Role of Government in HPC Funding

• Government Original Interest in the 1950s
• U.S. DOD Lead the Charge
• Code Breaking Hungry for Computing Cycles
• CDC 1604 Delivered to Navy in 1960
• CDC 6600 Released in 1964, 1 MFlop
  • About Ten Times its Nearest Competitor
• Followed by CDC 7600
  • Clock Speed to 36 MHz from 10 MHz
• Four Processor CDC 8600

• Adoption of Fortran Programming Language
Role of Government in HPC Funding

• CDC Advanced Flexible Processor (AFP)
  • Black Project Computer
• Vector Processors (hardware parallel)
  • CDC STAR-100
• Cray-1 (80 MHz)
  • NSA
• Cray-2 in 1985 (475 MFlop)
  • Developed for U.S. Dept. of Defense & Energy
• Cray X-MP, Y-MP, C90
  • Government & Industry
• Cray T90 (450 MHz, 1.8 GFlop)
Role of Government in HPC Funding

• Advanced Simulation and Computing Initiative
• Off the Shelf Processors
• Ride the Wave of Clock Speed Increases
  • 2 GHz early 2000’s
  • 2.5 GHz mid 2000’s
  • 3.0+ GHz late 2000’s
• Clock Speed has Run Its Course
• Power Requirements Become Prohibitive
• Double FP Instructions per Clock Cycle
• Inter-Processor Communication
• Software Burden on Parallelization
Role of Government in HPC Funding

• You Get what You Measure
  • Linpack
• Memory Bandwidth Neglected
• Programming Complexity Not Represented
• Inefficient Utilization Levels for Real Problems
• No Real Progress for Computational Intensive Work
  • Improvements for Transactional Based Work
• Hybrid Systems try to Break the Stagnation
Does Cloud Computing provide a reasonable HPC environment?

Would Government investment in it advance Supercomputing?
Is data-intensive analysis a legitimate supercomputing application?

Does investment in data-intensive analytics advance HPC?
New hardware directions are not favorable to computationally intensive problems.
Multi-architecture approaches utilizing GPUs and FPGAs attempt to compensate but complicate the environment.

Can automation reasonably manage this?
Can investment in application software compensate for the slower thread speeds we will be seeing?
Is investment in HPC specific processor hardware a reasonable alternative?