# Role of Memory in More than Moore

**Ajith Amerasekera**

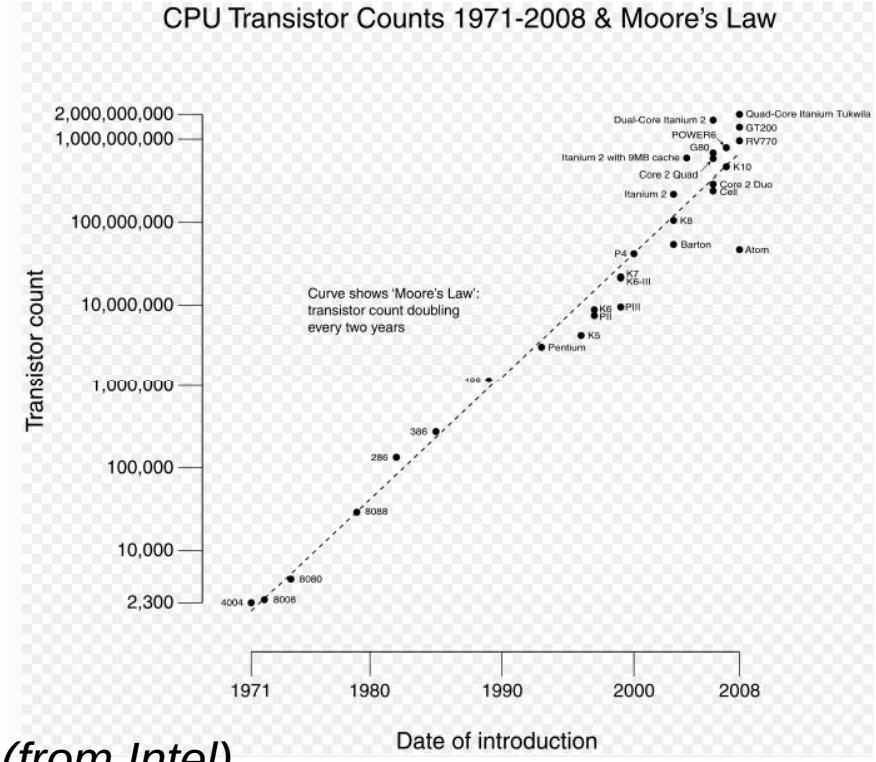
**Texas Instruments Inc.**
**Dallas, USA**
**22 October 2009**

***Looking forward to 2020***

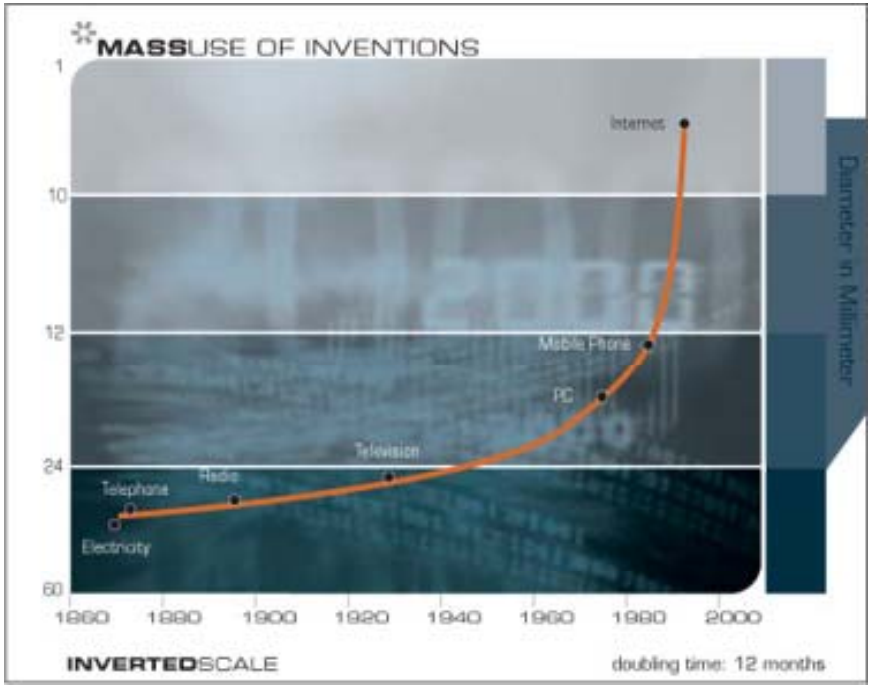
***SRC/NSF/A*Star Forum on 2020 Memory Strategies***

Texas Instruments

# What is More than Moore?



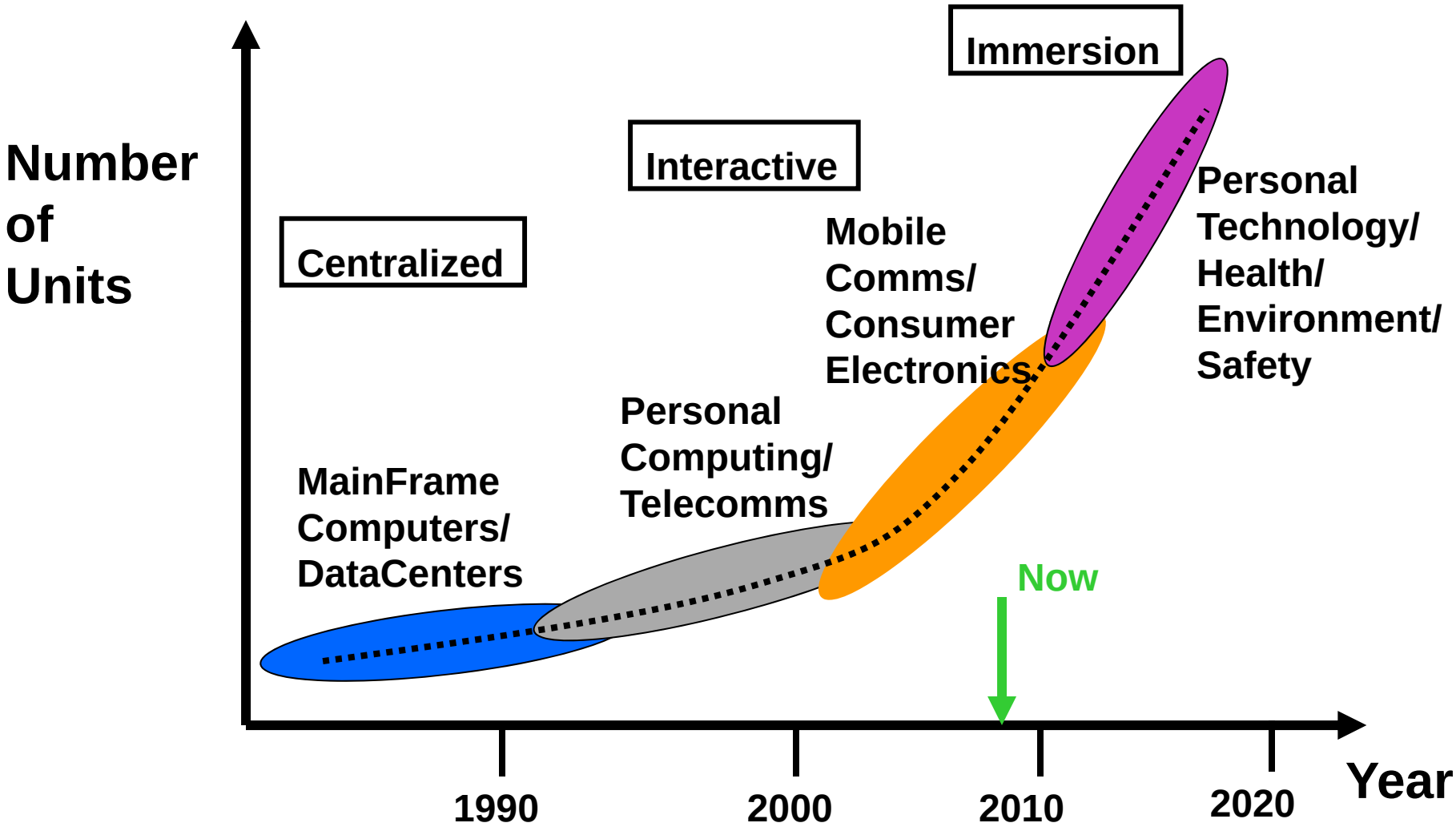

*(from Intel)*




*(From Kurzweil)*

- The driver is actually the need for exponential growth in **System performance**.
- We will take the path of least resistance to get there.
- Broadening of the application space is extending electronic technology into vast areas of uncharted territory for process technology
  - No longer driven by "simple" scaling paradigms.

# Looking to 2020



# The Emerging Technology Scene

*From Rabaey, 2009*

Infrastructional core

Sensory swarm

Mobile access

# The Technology Gradient: Computation

*From Rabaey*

Driven by Moore's Law

Driven by "More Than Moore" and "Beyond Moore"

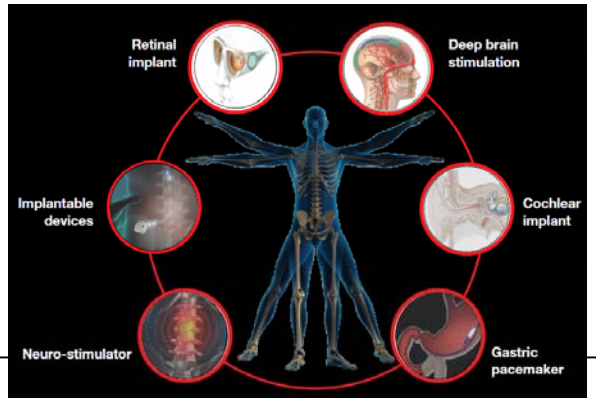
# Examples of Application Drivers For The Future

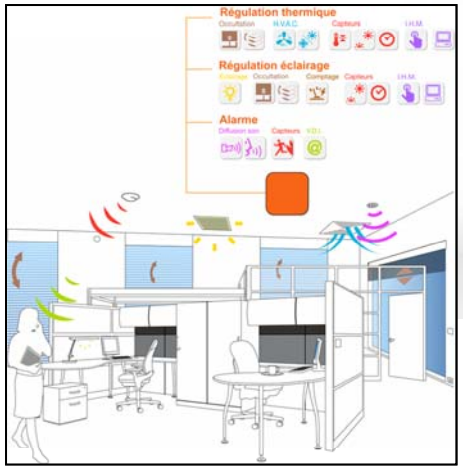
- **Smart Buildings**
- **Personal and Health Technology**
- **Energy Efficient Transportation**
- **Energy generation and management**
- **Lighting**
- **Communications**
- **Safety and Security**

Smart Surface

Future Car

Intelligent Medicine




Intelligent Ambient

# So what about memory in 2020 and beyond?

- Demand for memory is only going to increase.
- “Smart everything” and the intelligent ambient is driving the demand for embedded non-volatile memory.
  - The amount of data being gathered is increasing super-linearly.
  - Need to store multi-Gbytes of data in small formfactors and low power.
  - Speed is not critical now, but will be by the 2020s.
  - Not just silicon; flexible electronics, large area electronics, organic electronics.
- SRAMs need to be both low leakage and low-voltage.
- Advent of autonomous systems using novel battery technology and energy harvesting will require circuits that can operate with unreliable power sources.
- What would we do with true 3-D memory systems?
- What about hard disk drive technology?  How much scaling can we get?
- Never say never……!