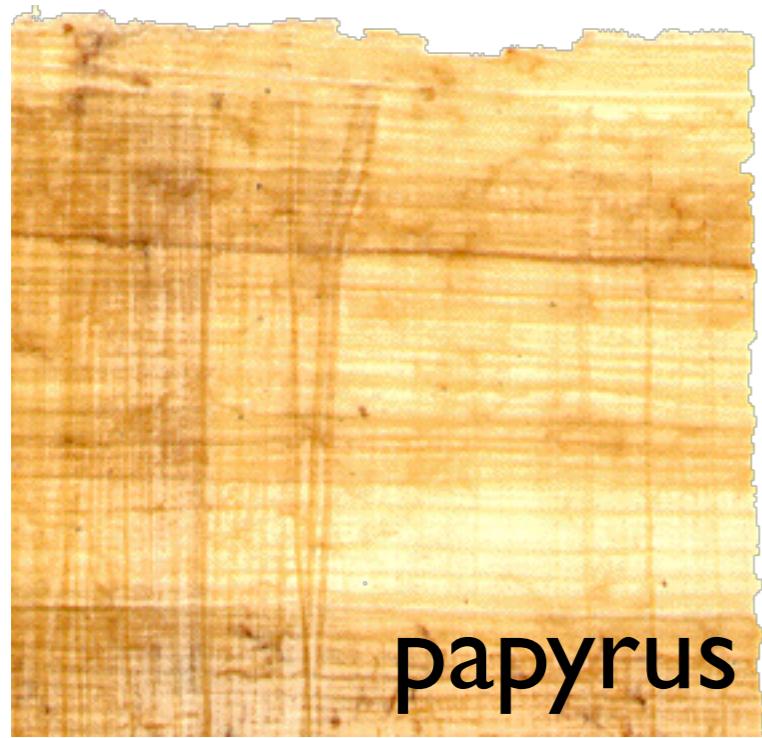




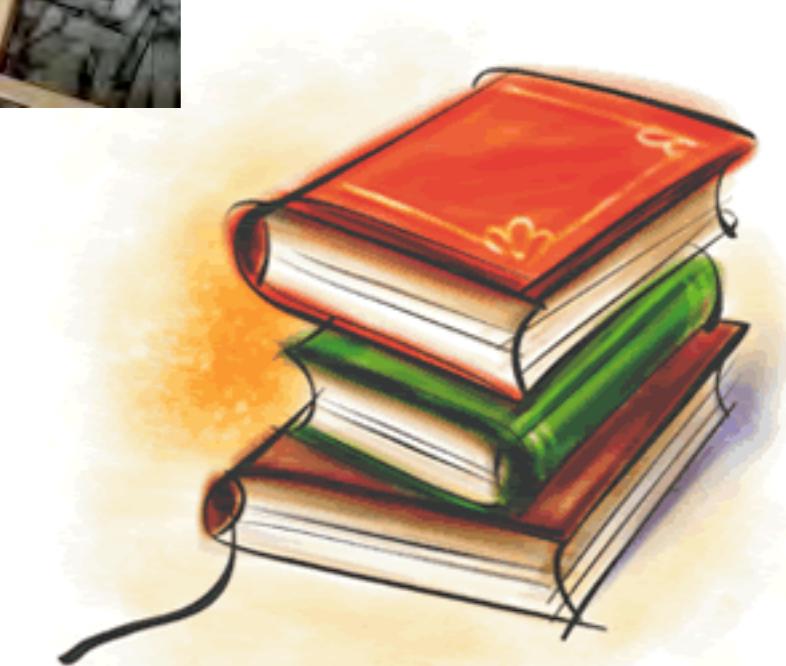


Knowledge





papyrus





"On the Internet, nobody knows you're a dog."

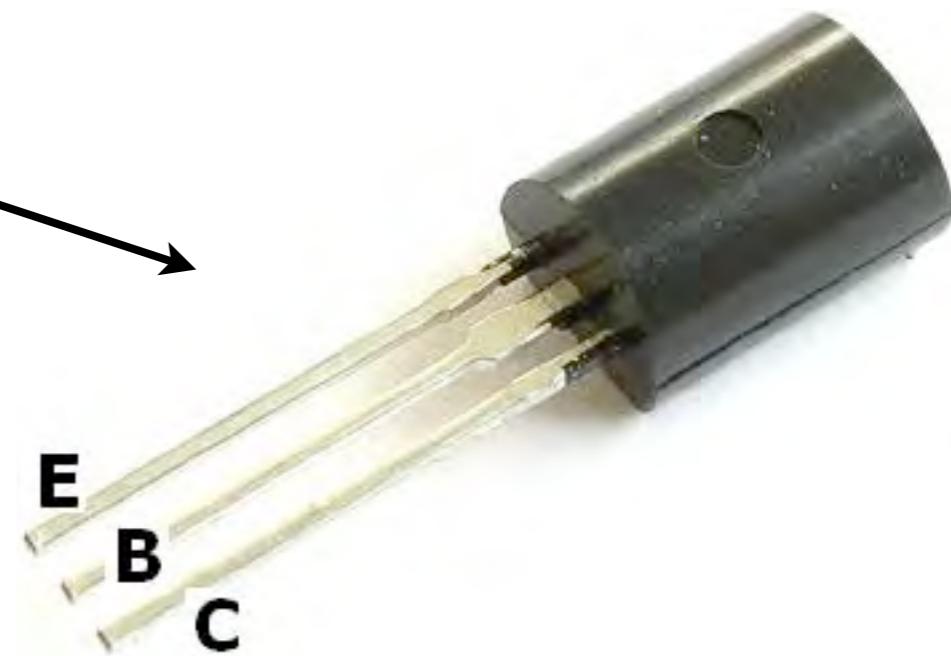
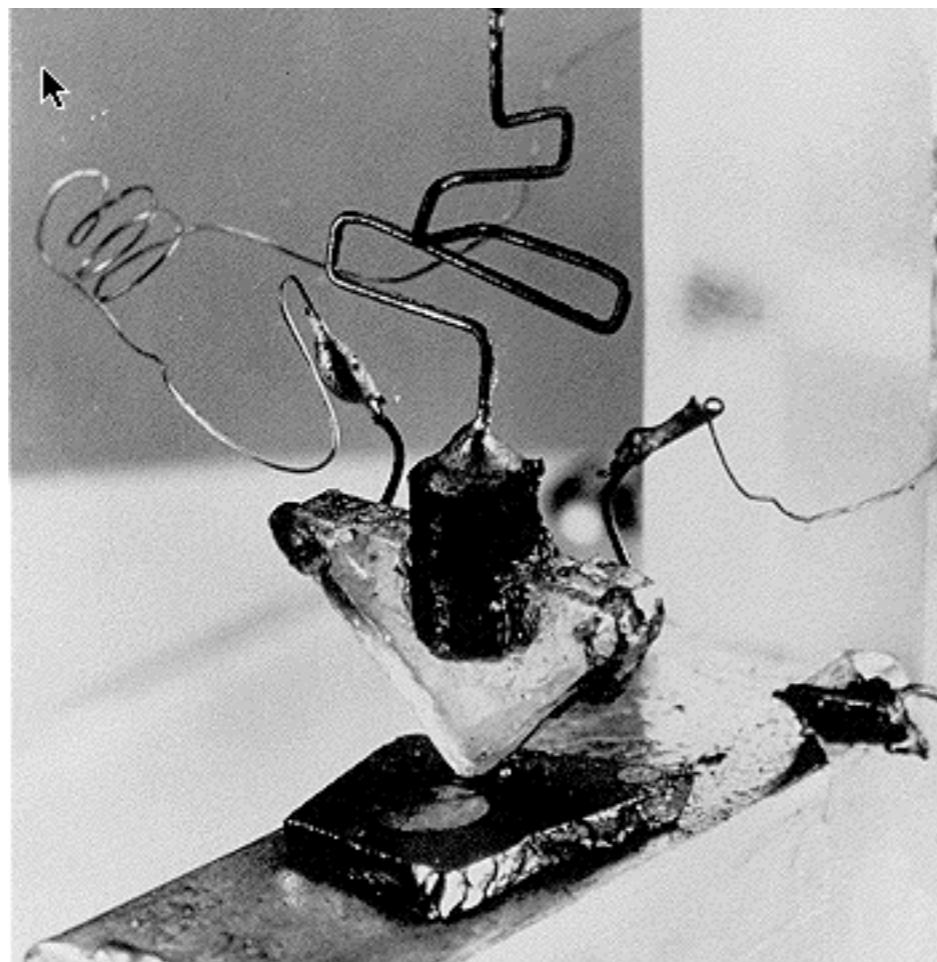
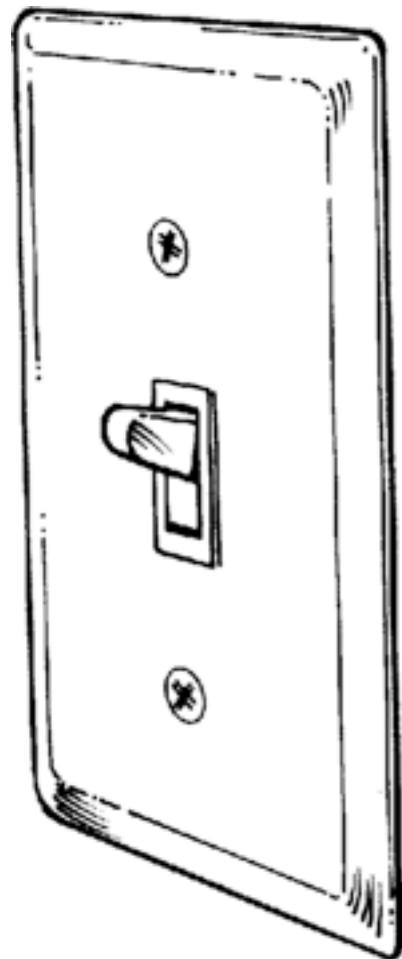




**Yes, but I came here today because I
thought I was going to learn what is in my
Gameboy, DS, Playstation 3, X-Box...**

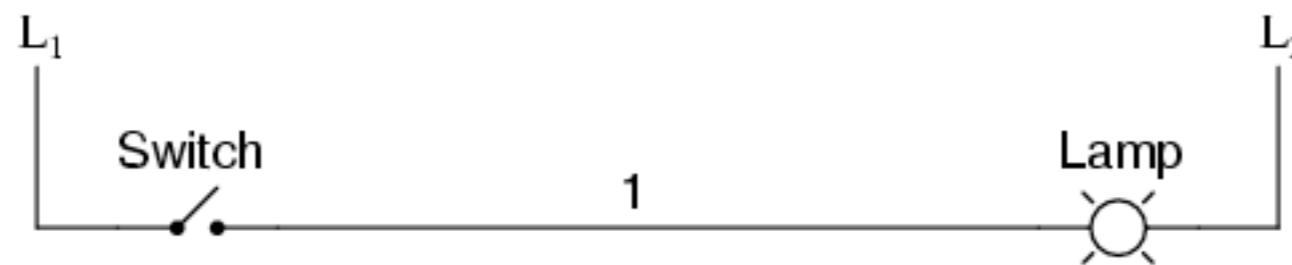
Computer



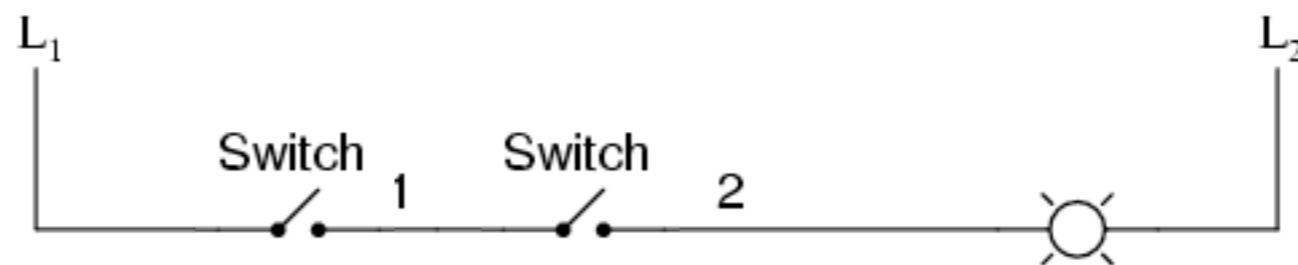
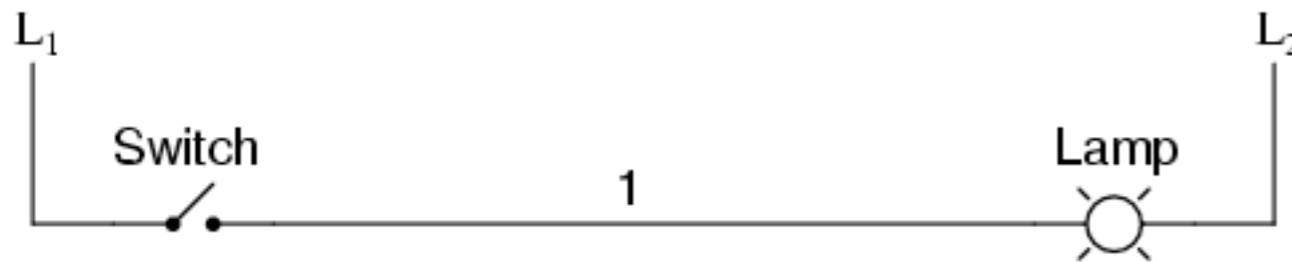


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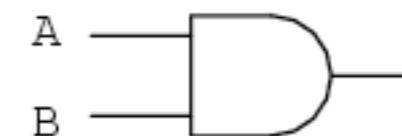
Got switch?



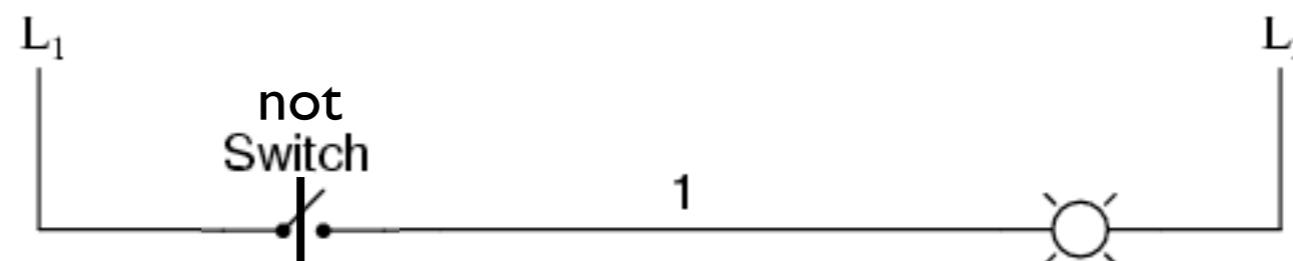
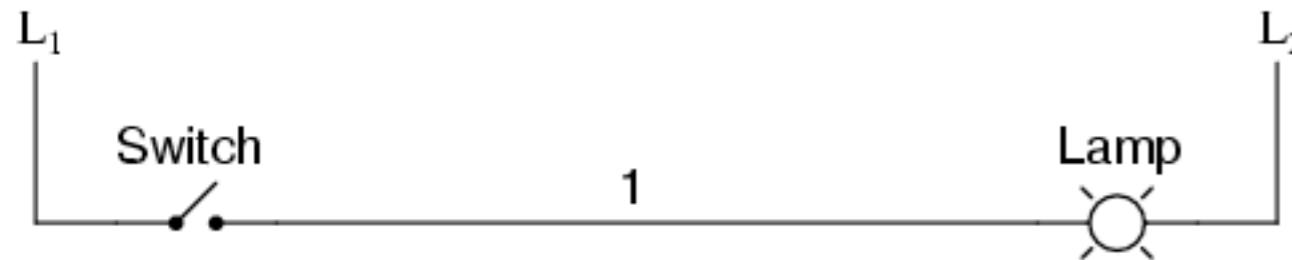
AND



A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1



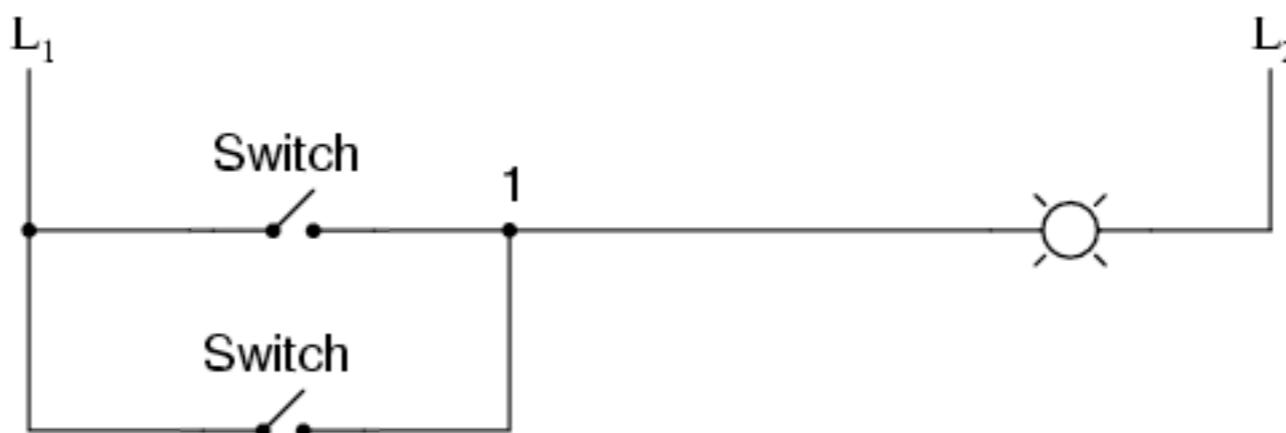
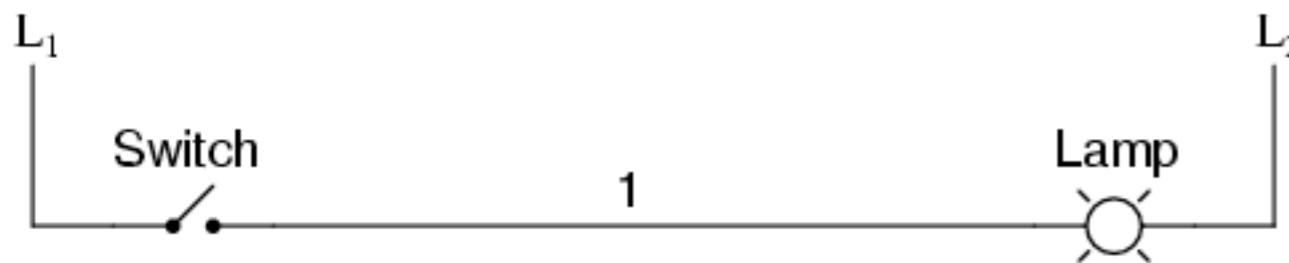
NOT



A	Output
0	1
1	0



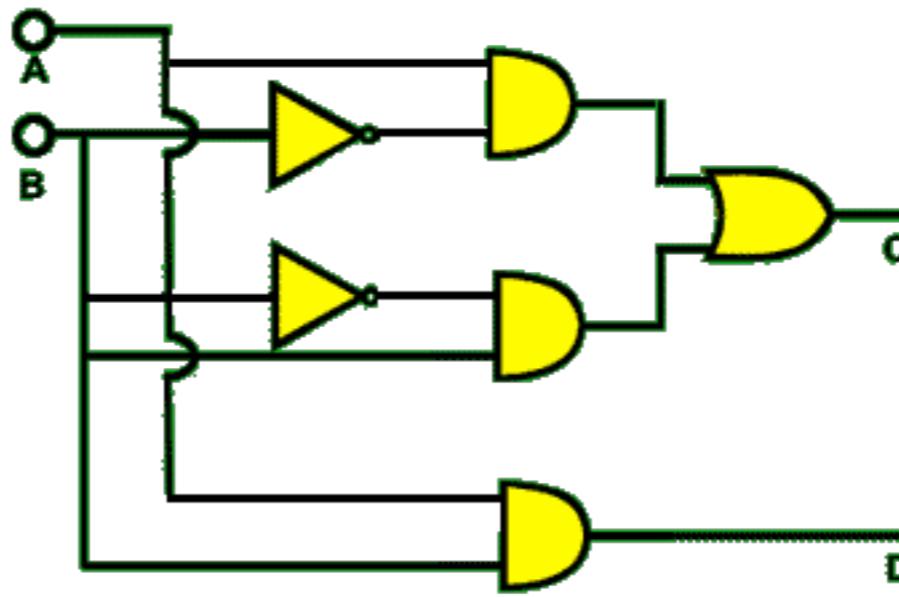
OR



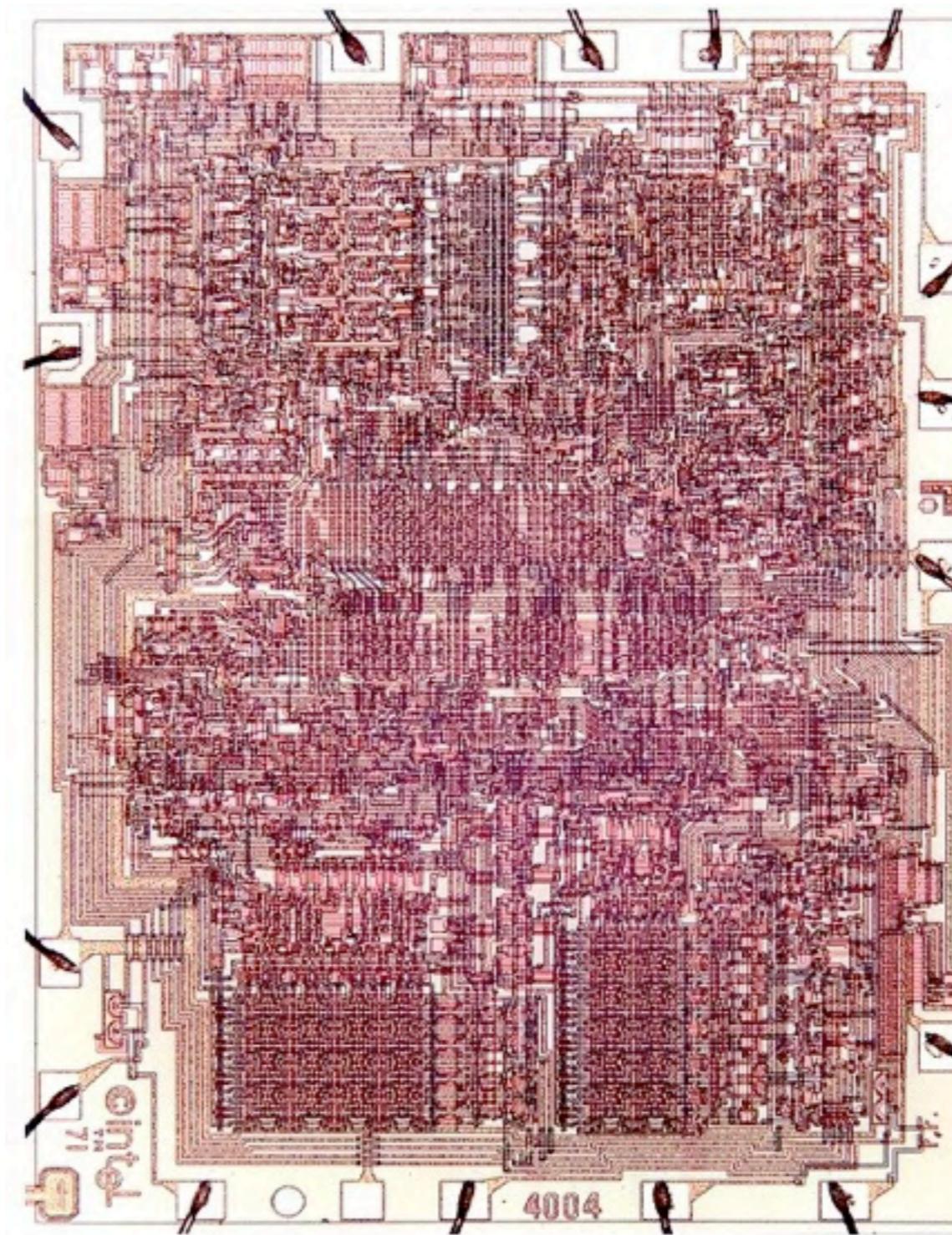
A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1



20 transistors



2300 transistors

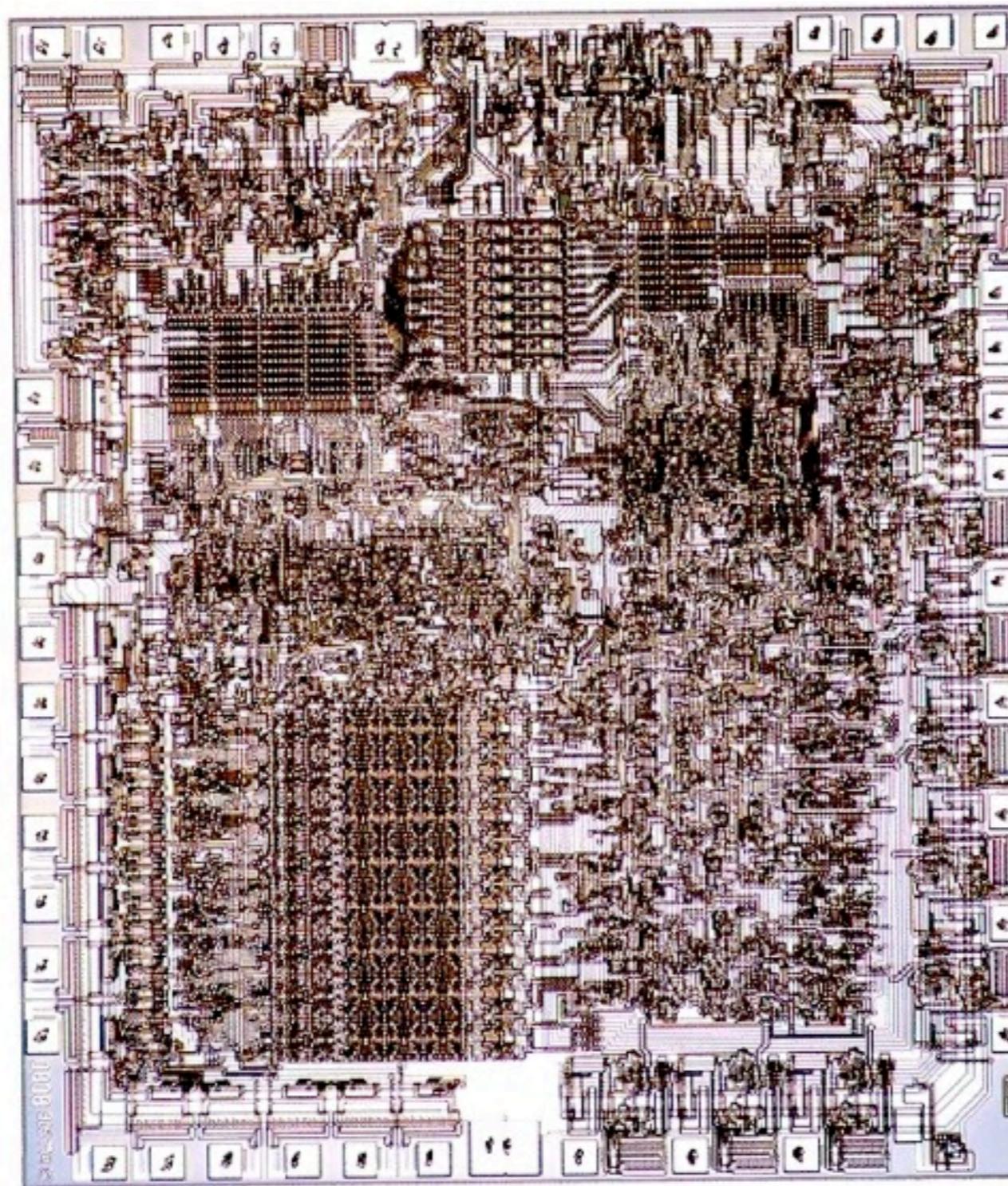


Intel 4004
1st 4-bit Microprocessor

1971, 108kHz, 2300 transistors, PMOS

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6000 transistors

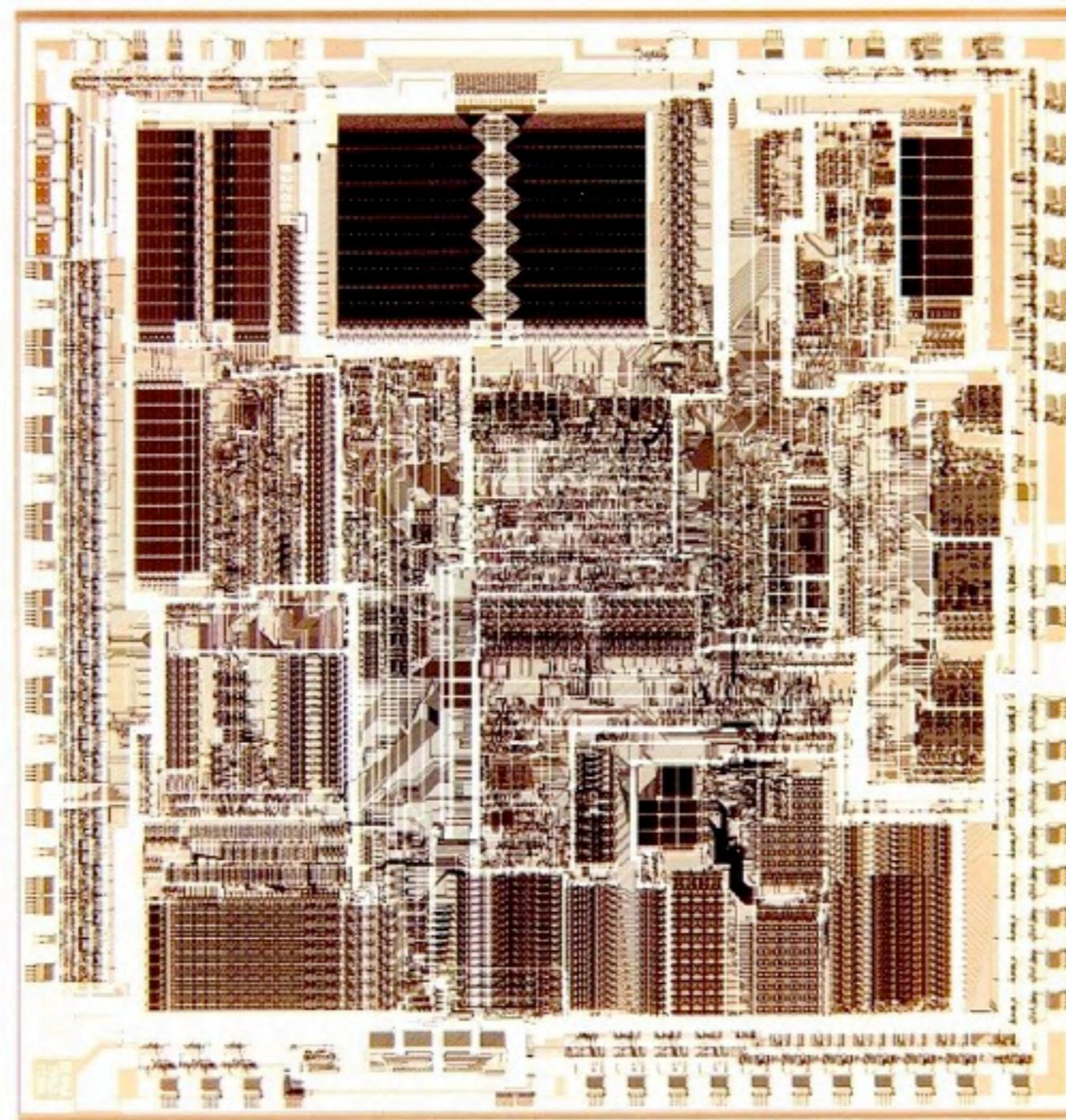


**Intel 8080
NMOS 8-bit Microprocessor**

1974, 2MHz, 6,000 transistors

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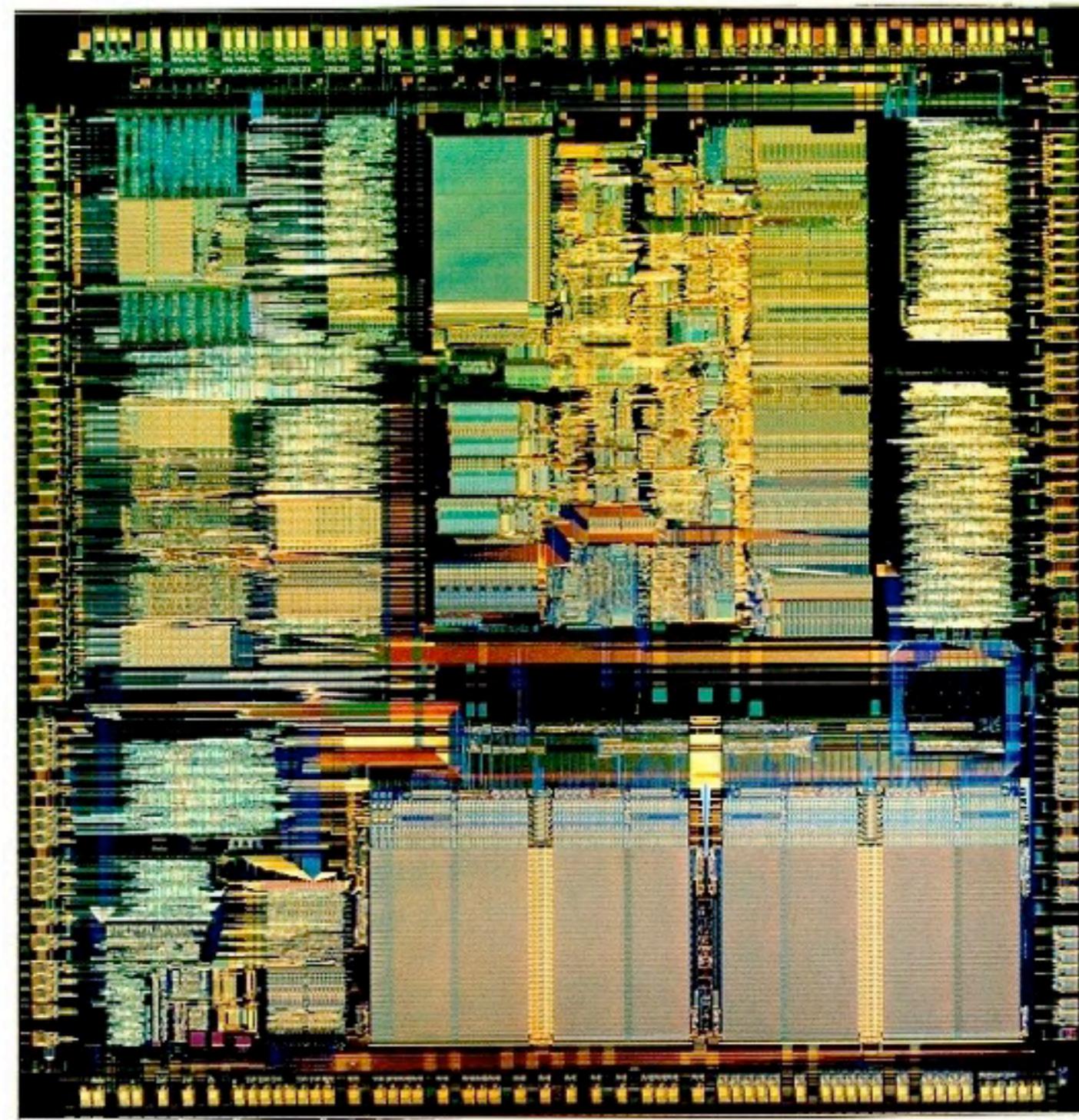
| 30,000 transistors



Intel 80286, PC's x286 chip

1982, ~10 MHz, 130,000 transistors

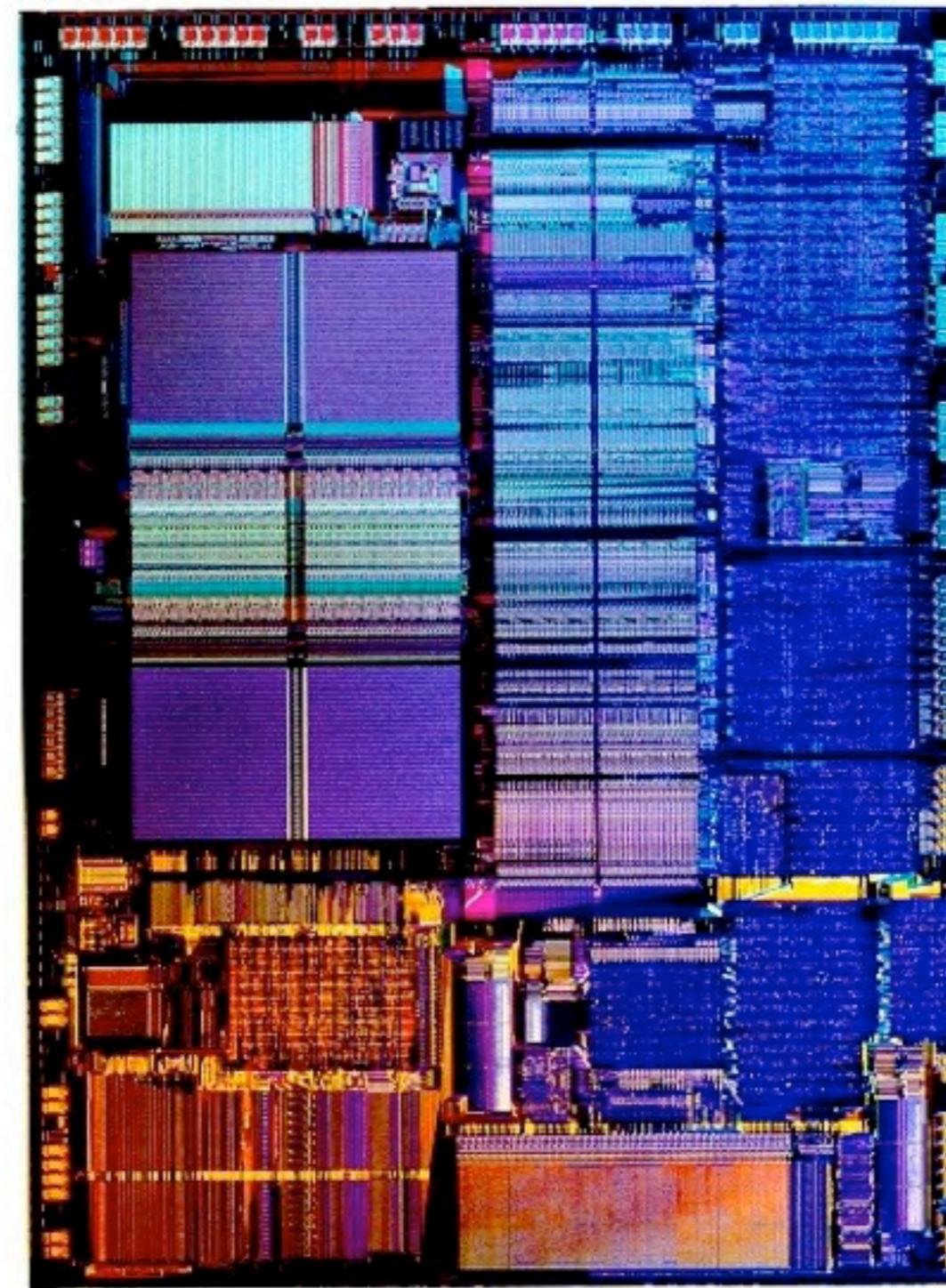
275,000 transistors



**Intel 80386, PC's x386 chip
1985, ~30 MHz, 275,000 transistors**

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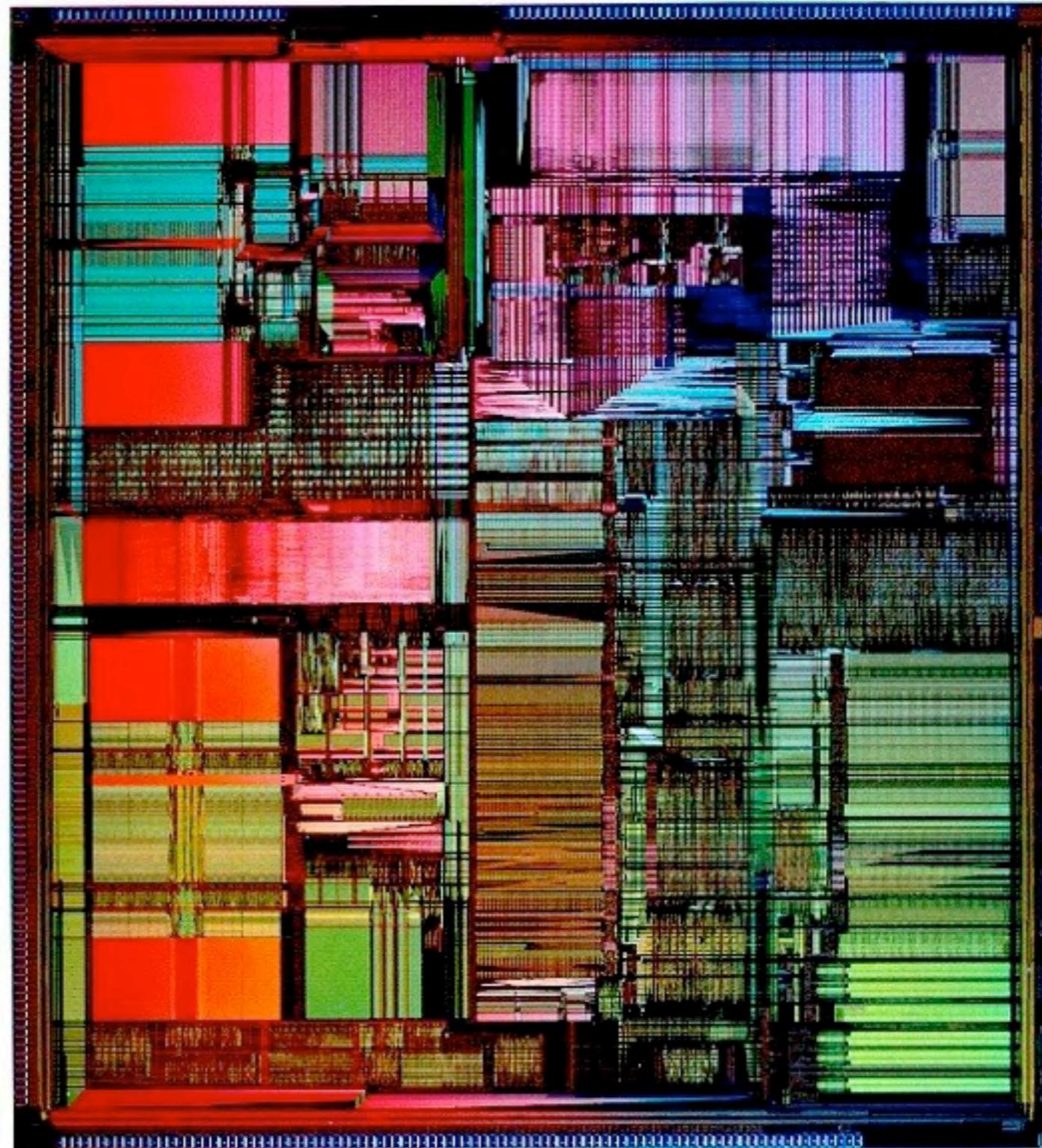
1.2M transistors



**Intel 80486, PC's x486 chip
1989, 50 MHz, 1.2 million transistors**

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3.1M transistors

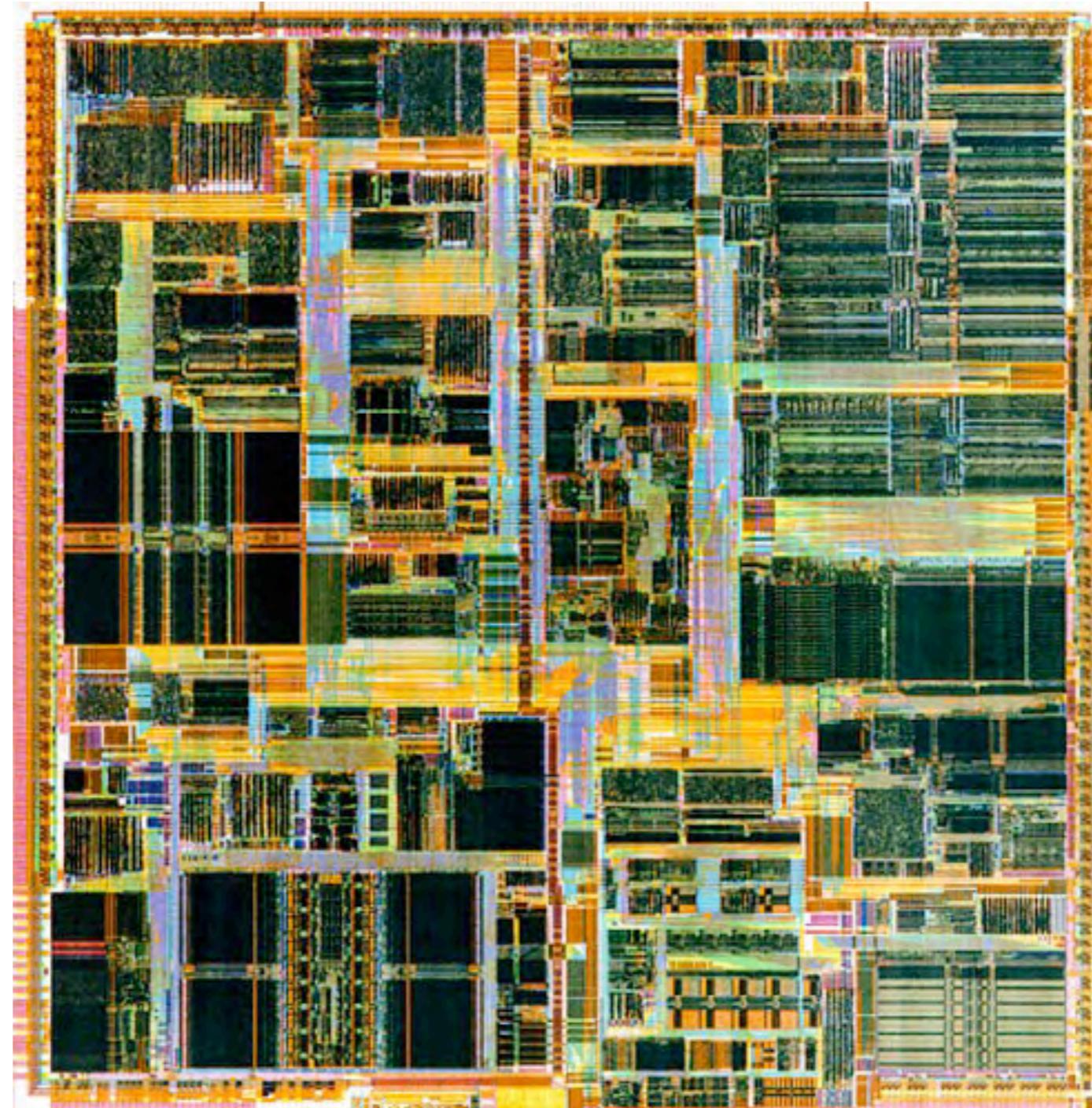


Pentium

1993, 66 MHz, 3.1 million transistors

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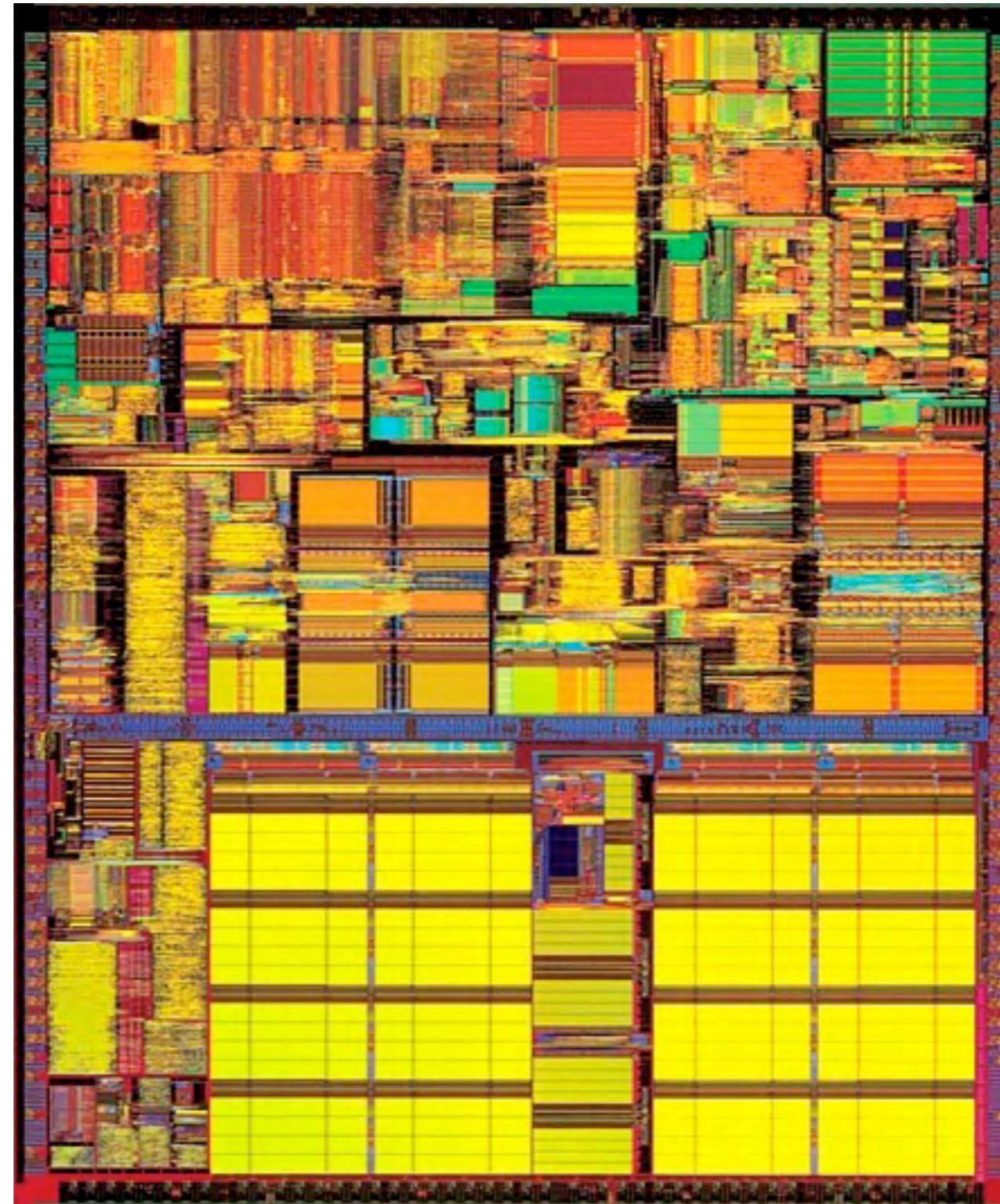
7.5M transistors



Pentium II

1997, 300 MHz, 7.5 million transistors

28M transistors

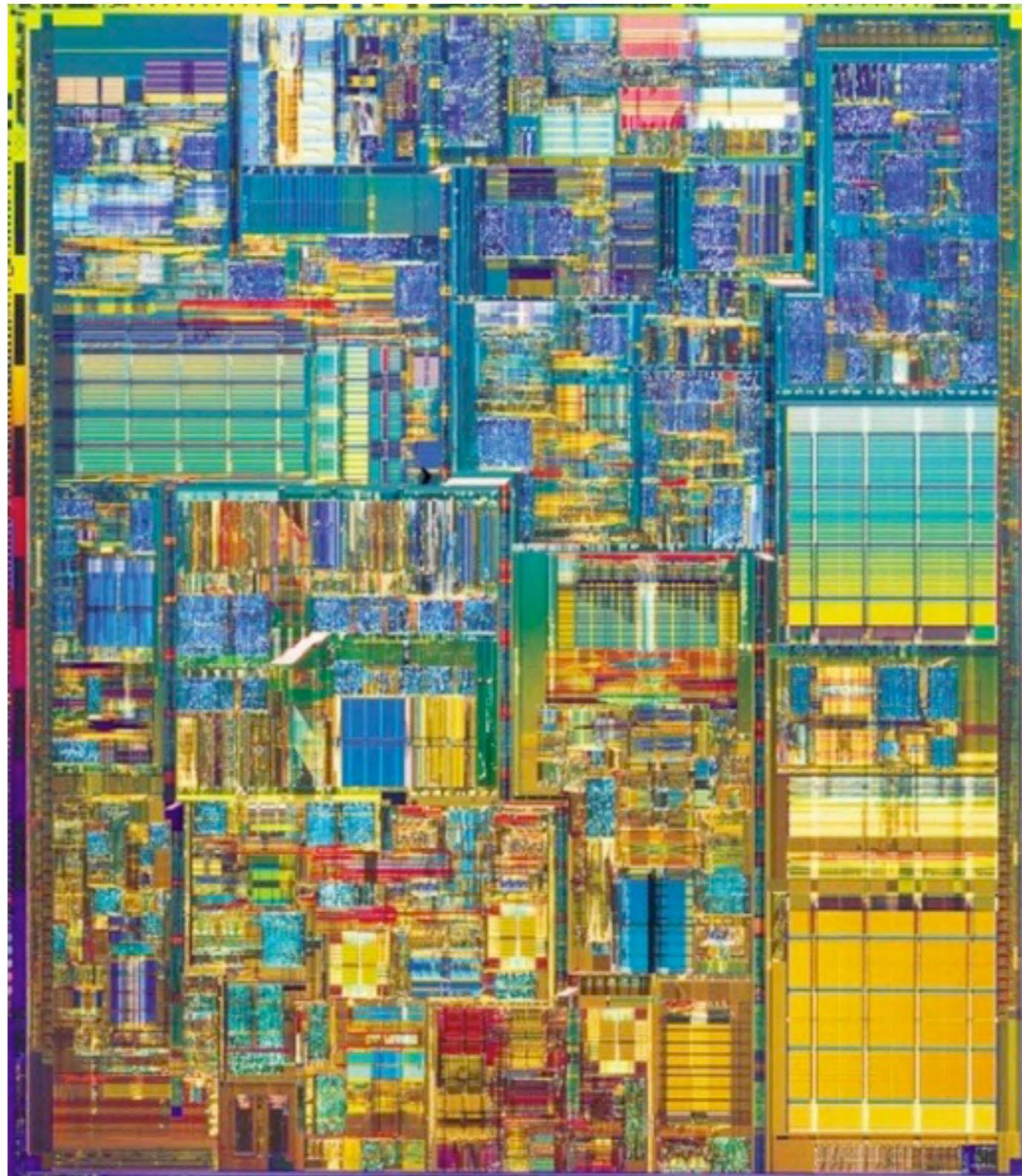


Pentium III

1999, 733 MHz, 28 million transistors

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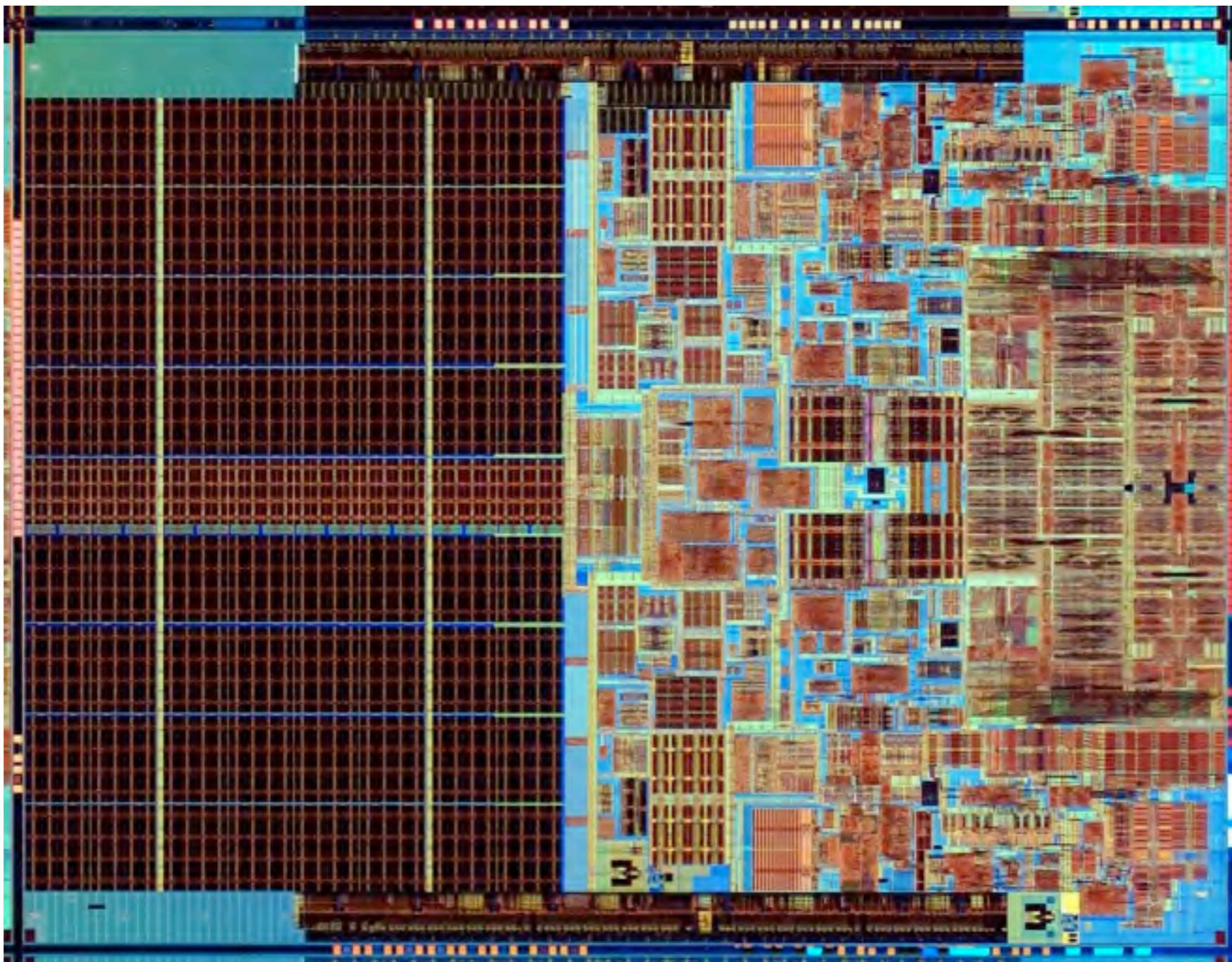
42M transistors



Pentium 4
2000, 1.5 GHz, 42 million transistors

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410M transistors

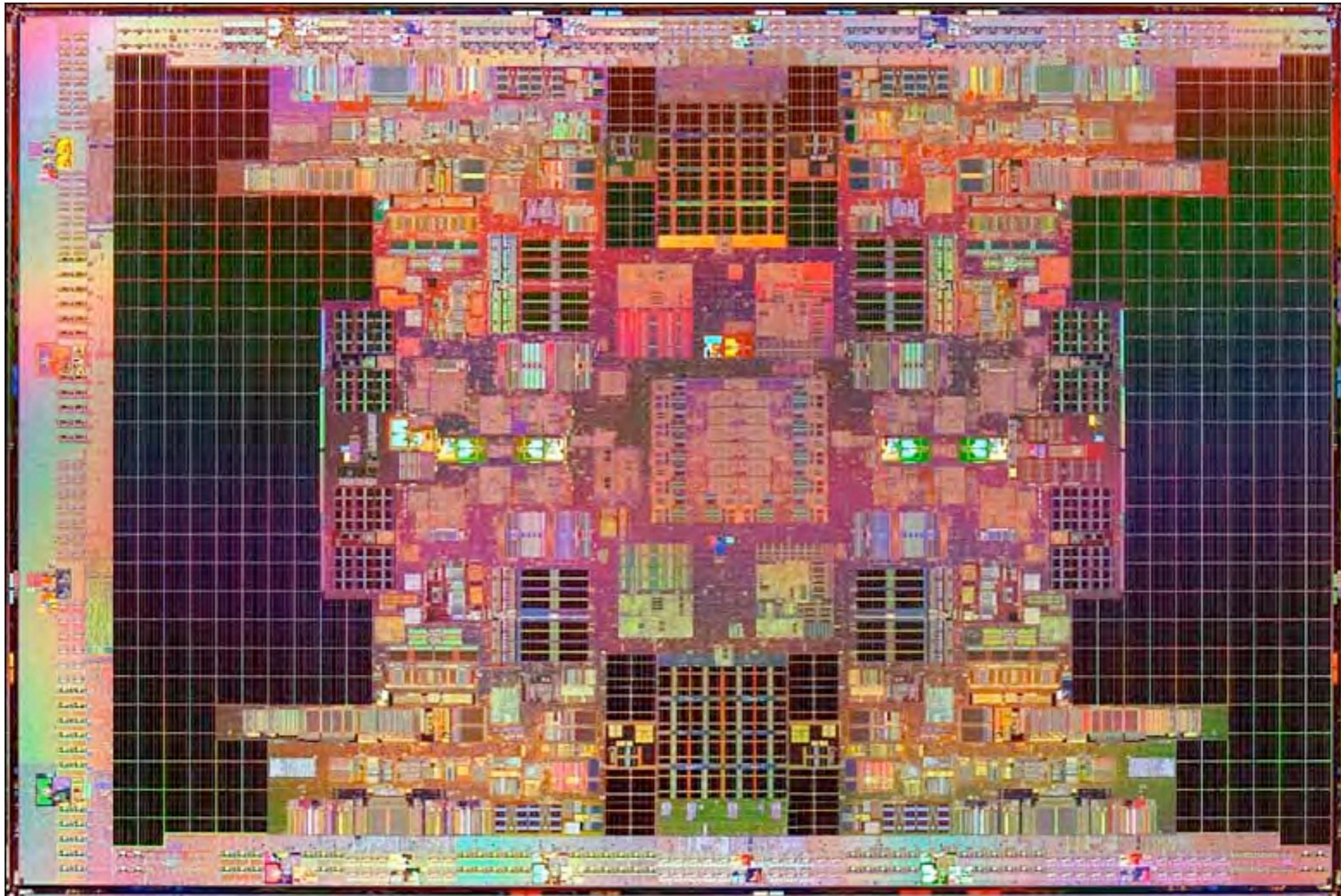


“Conroe” Core 2 Duo

2009, 3.16 GHz, 410 million transistors

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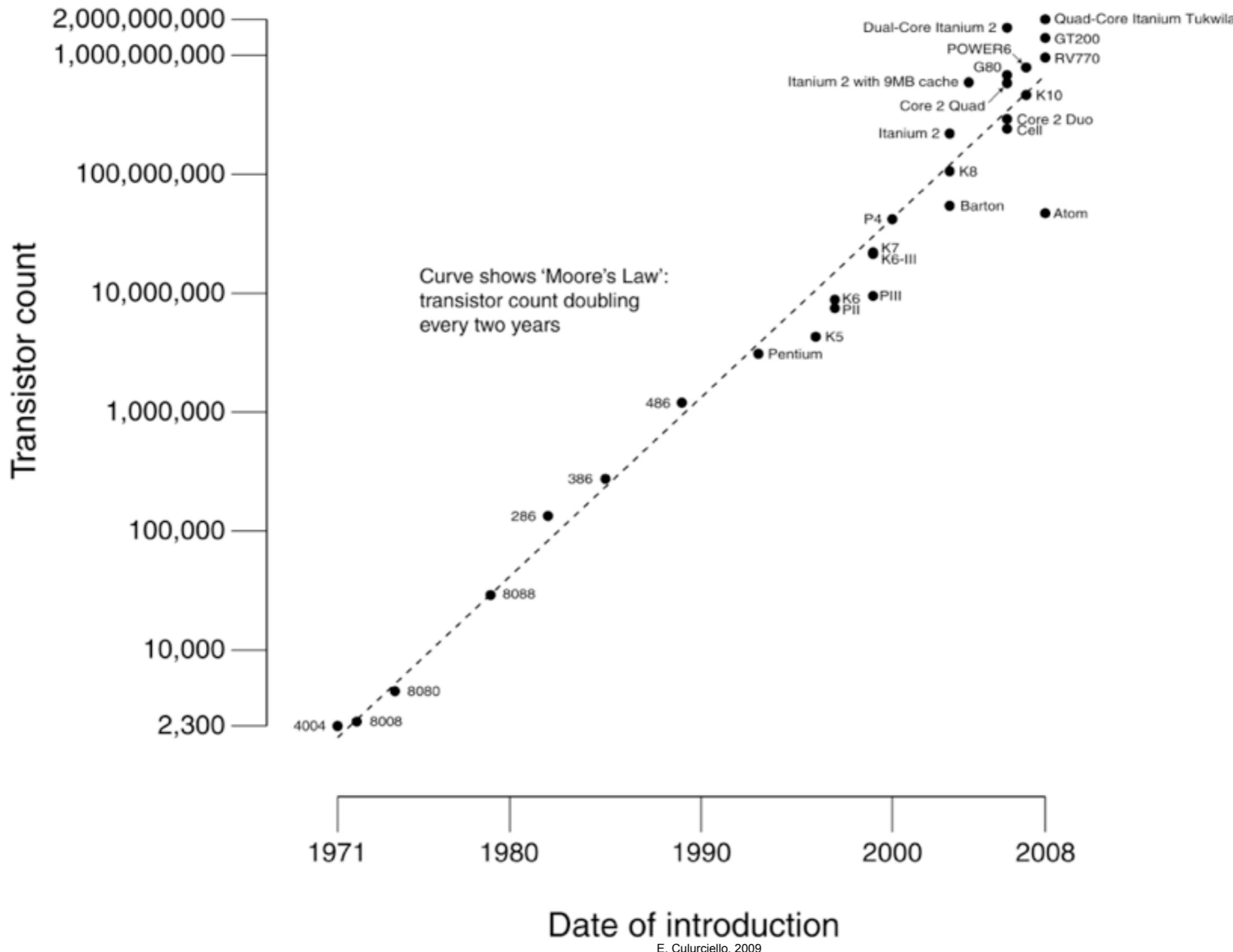
2 Billion transistors



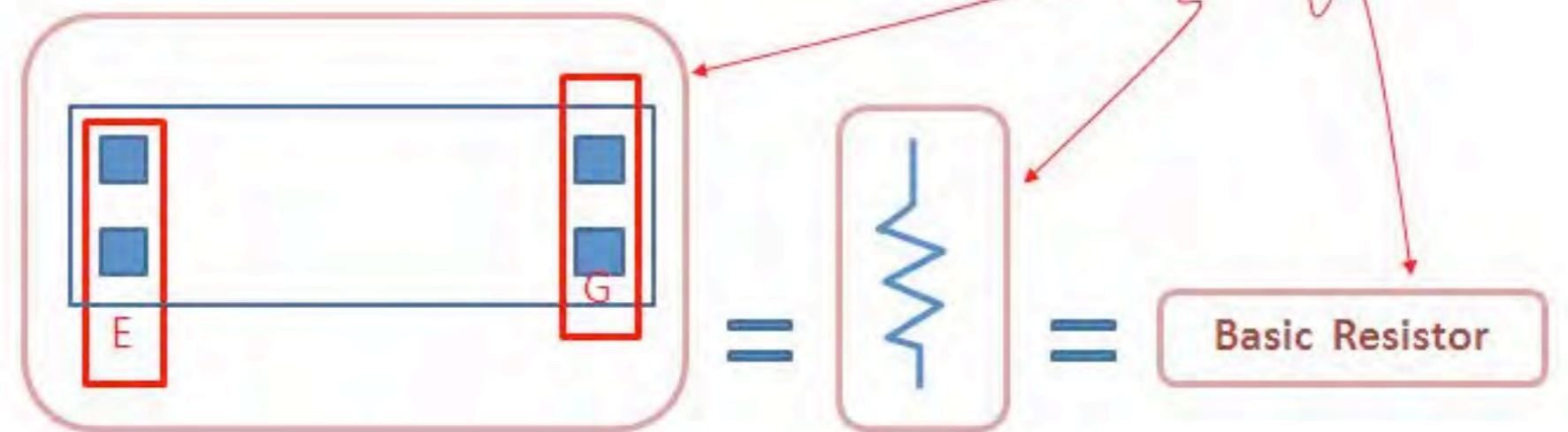
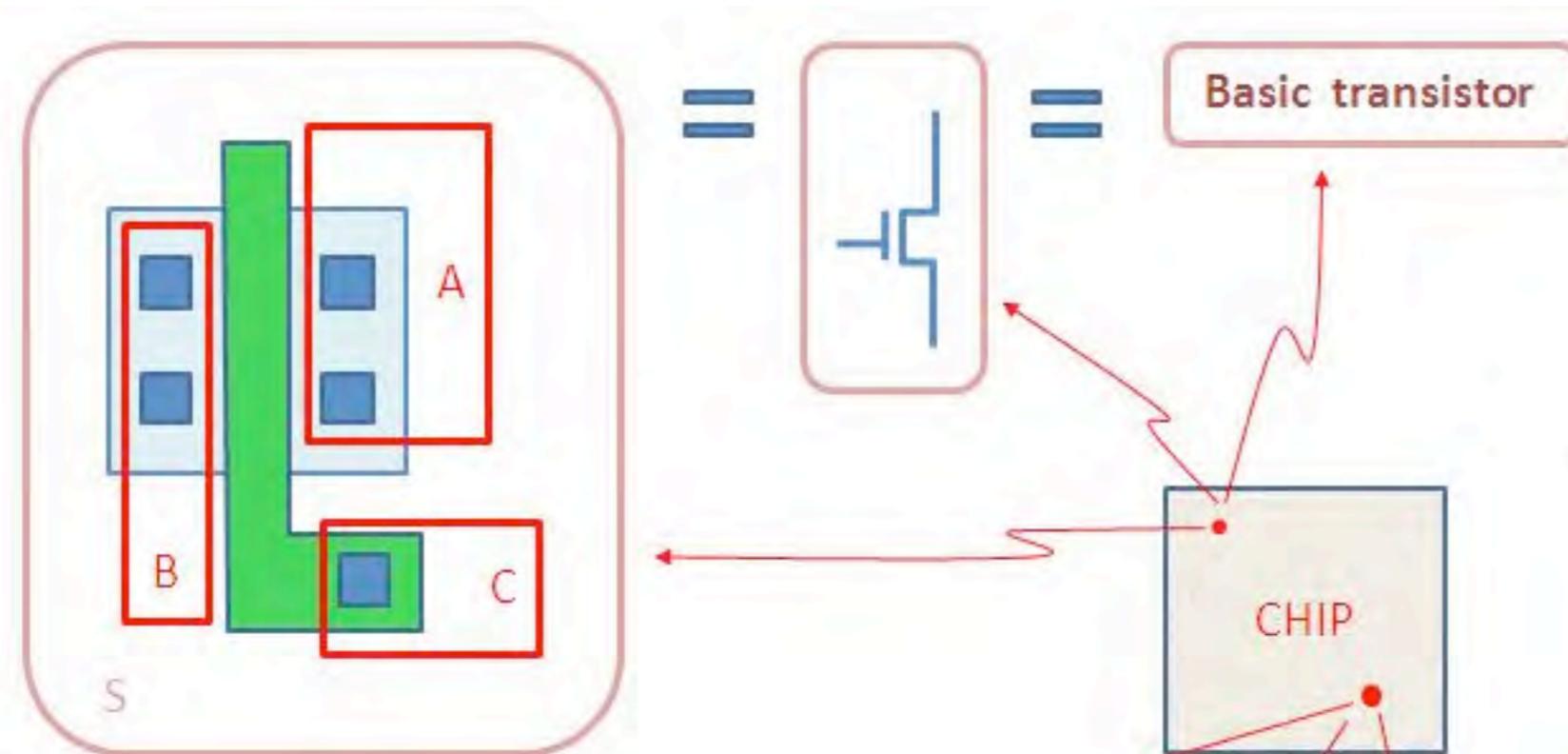
Intel “Tukwila”
2008, 2 billion transistors

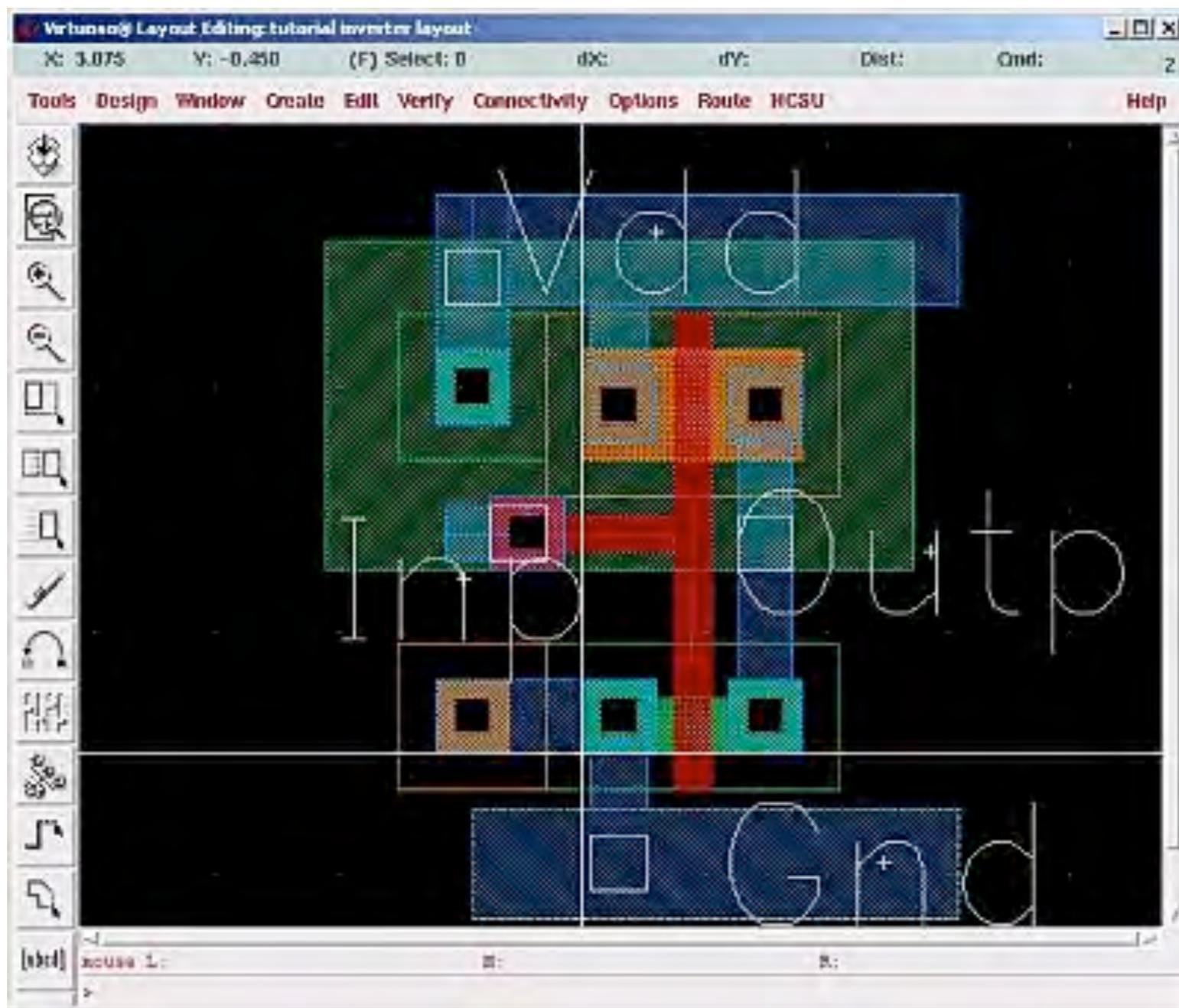
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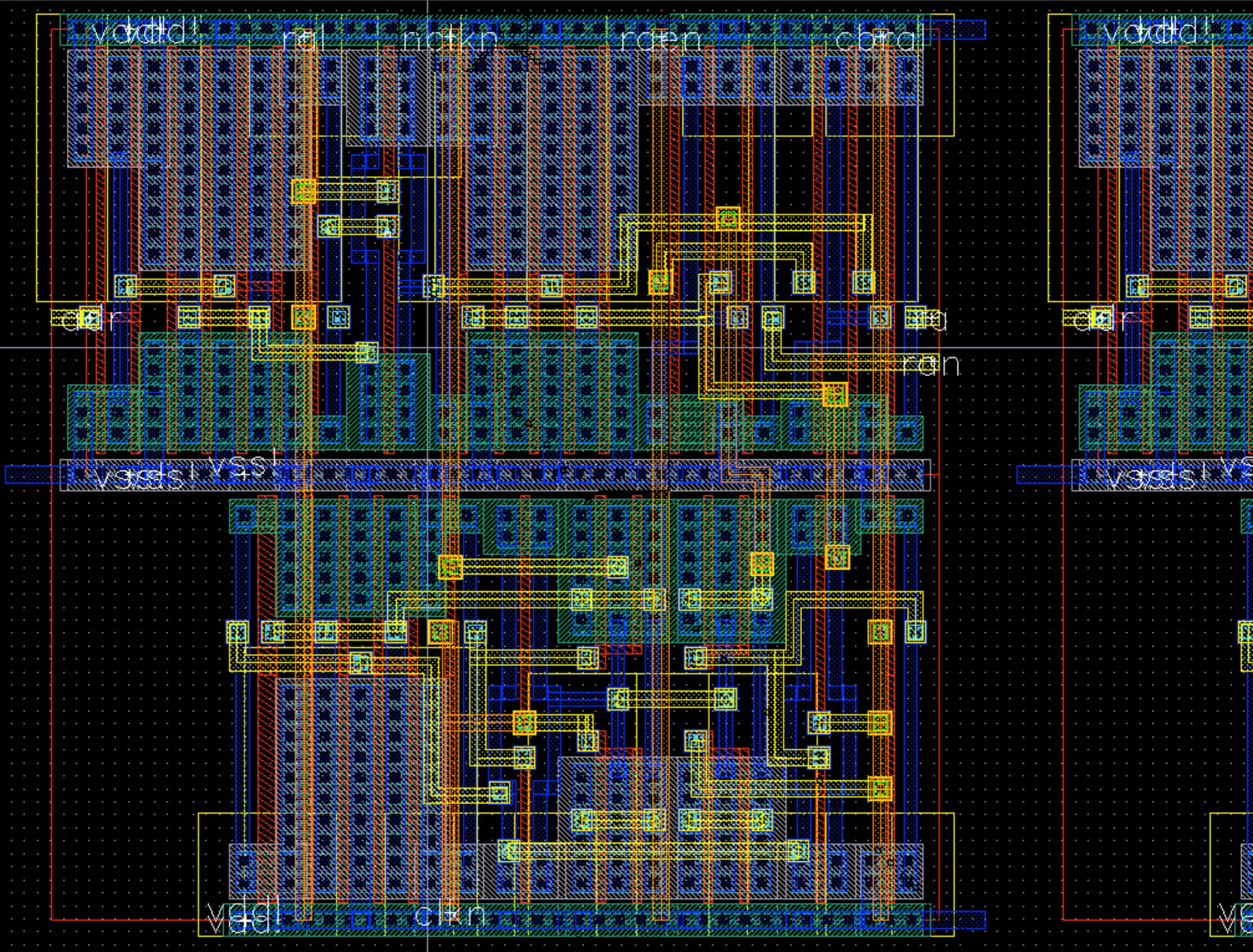
CPU Transistor Counts 1971-2008 & Moore's Law

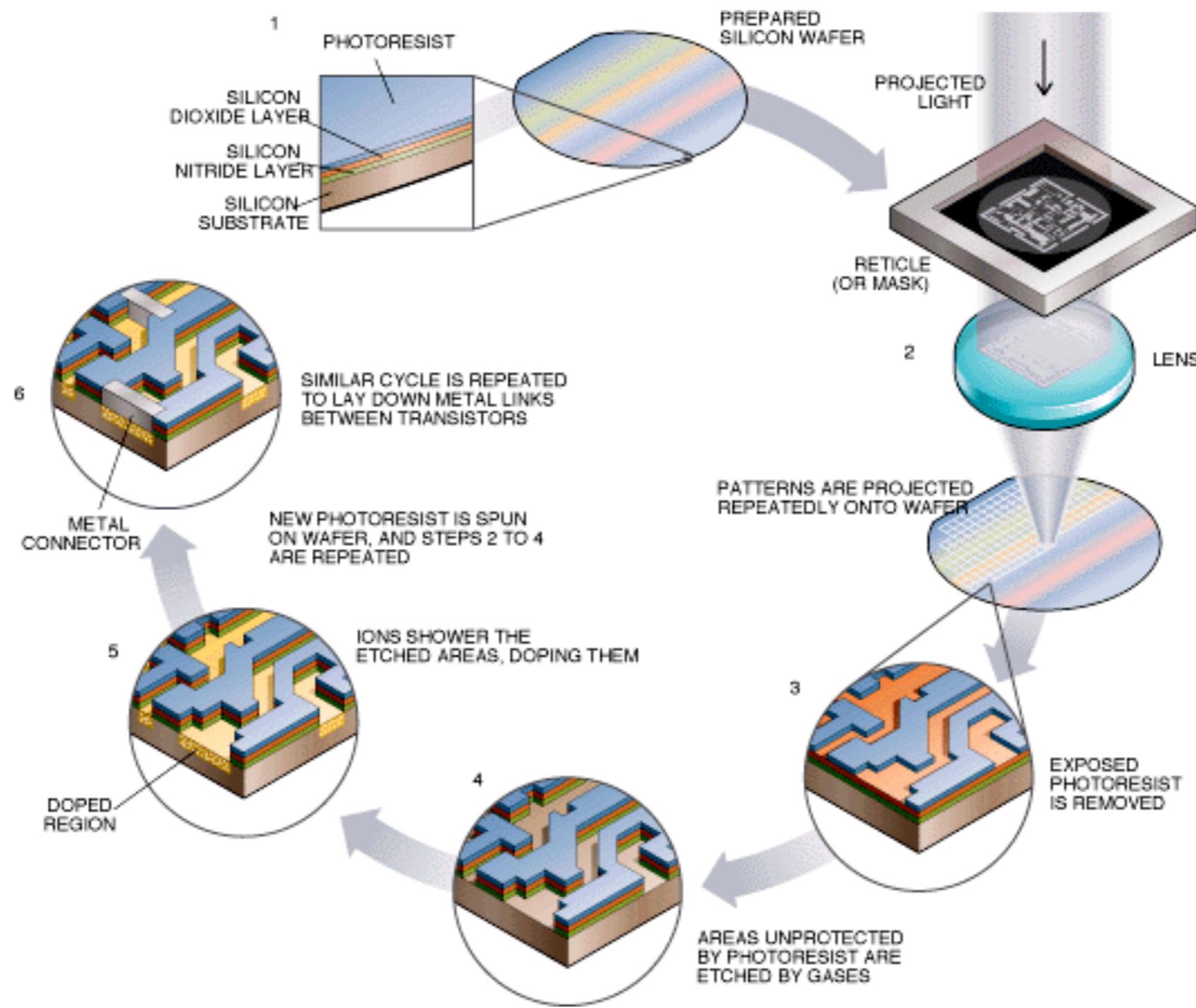


So many transistors... How is it possible?

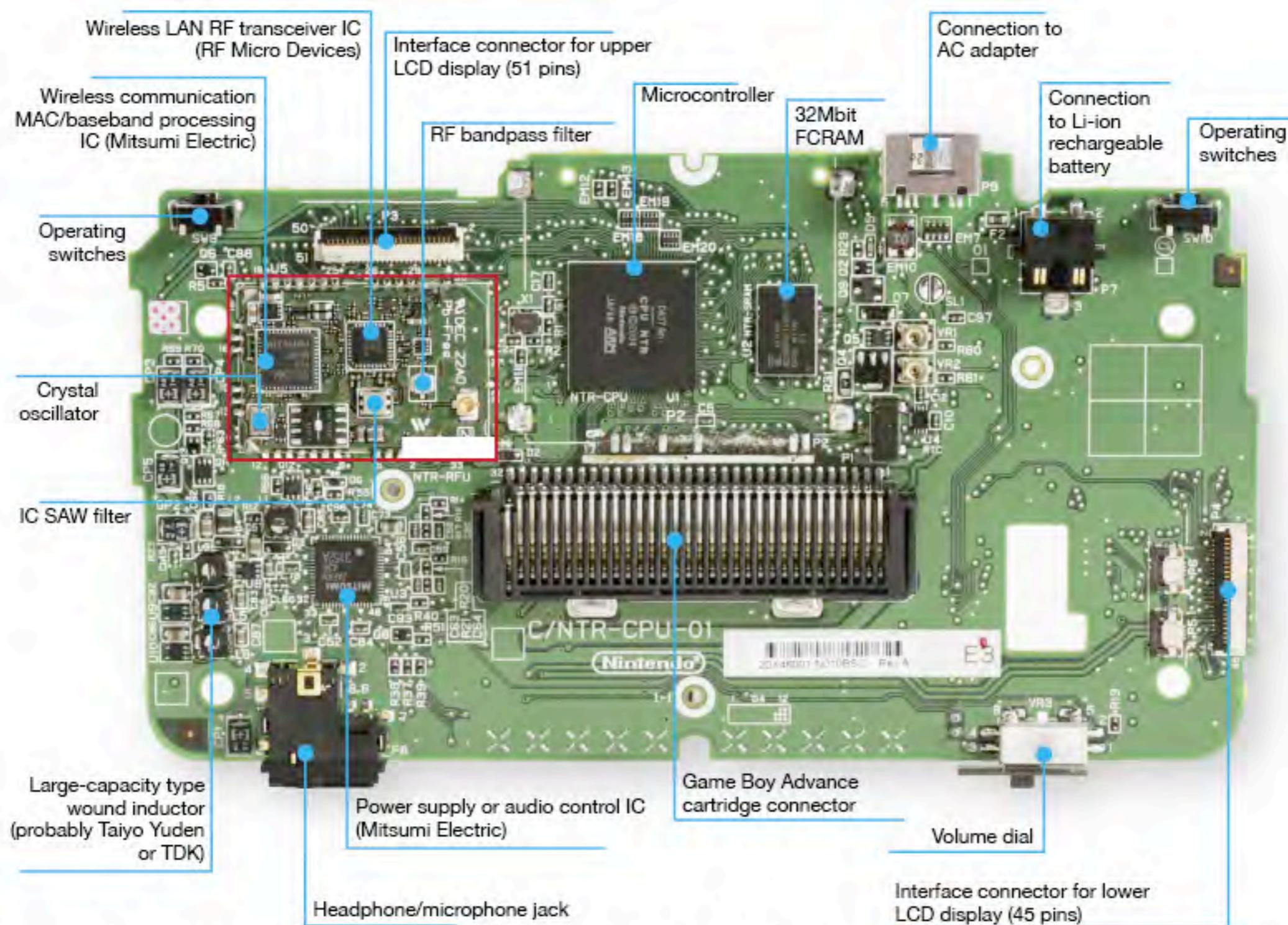


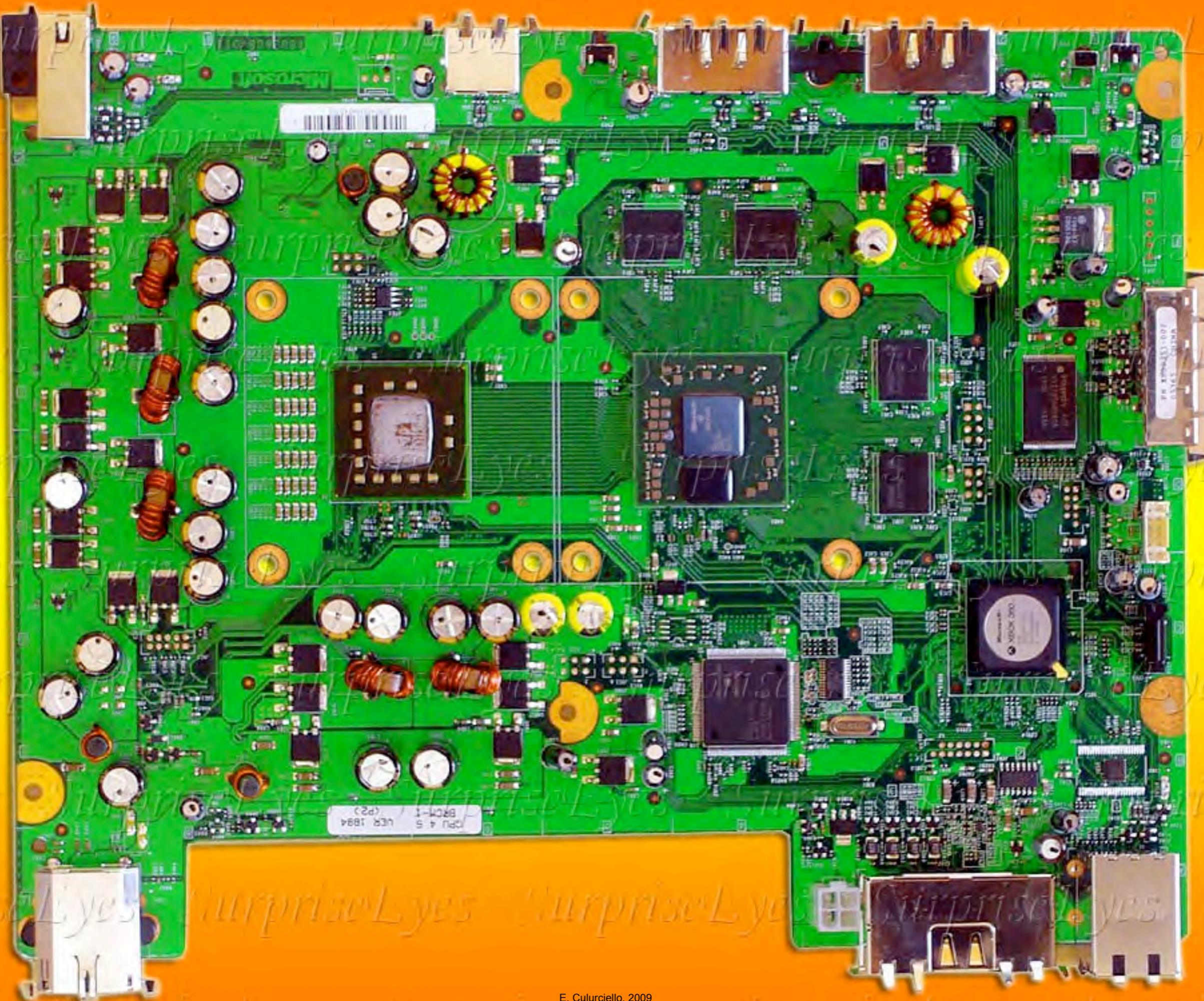


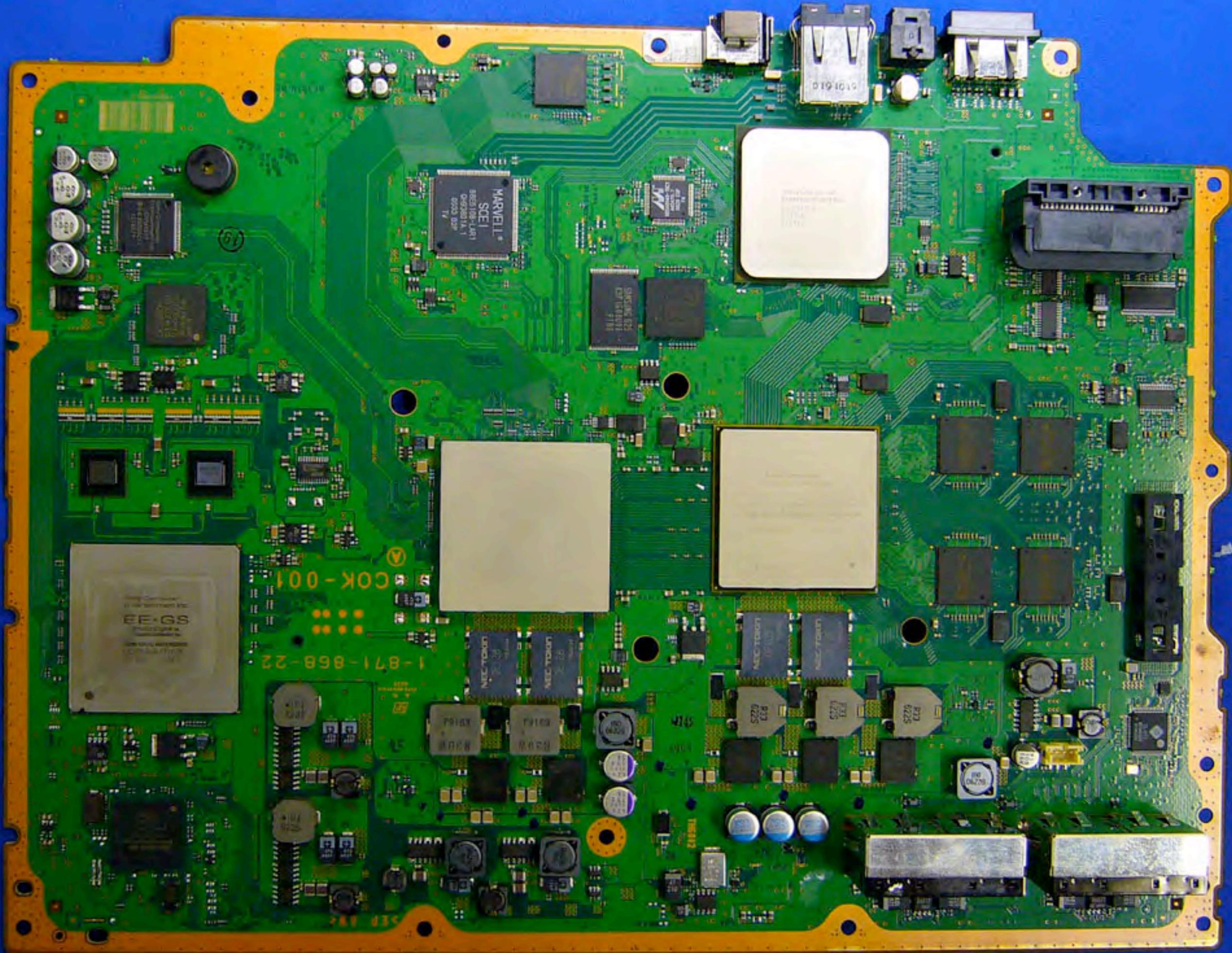


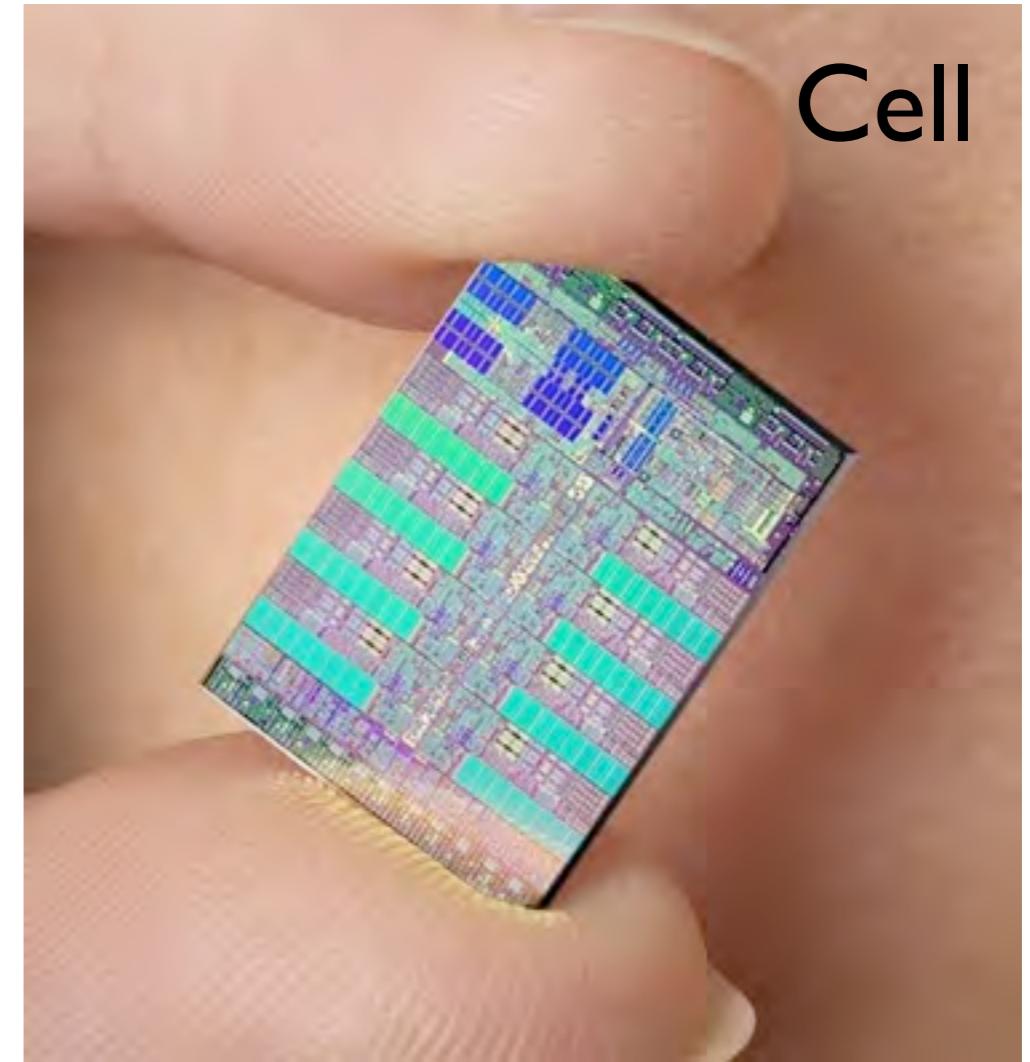
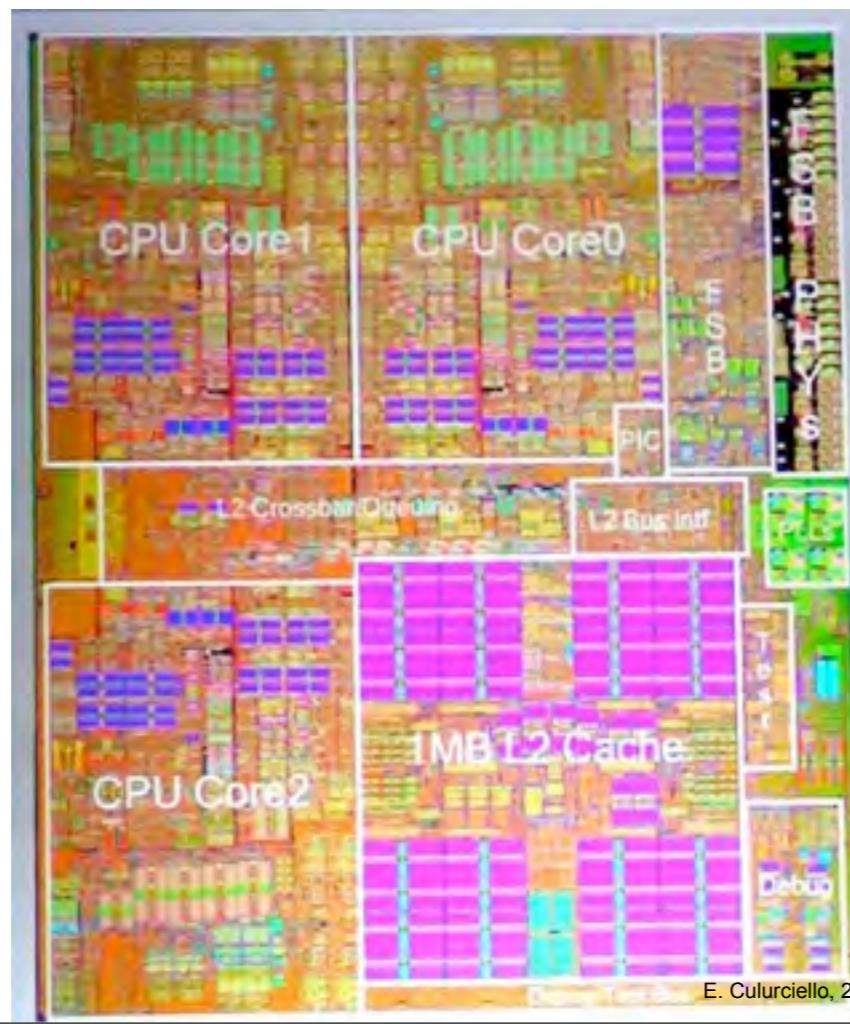
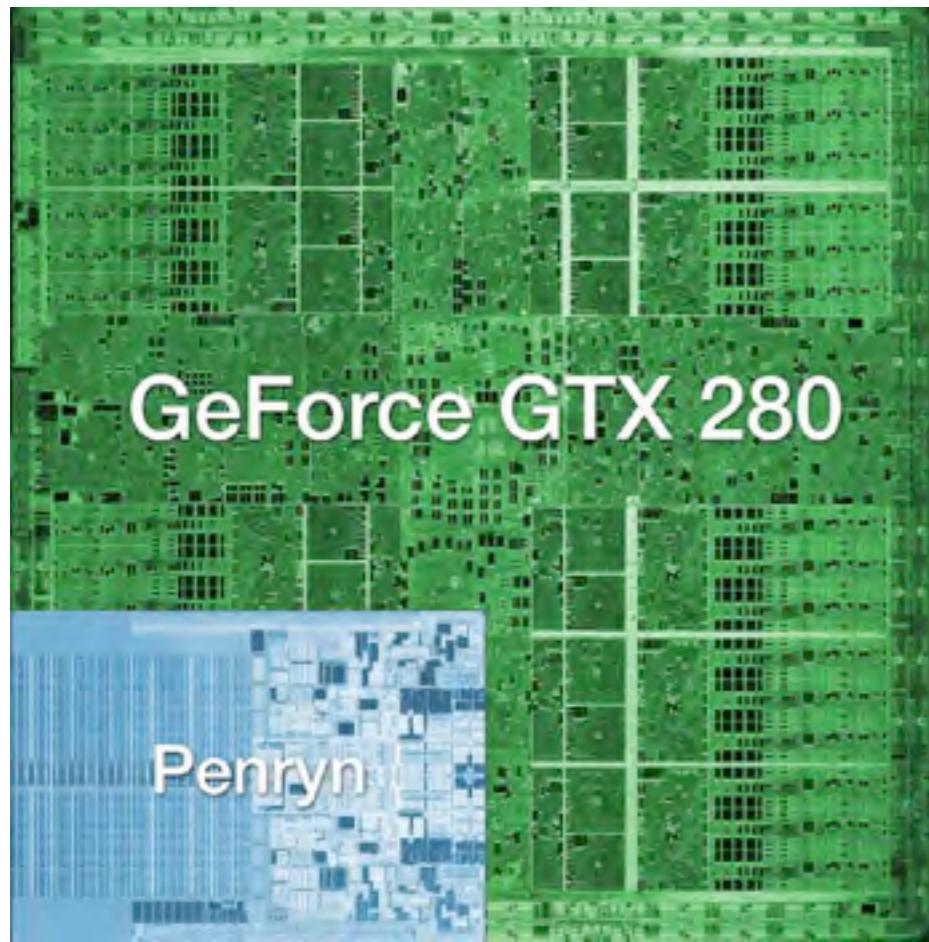


Ok, but still not my DS, XBox, PS3...

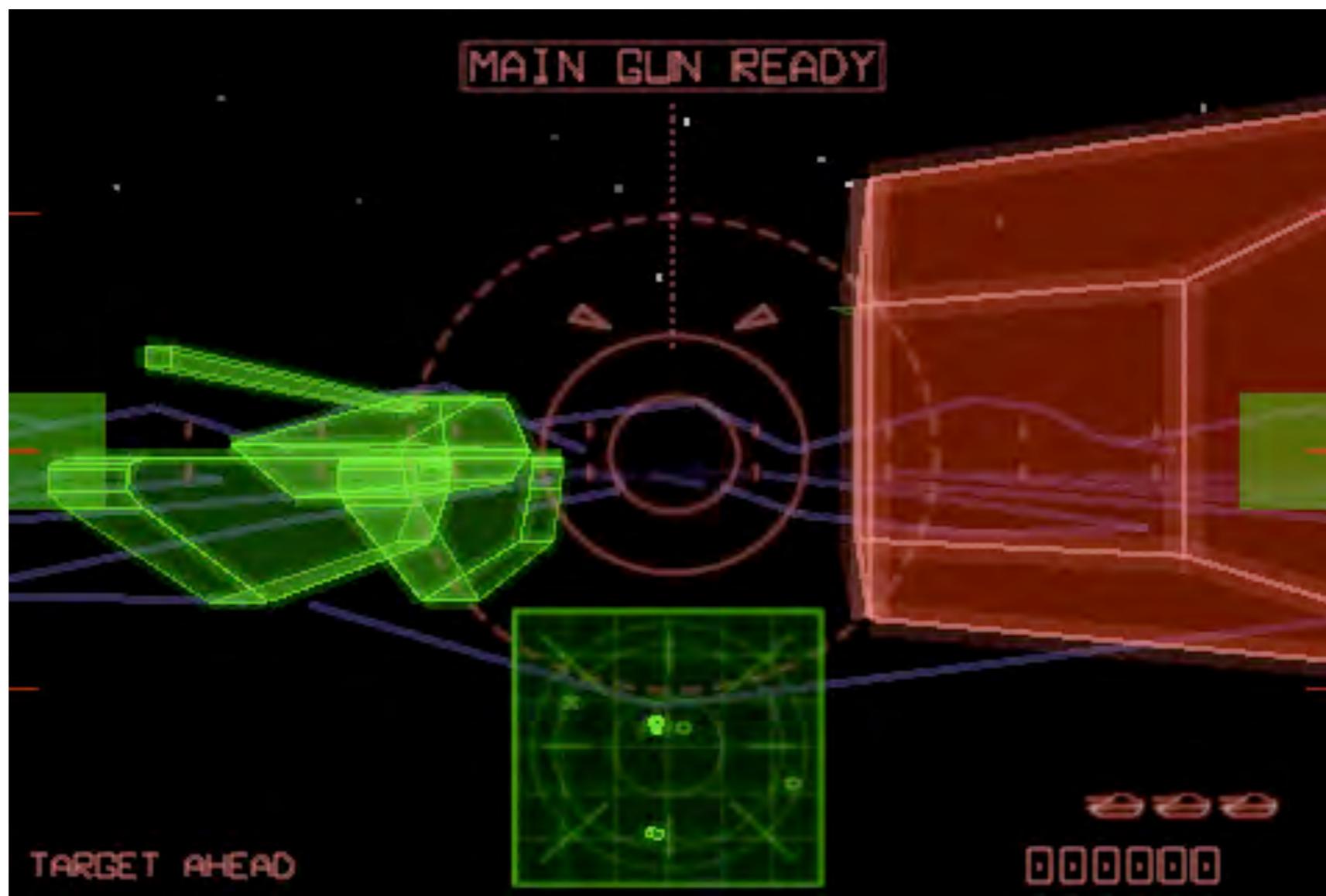








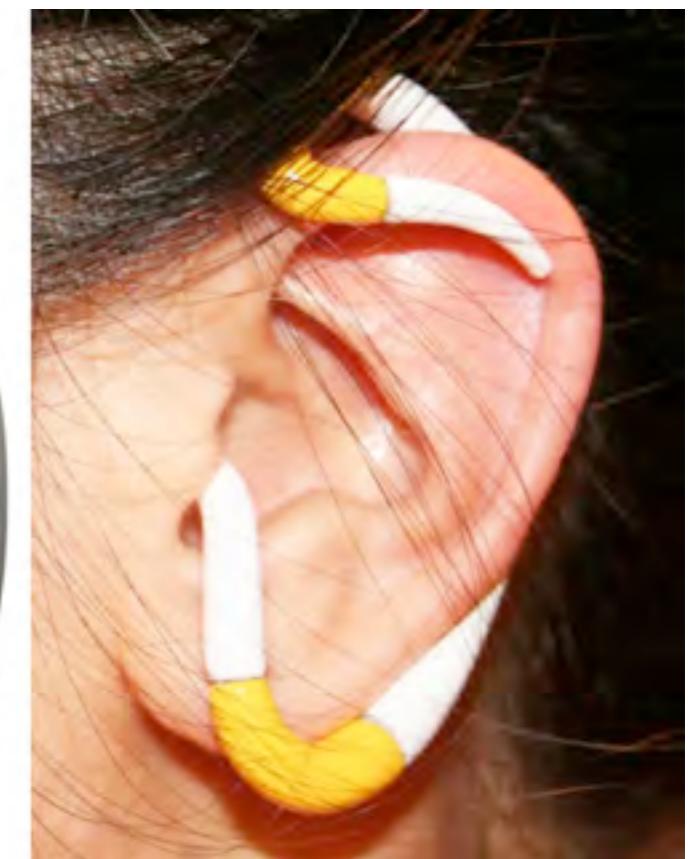
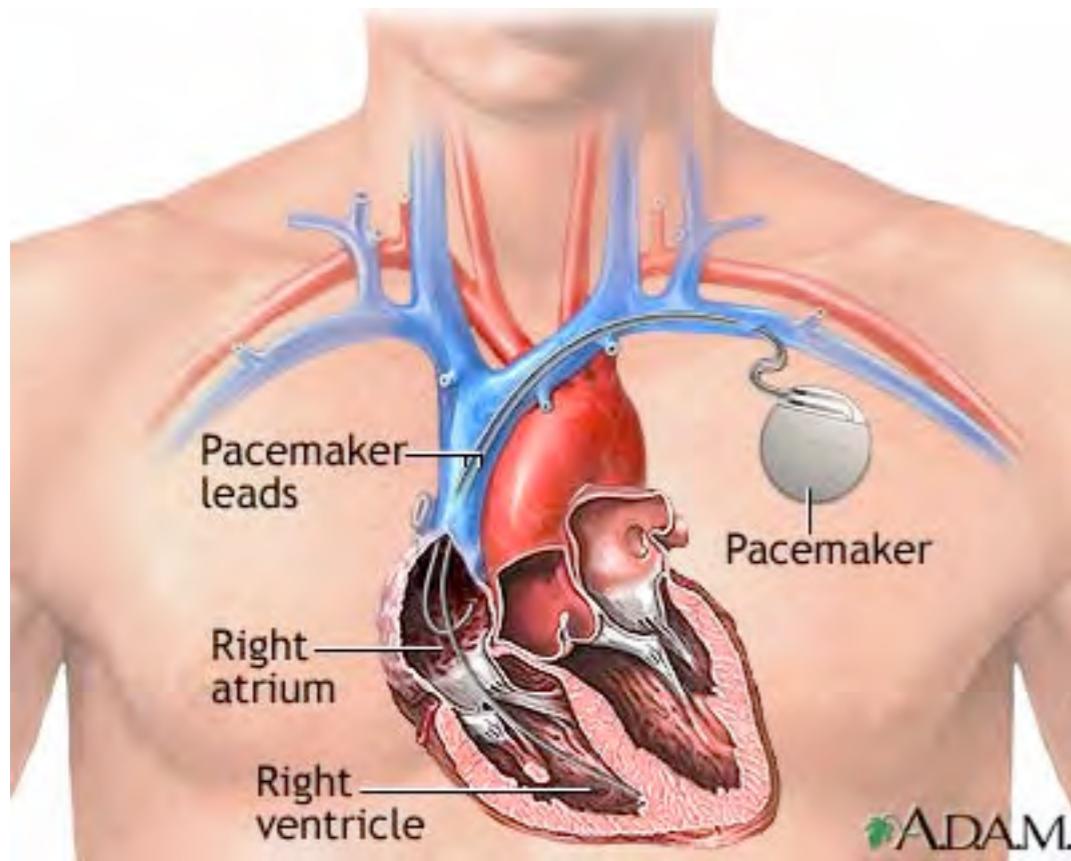
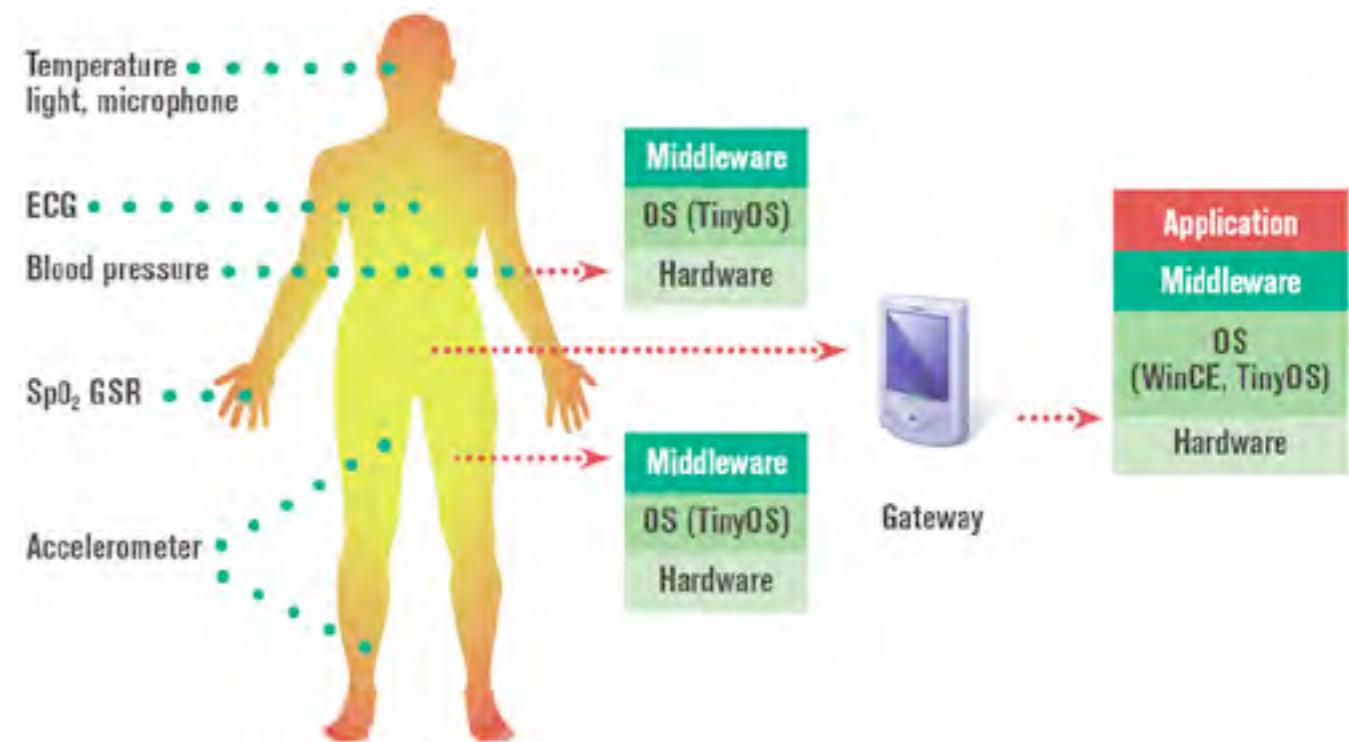
X-Box



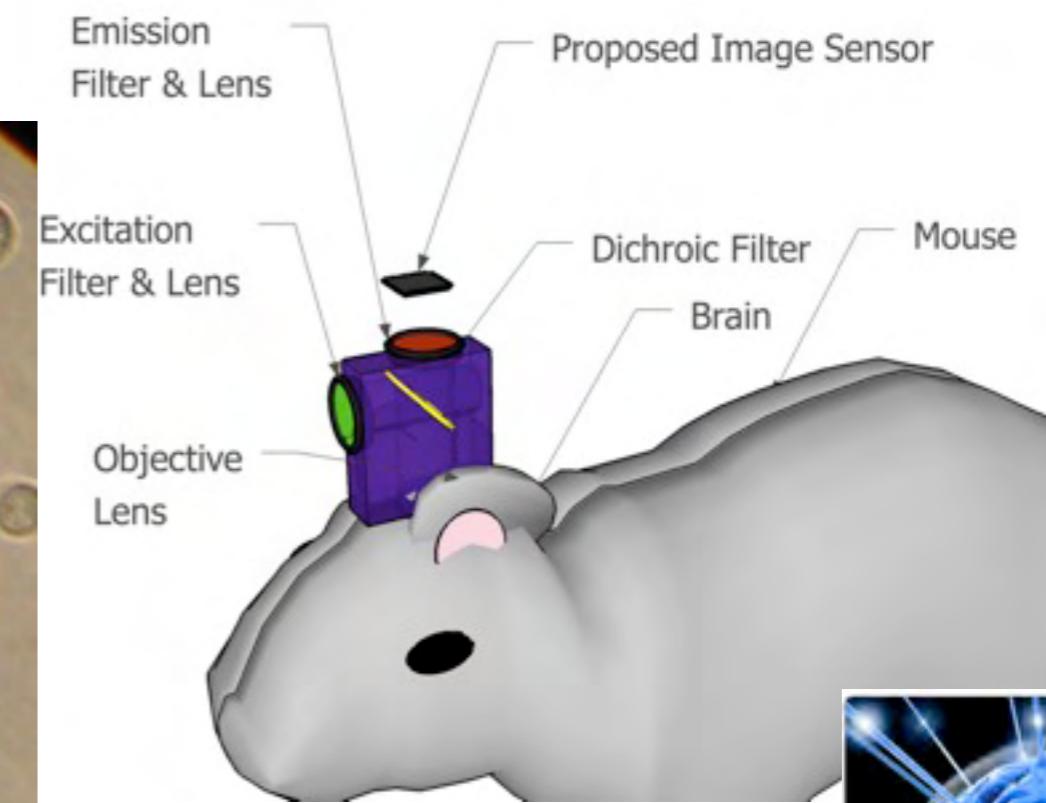
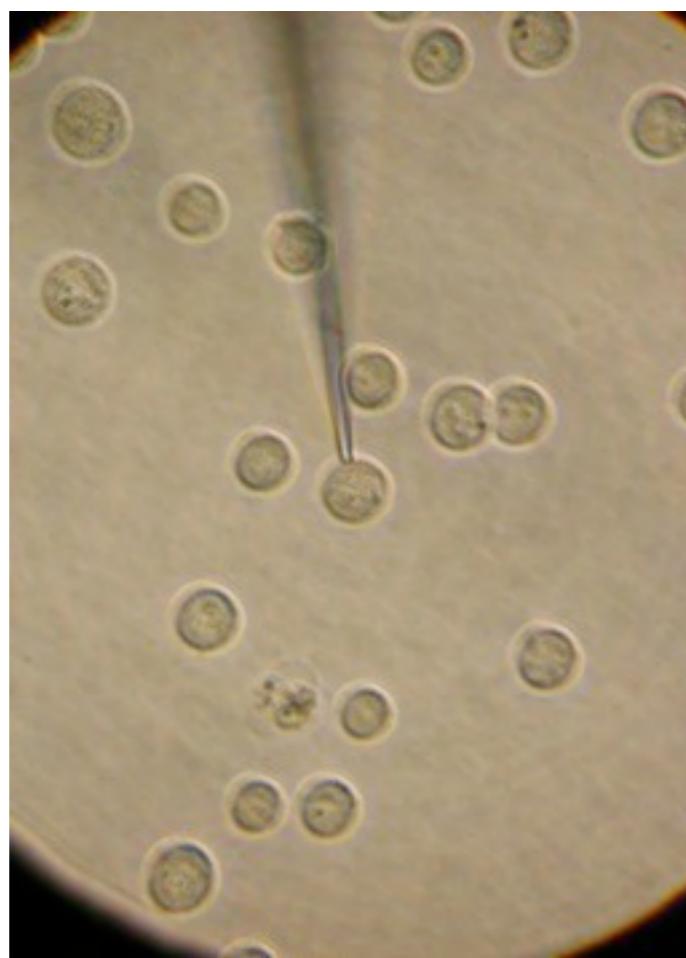
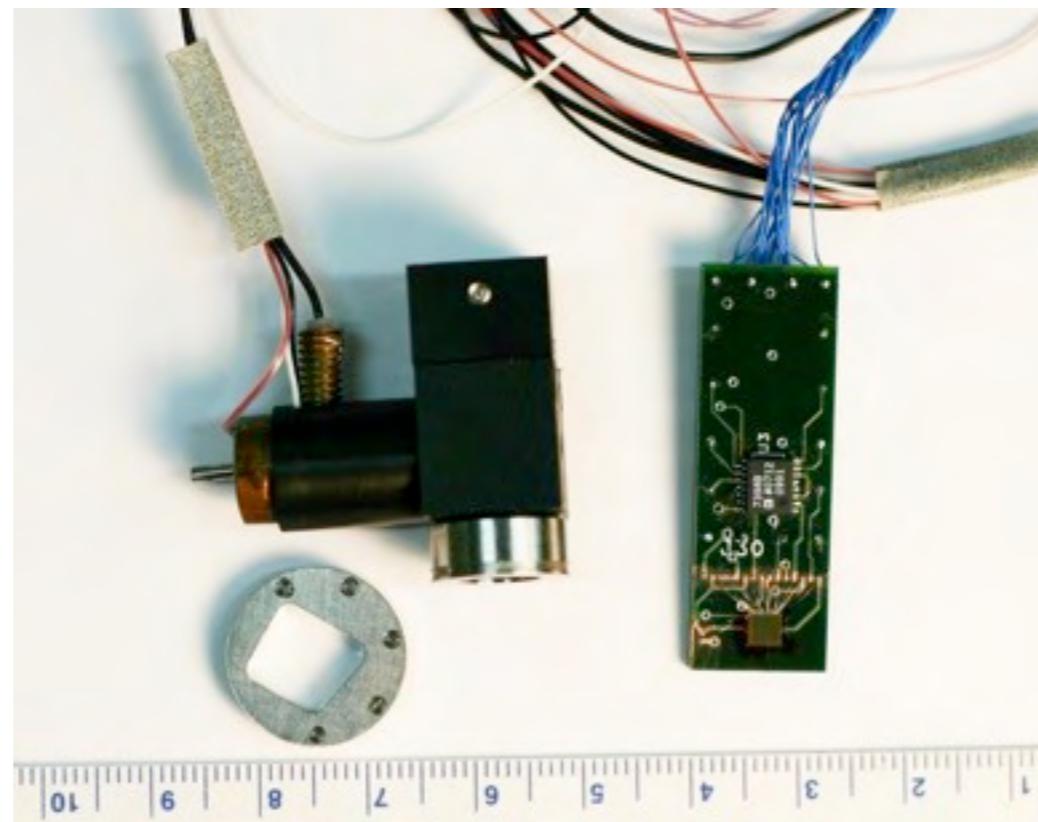
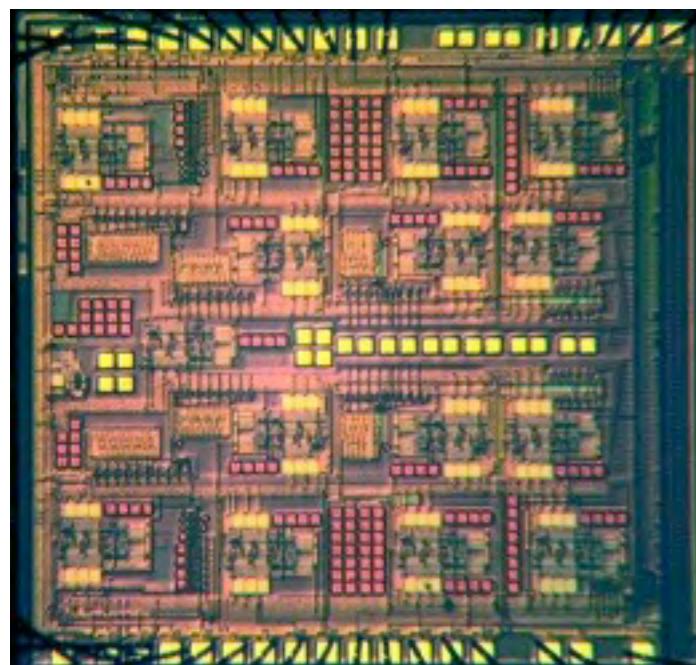


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Chips in medicine



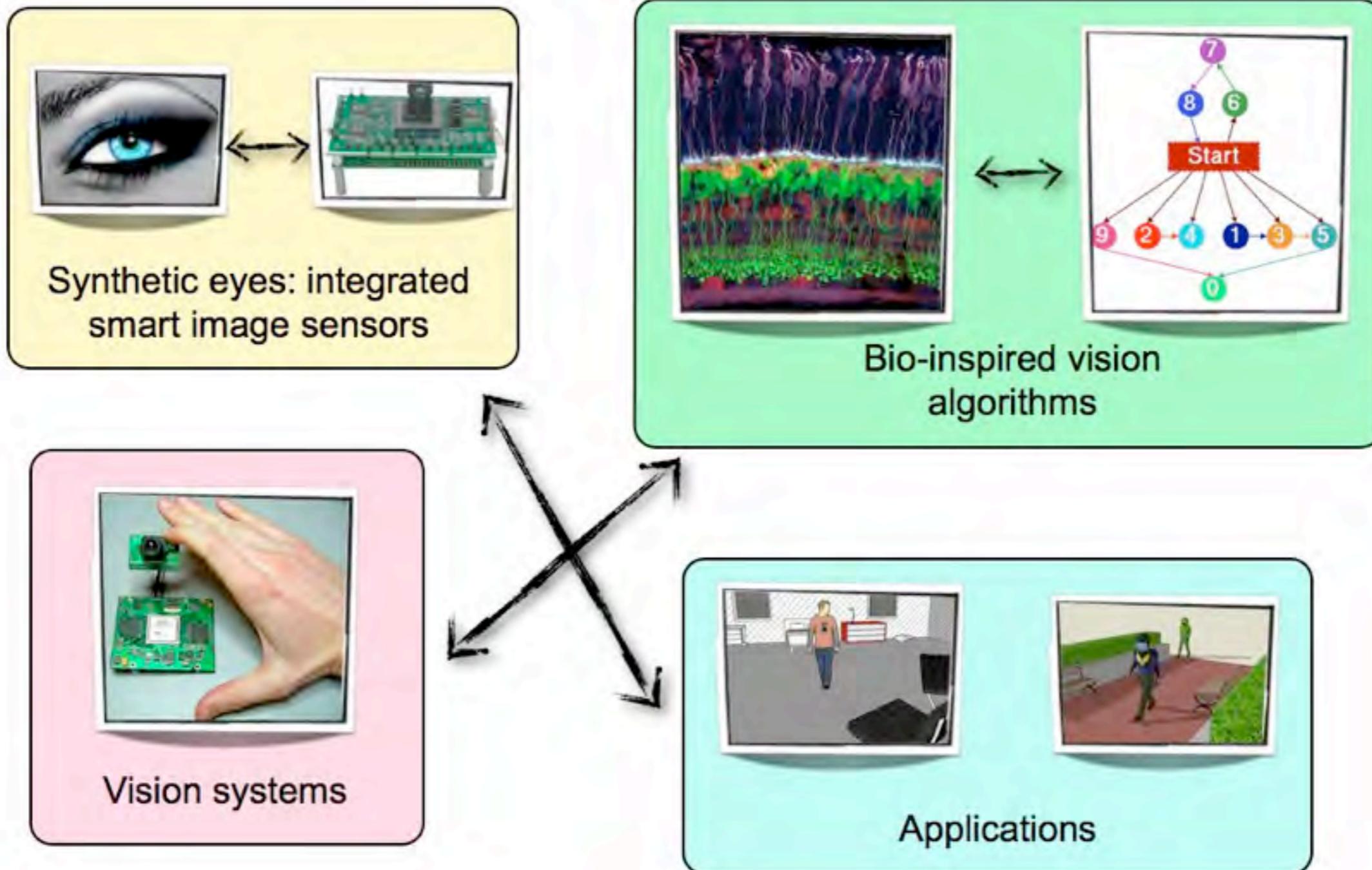
Chips in medicine: our Lab



Chips in robotics

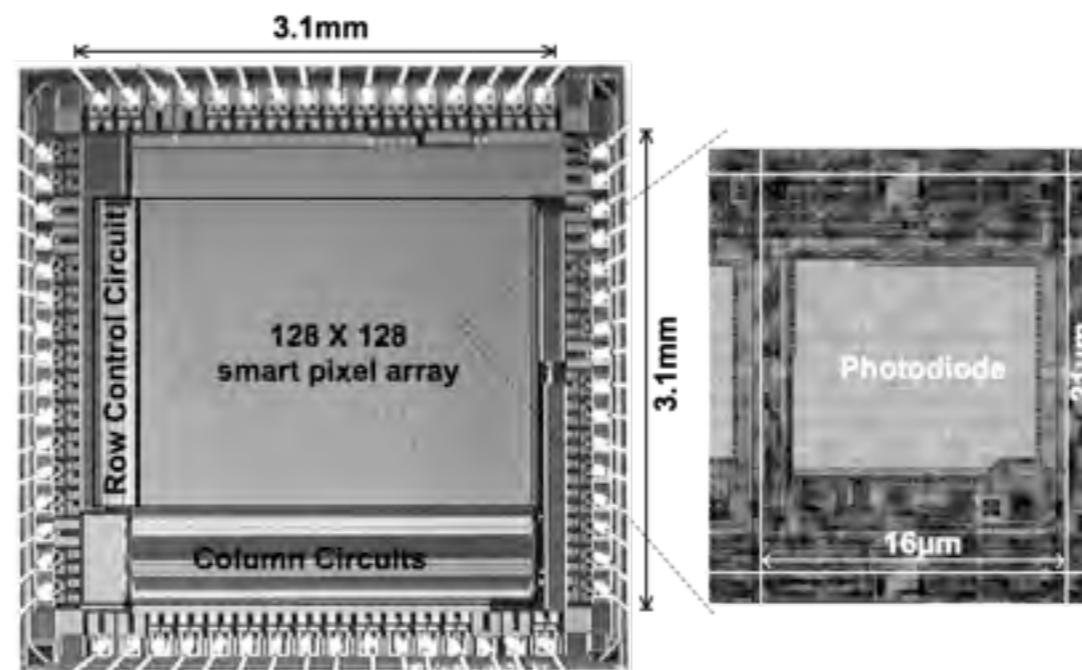
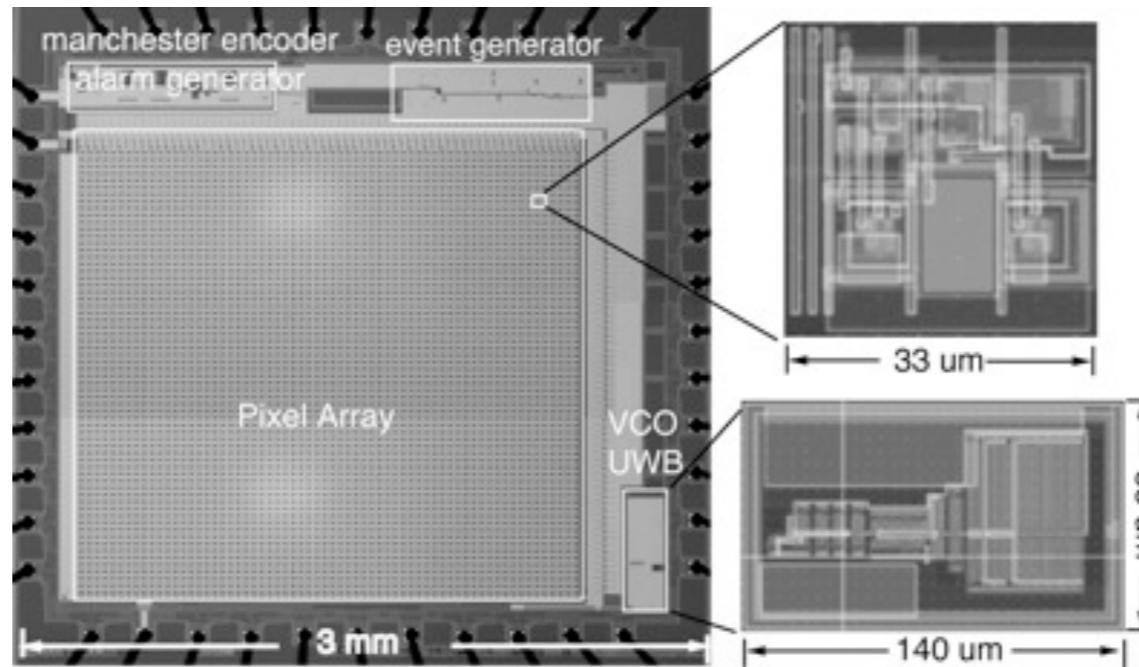


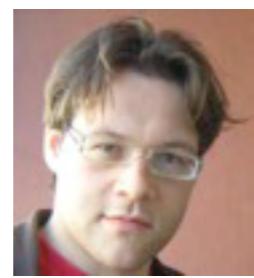
Robotics Eyes: our Lab



e-Lab

Robotics Eyes: our Lab





Thanksgiving

E-Lab current members:

Evan Park
Wei Tang
Brian Goldstein
Dongsoo Kim
Selcuk Talay
Berin Martini
Polina Askelrod
Hazael Montanaro

Past members:

Zhengming Fu
Pujitha Weerakoon
Shoushun Chen
Farah Laiwalla
Huang Chenxi

Visitors:

Jose Carrasco
Angelo Rottigni



National Science Foundation
WHERE DISCOVERIES BEGIN



Peregrine
Semiconductor

