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**GSA / SEMATECH
Memory+ Conference
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Nothing on the Extrapolation In the Chip Industry

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Dr. T. Makimoto (TechnoVision)

Outline

★ Impact of Chip Innovation

★ Nothing is on the Extrapolation

★ Longtime Dreams Coming True

Mobile Phone in 1970's

* 3 sets of mobile phones
during Vietnamese War

* Picture in Ho Chi Minh
City (2006)



Supercomputer vs iPod

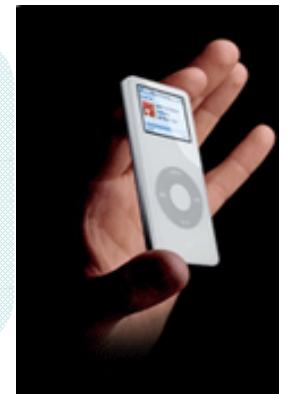


★ Cray-1A Introduced in 1976

- Speed: 160MFLOPS
- Weight: 5.5tons
- Price: \$6M
- 5u Bipolar Technology

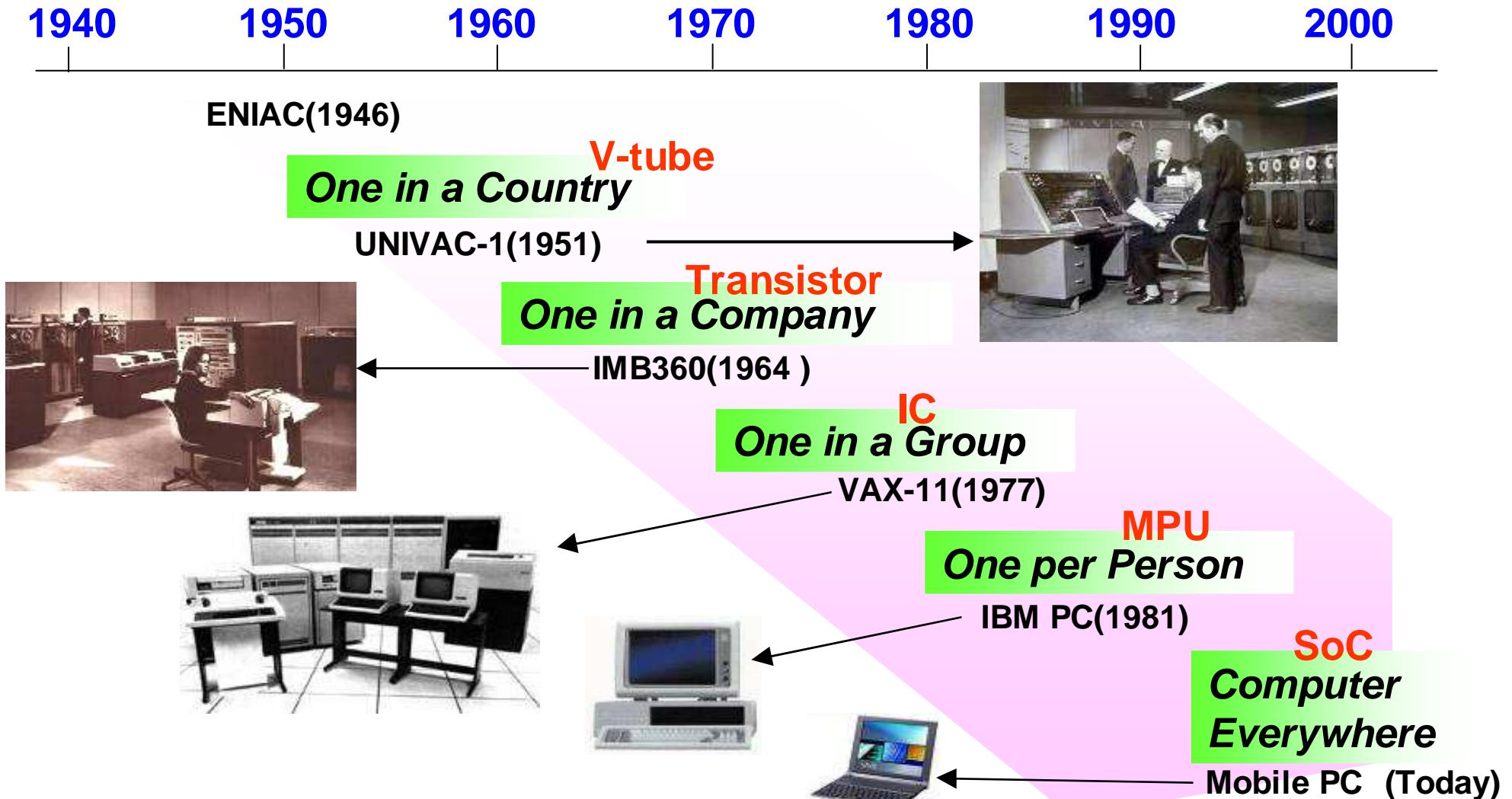
“Cray-1A specs are comparable to those of 2006 iPod shuffle” (Wikipedia)

- 90nm CMOS Technology

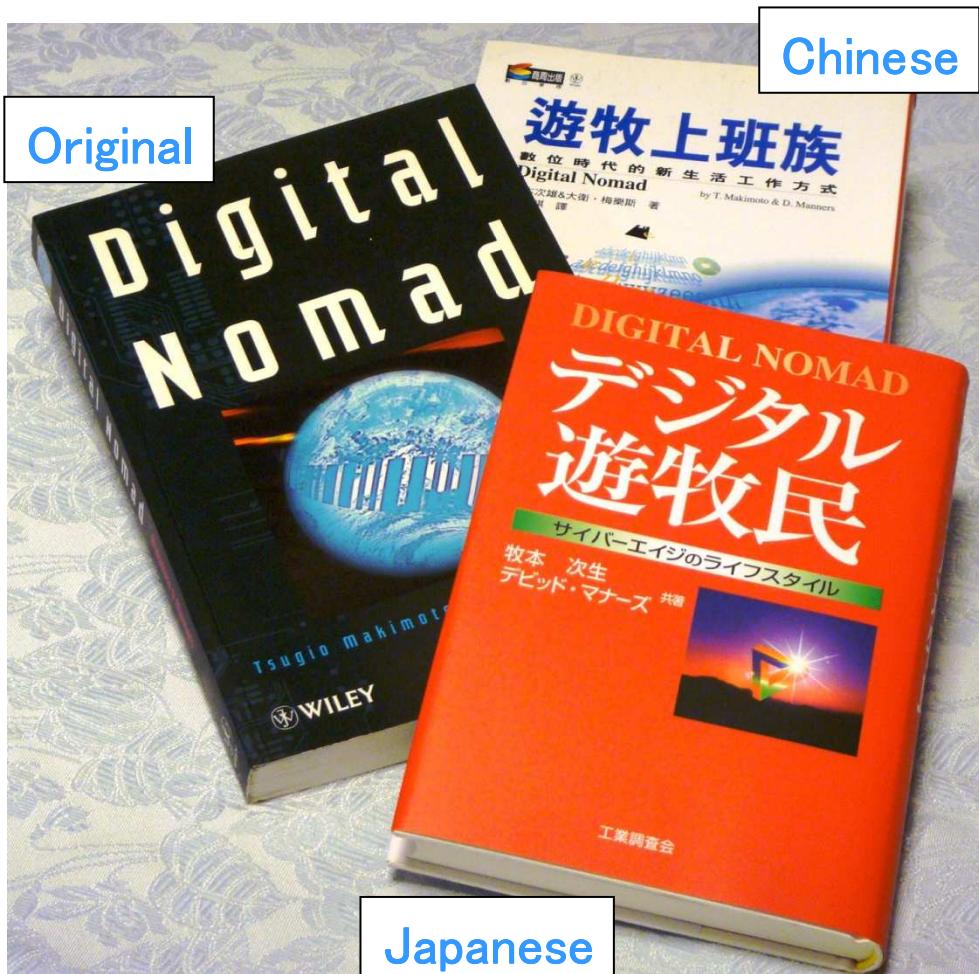




Computer Revolution Driven by Chip Innovation



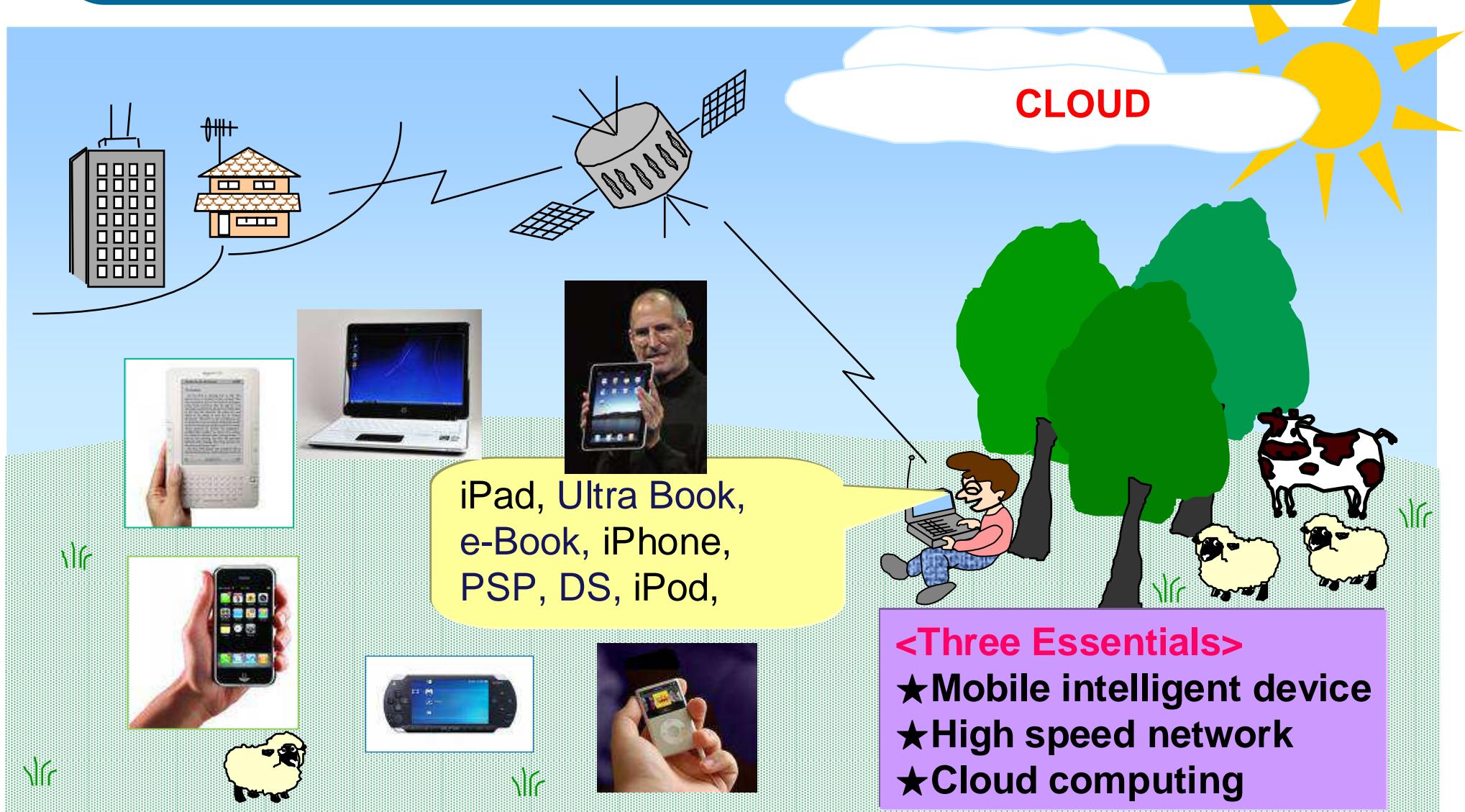
“Digital Nomad” Published in 1997



Co-authors

David Manners (left)
Tsugio Makimoto (right)

Infrastructures Supporting Nomadic Lifestyle



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Customer is the King

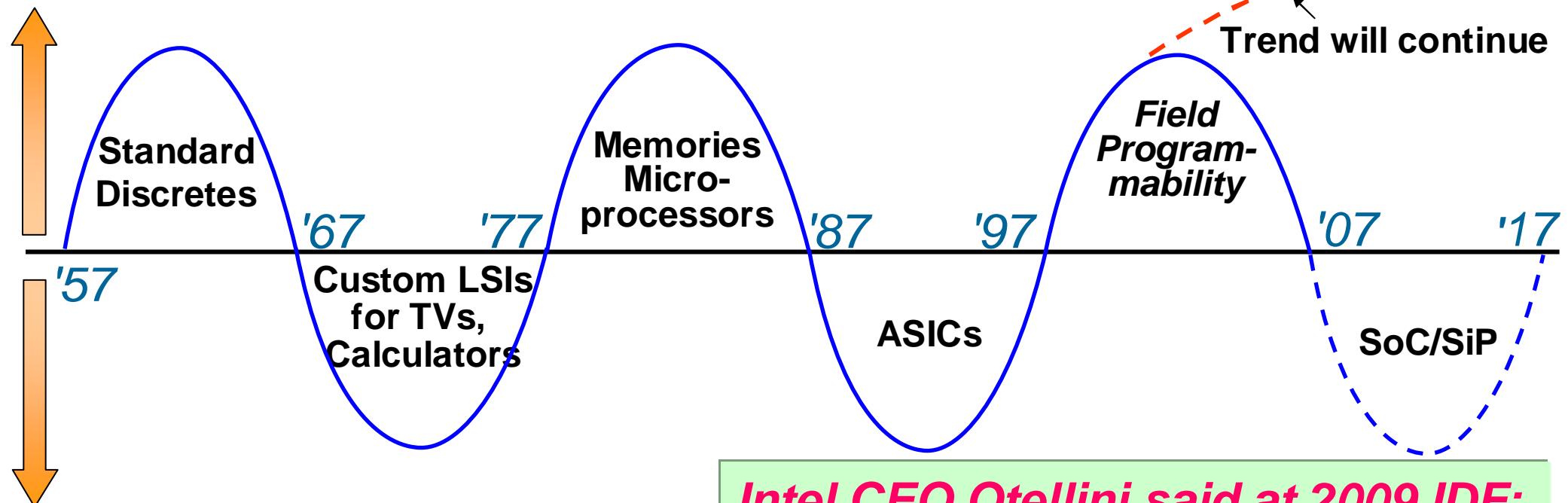
The King Wants	Choice
Differentiation	Custom
Flexibility	Standard
Hi Performance/Lo Power	Custom
Time to Market	Standard
Low Initial Cost	Standard
Low Unit Cost	Custom

Standard	Discrete, MCU, MPU, DSP, Memory, FPGA, etc.
Custom	Pure Custom, ASIC(ASCP & ASSP), SoC & SiP, etc.

Makimoto's Wave

(Named by David Manners in 1991)

Standardization



Customization

Intel CEO Otellini said at 2009 IDF:

“In five years' time, Intel will be selling more SoC products than mainstream microprocessors”

Extension of the Wave Beyond 2017

(Altera's Vision)



Source: Electronics Weekly, Jan. 1991/Dr. T. Makimoto TechnoVision

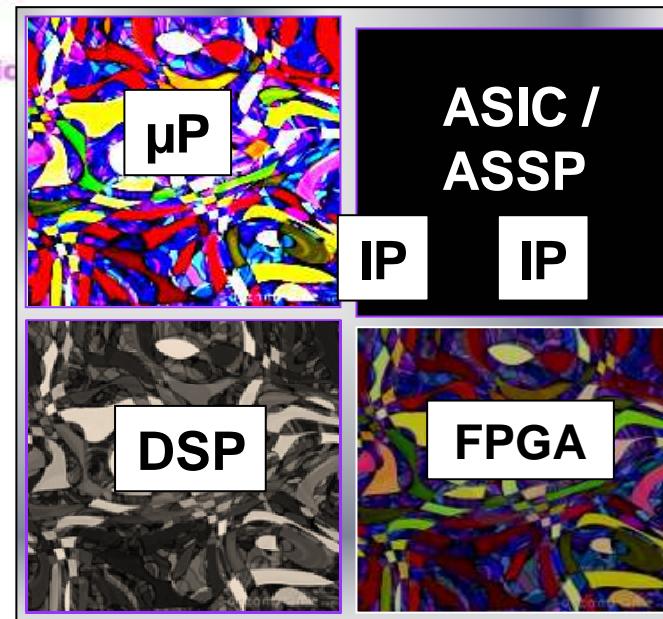
Programmable Silicon Convergence

Microprocessor and DSP: Standard

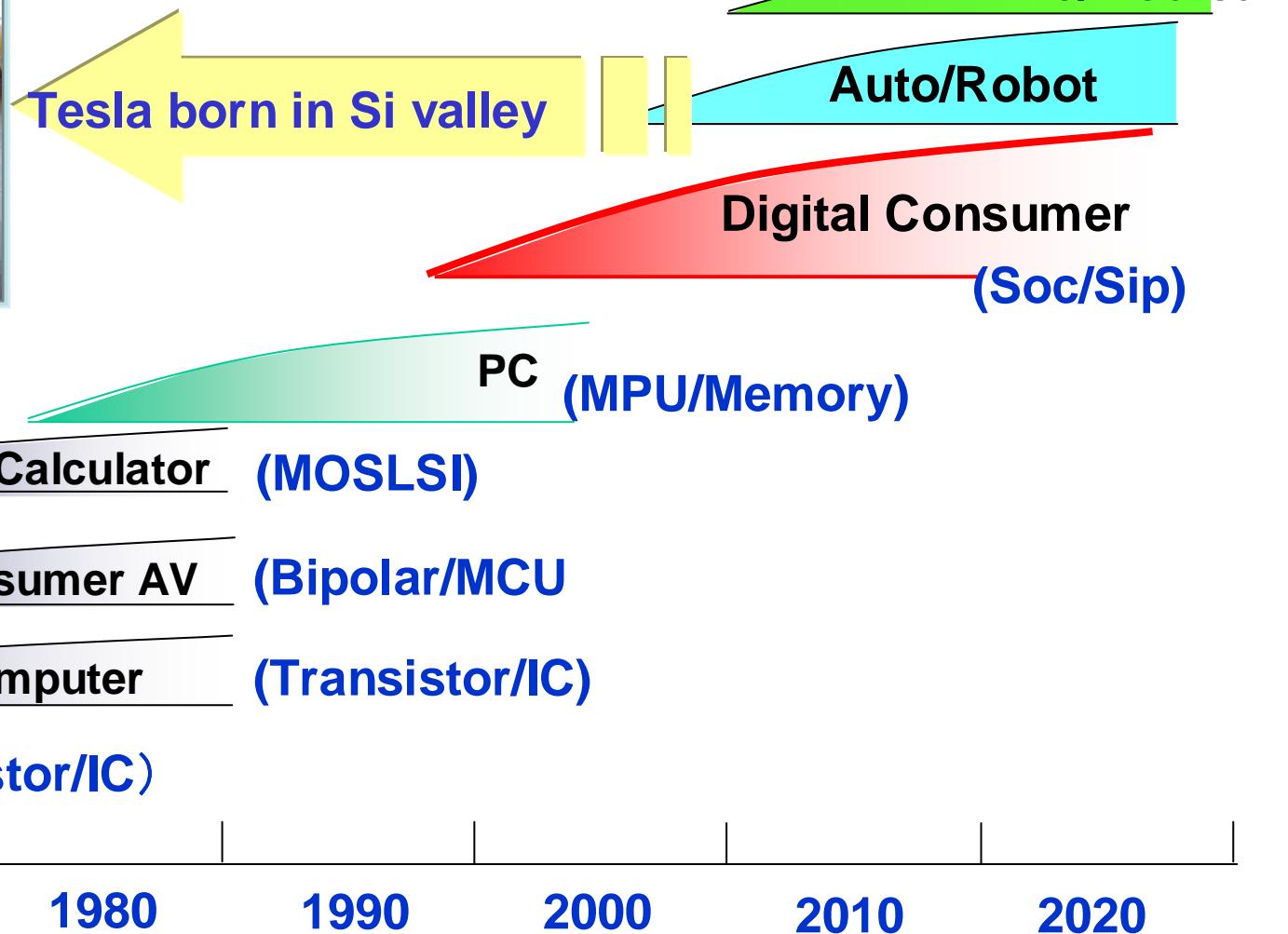
Application specific IP: Custom

FPGA fabric: Programmable

.....contains every component for flexibility and differentiation



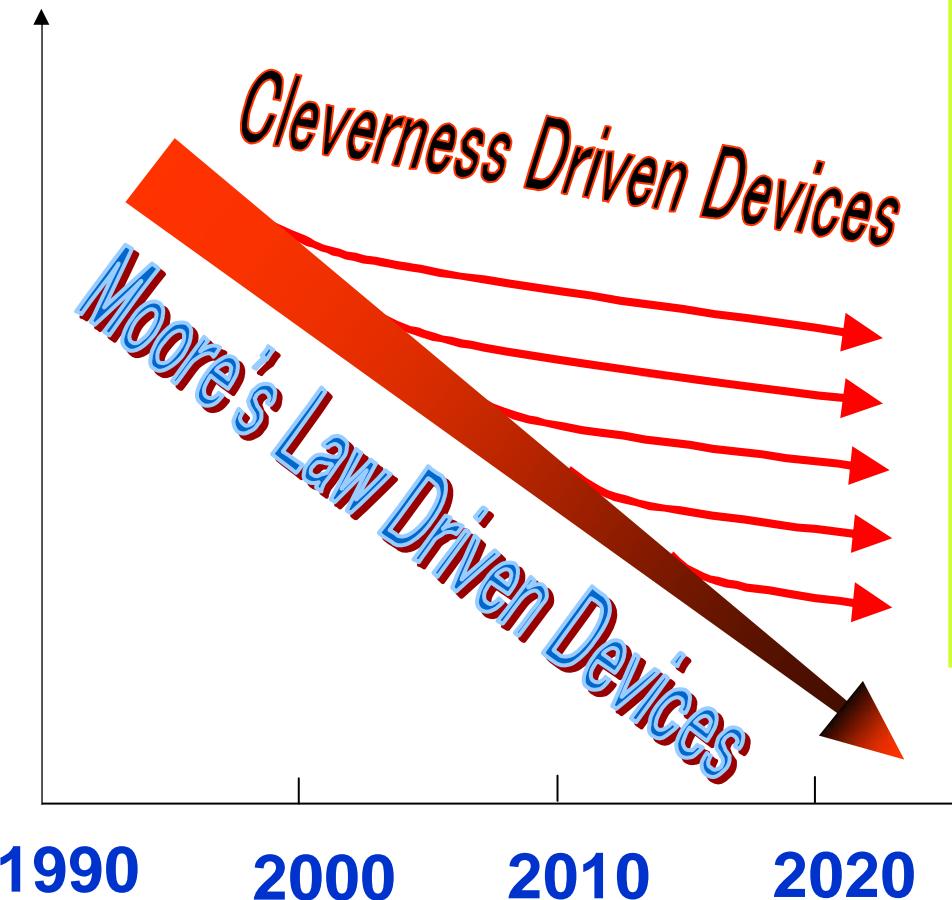
Evolution of Application Market



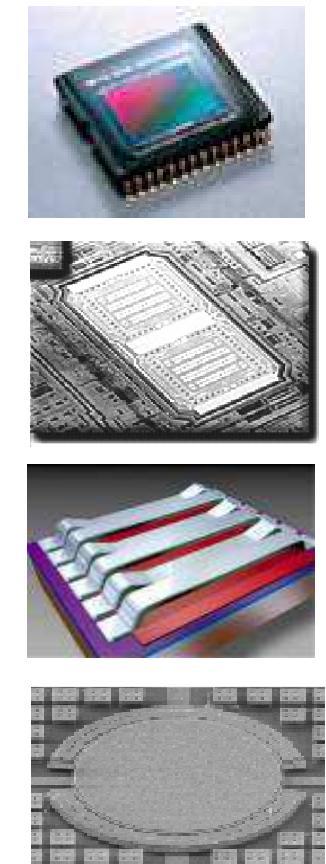
Diversifying Directions of Chip Technologies

Presented at 2002 IEDM

Geometry of Devices

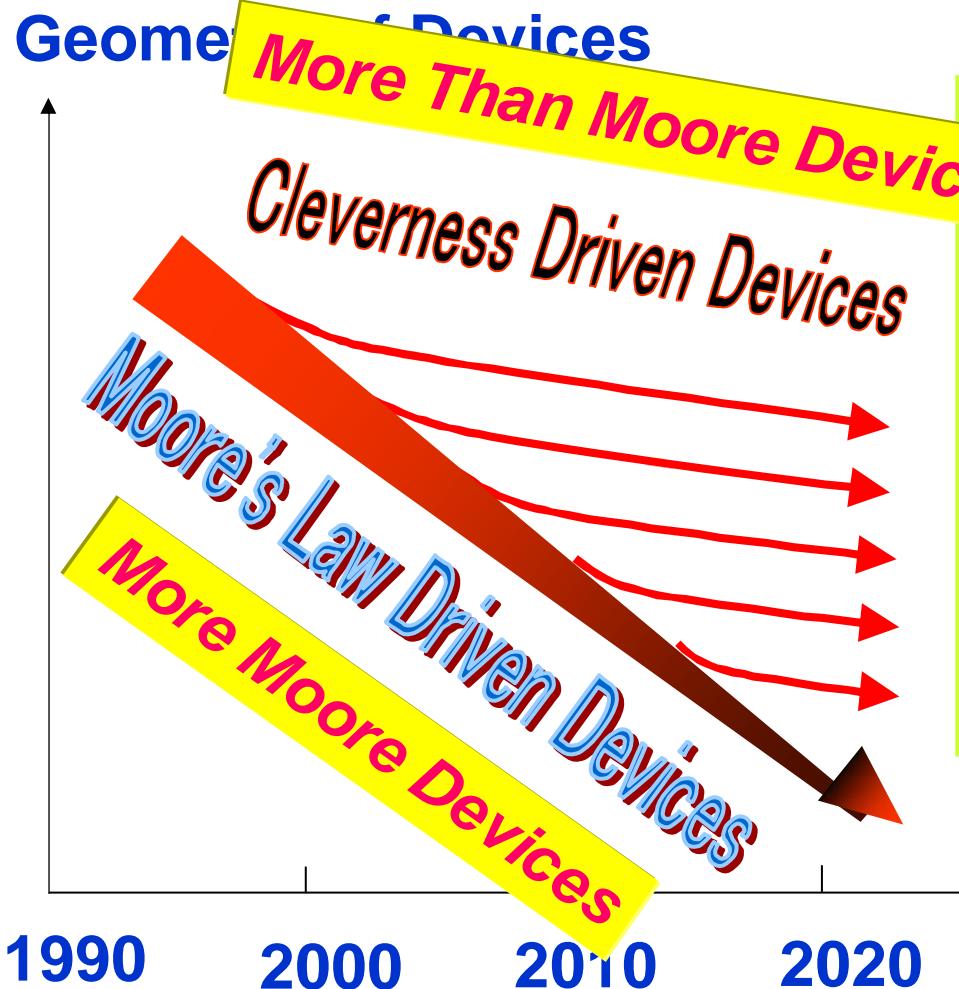


- Optical Sensors
- Inertial Sensors
- Force Sensors
- Display Devices
- Actuators
- RF Devices etc.

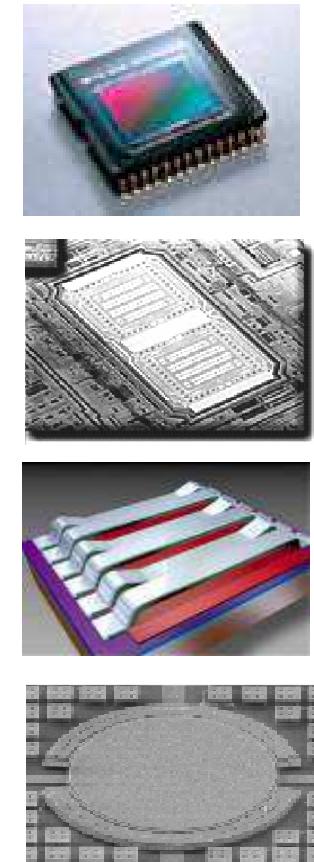


Diversifying Directions of Chip Technologies

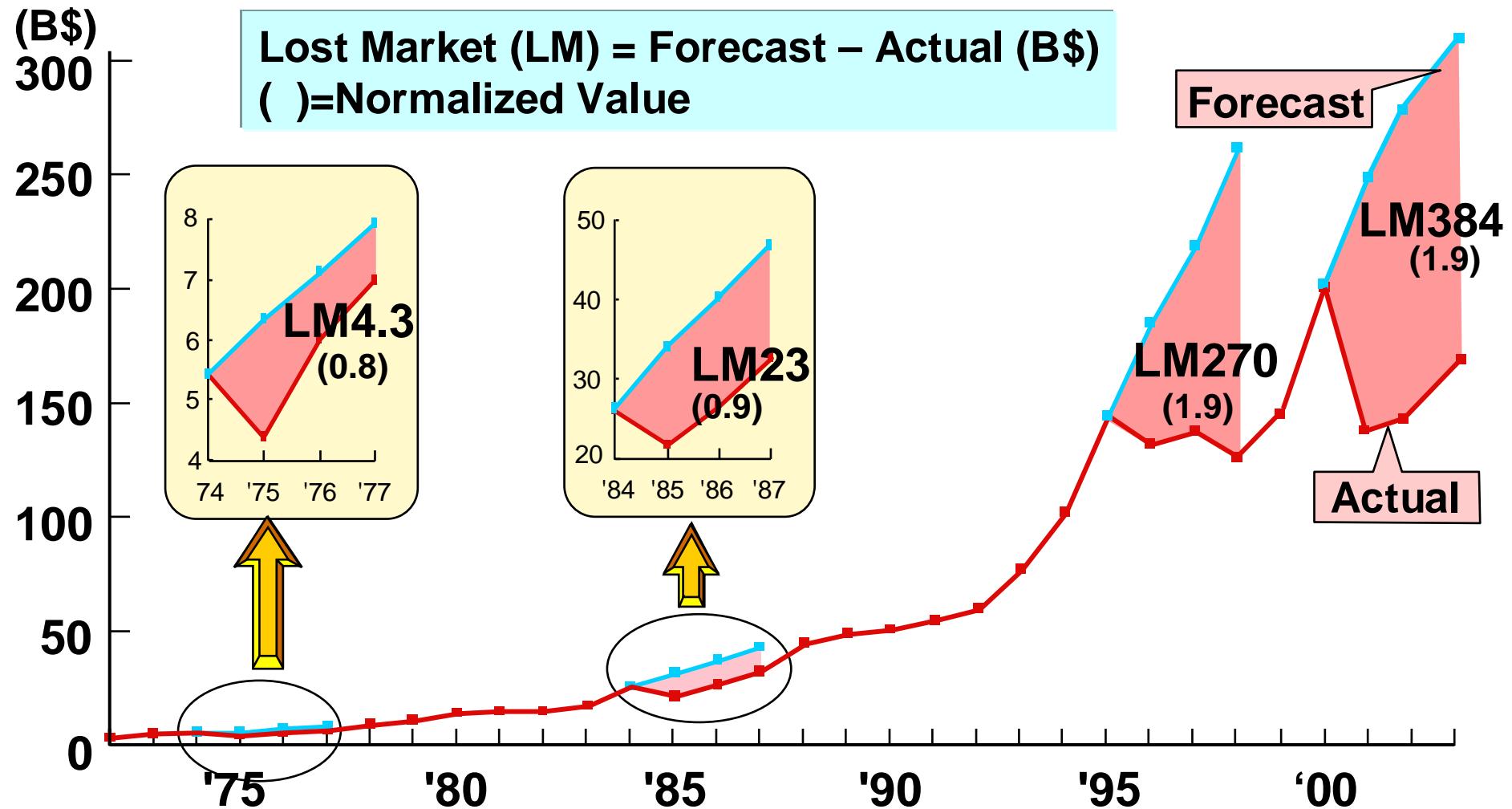
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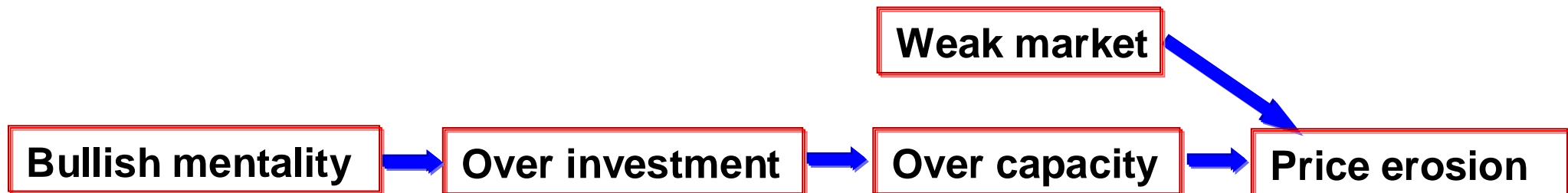


Semiconductor Market is Unpredictable



Remember the '95 Mentality

- Market will reach 200B\$ in '97, exceeding 300B\$ by the year 2000
- No more Silicon Cycle because of solid state pervasiveness
- 400 new fabs required by 2000
- Severe shortage of resources



Outline

★ Impact of Chip Innovation

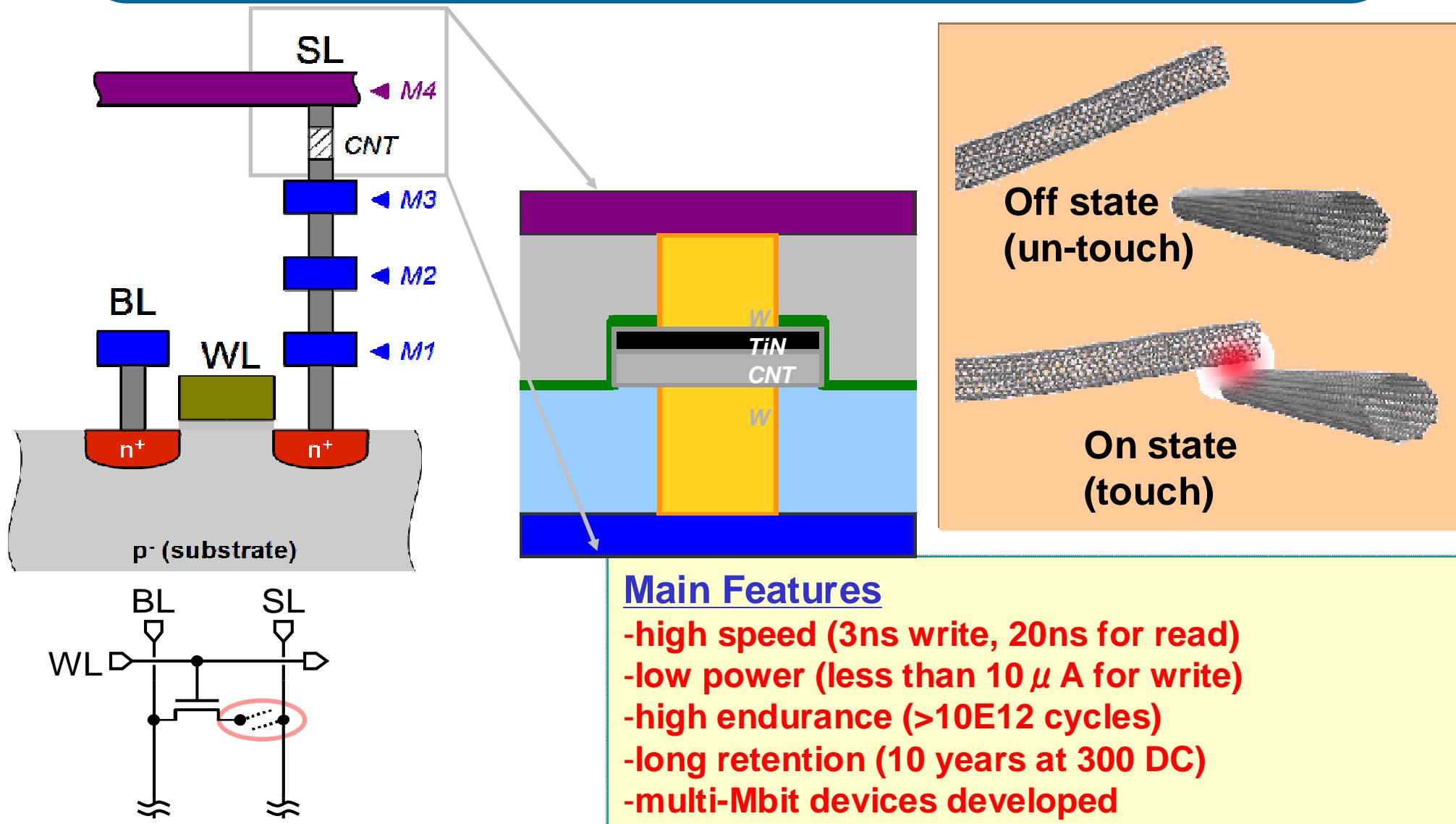
★ Nothing is on the Extrapolation

★ Longtime Dreams Coming True

Emerging Non-Volatile RAM

	FeRAM	MRAM	PCRAM	RRAM
Basic mechanism	Polarization of ferroelectric crystal	Tunneling magneto-resistance effect	Resistance change by material's phase change	Mechanism depends on material used
Current status	Production	Early production	Limited production	R&D
Prospects	Embedded low power application	Embedded/stand-alone hi-speed application	8Gb chip was presented at ISSCC 2012	Promising candidate for SCM (storage class memory)

NRAM: The New Entrant of NV-RAM



Challenging the Language Barrier

New business potential is opening



Presented at 1999 Instat
Conference

LET'S TALK!

SPEECH TECHNOLOGY IS THE NEXT BIG THING IN COMPUTING. WILL IT PUT A PC IN EVERY HOME?

By Markoff, at IBM Watson Research Center in Hawthorne, N.J., and the excitement is palpable. Since the 1960s, attempts have been made—using Henry Higgins-like—systems to talk with humans. Invented powerful programs that people can understand with 90% accuracy. Impressively, one beat most of them to market with a jazzy, mobile speech program, Voice Gold. It transforms sentences into text on a screen and lets users open programs by voice command. But at Watson, no one seems content with this fun. Instead, scientists are scrambling to perfect the next generation of speech technology, which will make systems and topographic maps on a wall-size display merely by gesturing and speaking to the images.

With these prototypes, IBM is taking a giant step toward a long-dreamed ideal of computer scientists and scientists: the world over machines that understand “natural language”—meaning sentences as people actually speak them, unstructured by special vocabularies.

Special Report

lary or cortex. Computers have been listening to humans and transcribing what they say for years. Since the 1960s, a host of startups, including Kurzweil Applied Intelligence and Dragon Systems Inc., have sold spe-

Special Report Business Week / Feb 23, 1998

Language Barrier Getting Lower

★ Language understanding has been the longtime dream and challenge for semiconductor technology

★ Why so difficult?

- Many languages in the world
- Many dialects for one language
- One word, different meanings
- Everyone talks differently
- Noise in the real environment

★ Siri as intelligent assistant

- Siri makes phone call, sends messages, sets reminders, and answers your question
- Siri supports English, French, and German



iPhone 4S

Summary

Nothing is on the extrapolation of the past

- ★ Custom or Standard
- ★ Unpredictable semiconductor market
- ★ Diversifying technology directions
- ★ Emergence of new market

Longtime dreams coming true

- ★ NV RAM and language technology

“Catch the turning point and ride the new wave! Bravely!!”

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Thank you for your attention!

Tsugio Makimoto, Ph. D