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# A Nice Time to be NICE

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

# We Live in Exciting Times

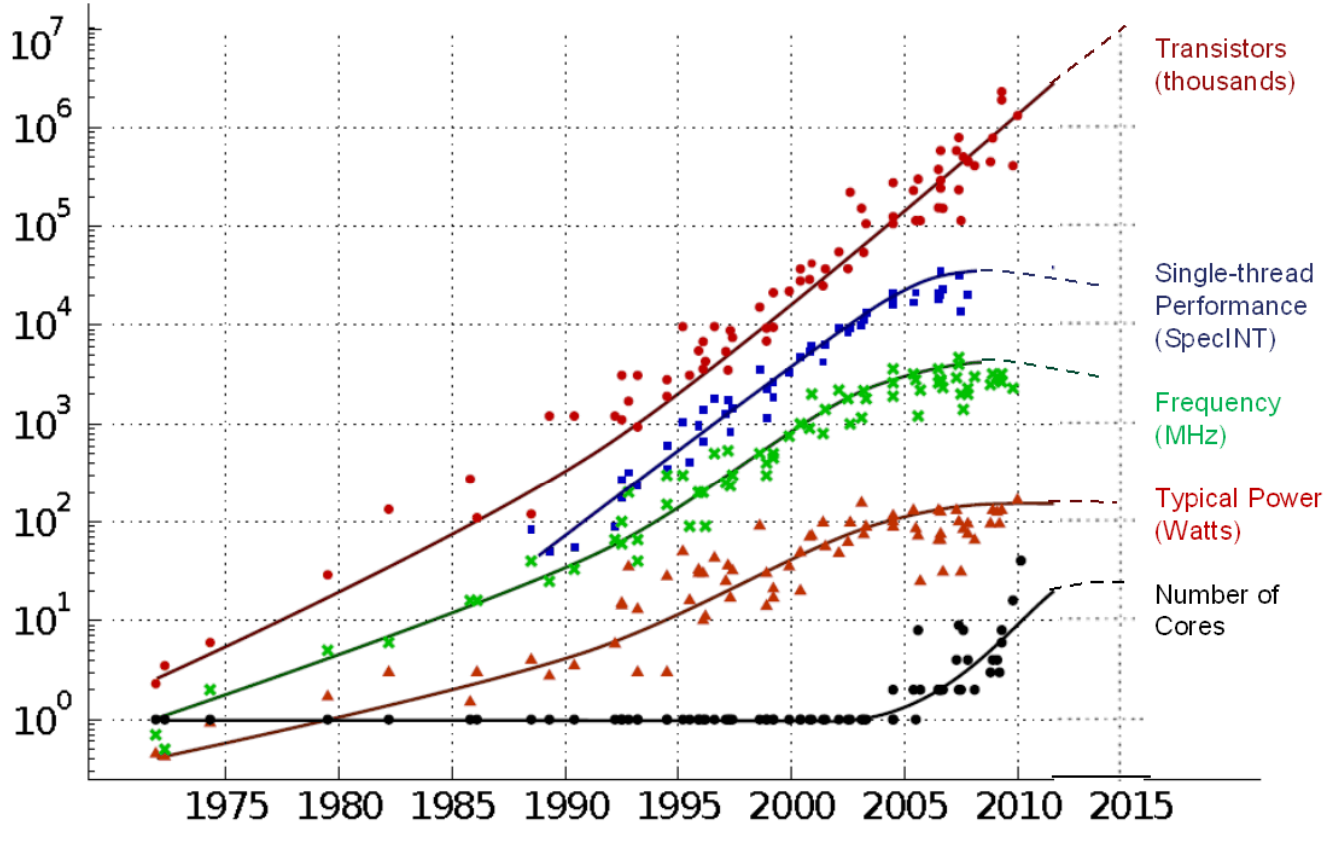
- **Computing is changing the world**
  - How we learn and how we decide
  - How we design and how we build
  - How we consume and how we live

- **BRAIN Initiative and (hopefully) National Strategic Computing Initiative**
  - Exciting opportunities to advance the scientific frontiers and reimagine the future of computing

- **But great opportunities come with great challenges**
  - Tomorrow's computing will need to be very different from yesterday's

# Computing is at a Crossroads

35 YEARS OF MICROPROCESSOR TREND DATA




Original data collected and plotted by M. Horowitz, F. Labonte, O. Shacham, K. Olukotun, L. Hammond and C. Batten
Dotted line extrapolations by C. Moore

**Moore's Law continues**
Transistor count still doubles every 24 months

**Dennard scaling stalls – key parameters flatline:**
Voltage
Clock Speed
Power
Performance/clock



Algorithms Architecture Applications

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# National Strategic Computing Initiative

- **Multi-agency undertaking in advanced computing**
  - Signaled within President's FY'16 budget, but not yet formally announced
  - Broad scope including scientific and data computing

- **Also includes high-risk, forward-looking elements**
  - Beyond-CMOS technologies
  - Novel computing paradigms
    - Quantum computing
    - Neuro-inspired computing
  - Possible funding organizations include
    - NSF, IARPA, DARPA, DOE

# Leland's Catechism for Technology Transitions

- **(Concepts from Rob Leland's talk at 1st Rebooting Computing Summit)**

1. ***Is there a major conceptual advance?***
   - This community is trying to create one

2. ***Is there a technology/business opportunity?***
   - The rise of big data and its need for sensors and sense-making

3. ***Is there a sense of urgency*?**
   - Concern about erosion of Moore's law
   - Greater international competition

# Challenges and Opportunities

- **Challenges**
  - Von Neumann computing model is deeply entrenched
  - CMOS economic ecosystem is very robust

- **Reasons for optimism**
  - Tailing off of Moore's law
  - Security shortcomings of existing computing paradigms
  - Important niche applications where SWaP matters a lot

- **Potential targets of opportunity**
  - Autonomous vehicles (e.g. drones, satellites)
  - Medical applications
  - Neural augmentation

# Sandia Labs is Eager to Participate

- **Sandia is a large, multi-program lab with a national security focus**
  - National labs should be taking on audacious challenges
- **We believe that work in neuro-inspired computing is important and timely**
- **We have an unusual collection of relevant capabilities**
  - The only Fab in any DOE lab
  - A strong group of cognitive and neuro scientists
  - Major internal investments in neuro-inspired computing
- **We're eager to work with you to move this field forward!**

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