

DSB Report – March 2006

HPC Section

Steven J Wallach

wallach “at” cpventures.com

DISCLAIMER

The DSB is an independent *Advisory* committee and *does not* represent the official or unofficial position of the US Department of Defense.

Publication - URL

- [http://www.acq.osd.mil/dsb/reports/2006-03-Defense Critical Technologies.pdf](http://www.acq.osd.mil/dsb/reports/2006-03-Defense%20Critical%20Technologies.pdf)
- This was a Joint US/UK report on defense critical technologies. 5 critical technologies were studied:
 - Advanced Command Environments
 - Power Management for Small distributed Sensors
 - High Performance Computing
 - Electronic Components
 - Persistent Surveillance

HPC -Team Members

- Steve Wallach (Chair)
- Professor Bill Dally
- Dr. John Gilbert
- Dr. Peter Kogge
- Dr. Bob Lucas
- Mr. John Grosh – DoD Liaison

The Study & Report

- Previous HPC reports
- Agency Visits
- Findings and Recommendations (3)

Previous US HPC Studies

- ISAT Study (2001) – Technology Gaps
- IHEC Study (2002) – HPC and National Security
- NRC Study (2004) – Getting Up to Speed
- HECRTF study (2004)- High-End Revitalization Task Force

Previous Study Conclusions - General

- More direct government investment
- Vital to National Security & Stockpile Management
- Trickle down of technology to industry
- Missing opportunities for advancement of hardware and software technologies

HPC Agency Visits*

- Mr. Robert Graybill – DARPA
- National Security Agency
- National Reconnaissance Office

*Page 123 of Report

Report Findings

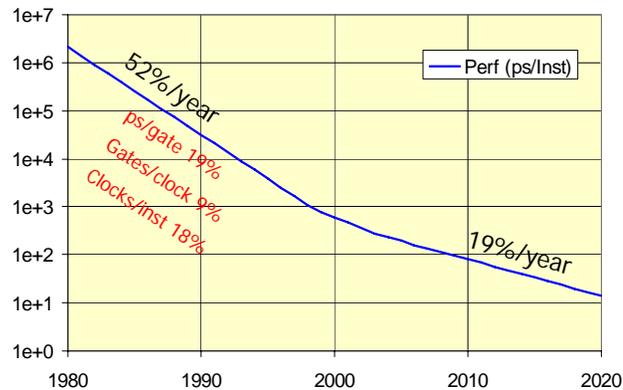
- Defense Critical Applications that cannot be solved with sufficient speed or with sufficient precision
 - Cryptanalysis
 - Knowledge discovery and integration
 - Image and video processing

Architectures

- Grid
- Clusters
- Novel Architectures

Novel Architectures

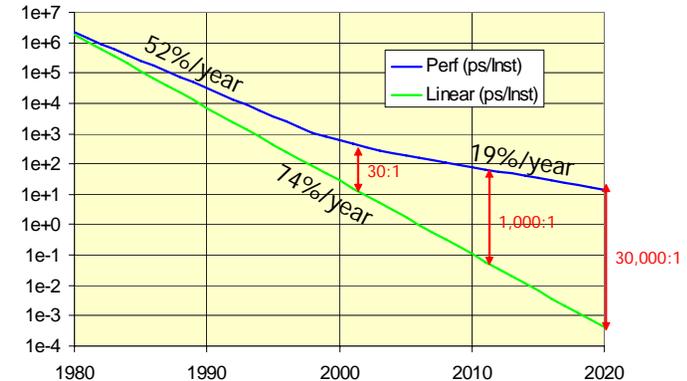
Conventional Processors No Longer Scale
Performance by 50% each year



ISAT LCC: 9

August 24, 2001

Future potential of novel architecture is
large (1000 vs 30)



ISAT LCC: 10

August 24, 2001

Last Classical Computer ISAT STUDY, August 24. 2001

Discussion

- What are novel architectures
 - Vectors
 - GPU's
 - FPGA's
 - Reconfigurable Processors (sea of processors)
 - Cell
 - PIM (Processor In Memory)
 - Quantum
- What are we missing??
 - New material technology
 - Optics
 - Super-cooled
- What problems are we trying to solve??
 - General vs. Special Purpose

Recommendations (1)

- **Fund DARPA's HPCS program robustly**
 - Support the Third Phase of the Current HPCS Program
 - Make HPCS a recurring Program
 - Multiple overlapping waves lasting 7 to 8 years
 - \$1 Billion per wave
 - Circa 2025 the development of a **EXAFLOP** HPC system
 - Encourage “flow down” (trickle down) to mid-range HPC systems such as clusters

Recommendations (2)

- **Initiate a UK HPC Programme**
 - Development of special purpose communications hardware
 - Research into special-purpose processors
 - Development of specialized programming aids, tools, and techniques of all classes of HPC machines
 - Definition of a clear roadmap for security mechanisms

Recommendations (3)

- **Invest in Research on Critical Applications and Technologies**
 - Exploration and prototyping of advanced high-end computing
 - Programming tools for HPC systems
 - High-productivity and rapid re-tasking
 - Improved knowledge discovery tools
 - New inference engines
 - High-level queries into efficient search procedures