

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

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- 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

ROLE OF GOVERNMENT IN HPC FUNDING

- 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?