



High Productivity Computing Systems



Goal:

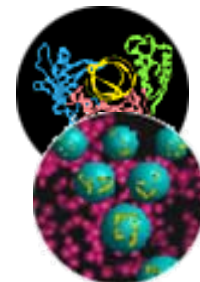
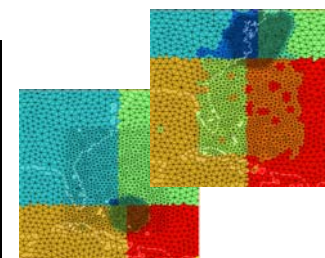
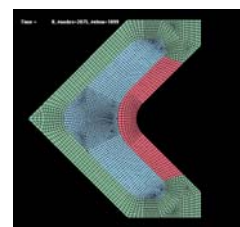
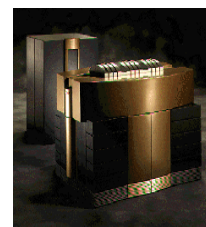
- Provide a new generation of economically viable high productivity computing systems for the national security and industrial user community (2010)

Impact:

- **Performance** (time-to-solution): speedup critical national security applications by a factor of 10X to 40X
- **Programmability** (idea-to-first-solution): reduce cost and time of developing application solutions
- **Portability** (transparency): insulate research and operational application software from system
- **Robustness** (reliability): apply all known techniques to **protect against outside attacks**, hardware faults, & programming errors



HPCS Program Focus Areas



Applications:

- Intelligence/surveillance, reconnaissance, cryptanalysis, weapons analysis, airborne contaminant modeling and biotechnology

Fill the Critical Technology and Capability Gap

Today (late 80's HPC technology).....to.....Future (Quantum/Bio Computing)



HPCS Program Phases I - III

HPCS

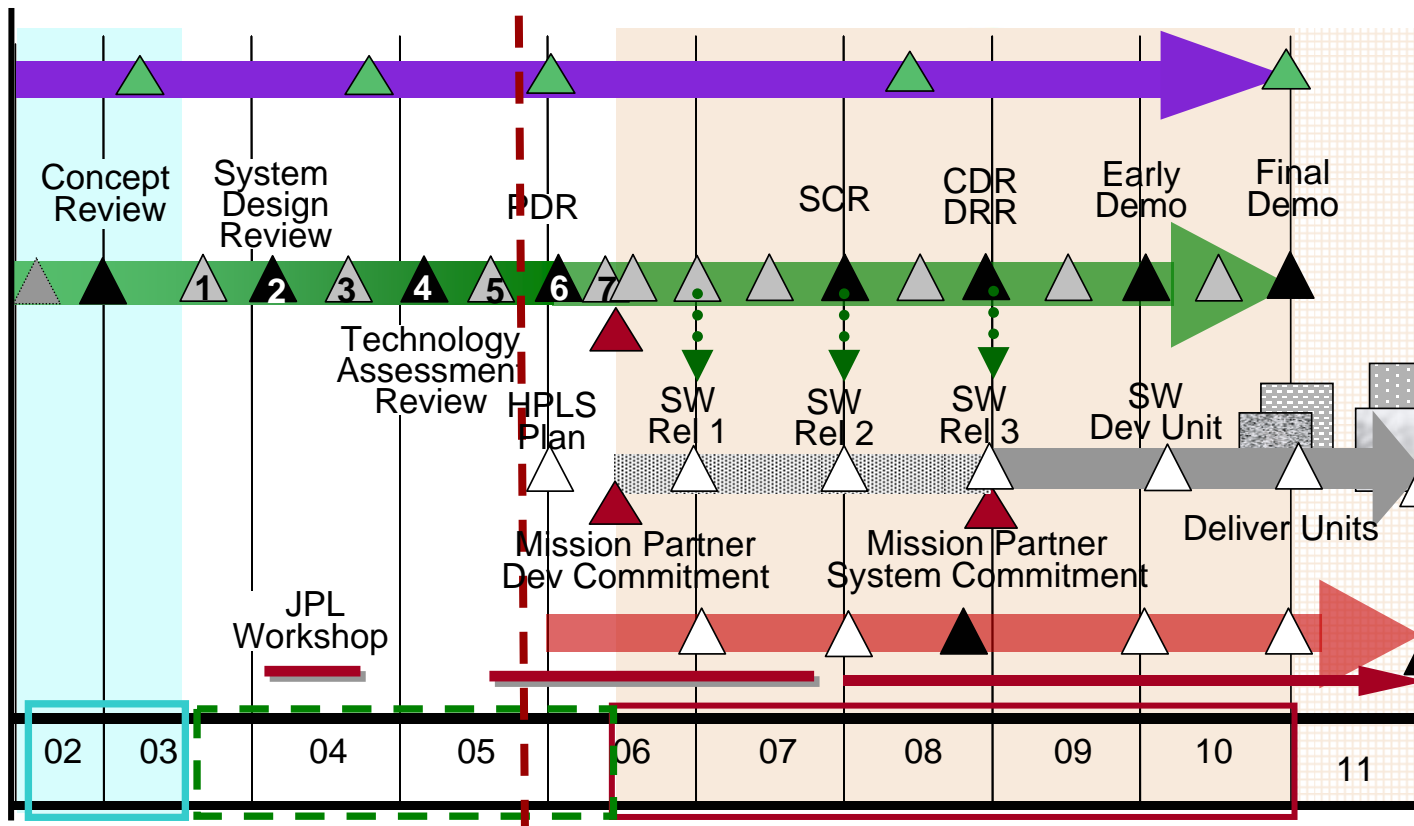
Productivity Assessment (MIT LL, DOE, DoD, NASA, NSF)

Industry Milestones

MP Peta-Scale Procurements

Mission Partner Peta-Scale Application Dev
HPLS Dev

Year (CY)



(Funded Five)
Phase I
Industry
Concept
Study

(Funded Three)
Phase II
R&D

Phase III
Prototype Development

Mission Partners

- ▲ Program Reviews
- ▲ Critical Milestones
- ▲ Program Procurements





Phase II Program Goals



◆ Phase II Overall Productivity Goals

- **Execution** (sustained performance) – 1 Petaflop/sec (scalable to greater than 4 Petaflop/sec). Reference: Workflow 3
- **Development** – 10X over today's systems. Reference: Workflows 1,2,4,5

◆ Productivity Framework

- Establish experimental baseline
- Evaluate emerging vendor execution and development productivity concepts
- Provide a solid reference for evaluation of vendor's Phase III designs
- Early adoption or phase in of execution and development metrics by mission partners

◆ Subsystem Performance Indicators

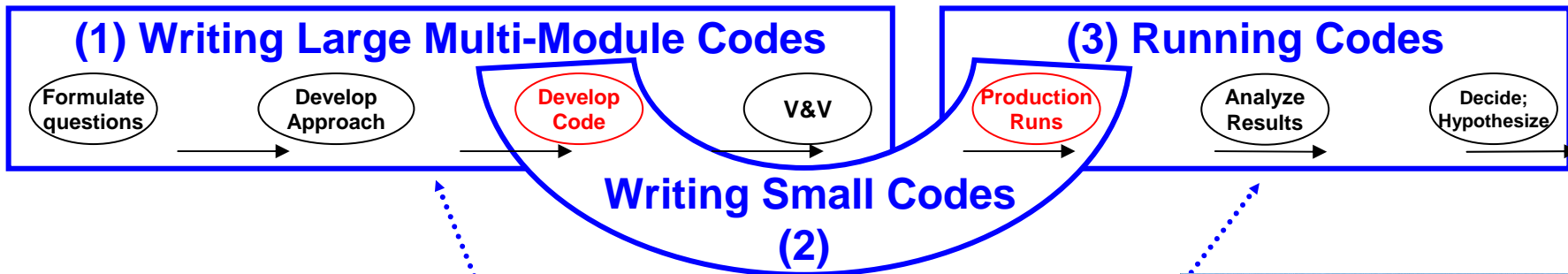
- 3.2 PB/sec bisection bandwidth;
- 64,000 GUPS;
- 6.5 PB/sec data streams bandwidth;
- 2+ PF/s Linpack

10 to 10K times Delta
from Business as Usual

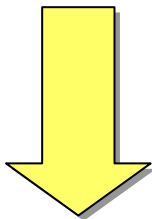
Documented and Validated Through Simulations,
Experiments, Prototypes, and Analysis



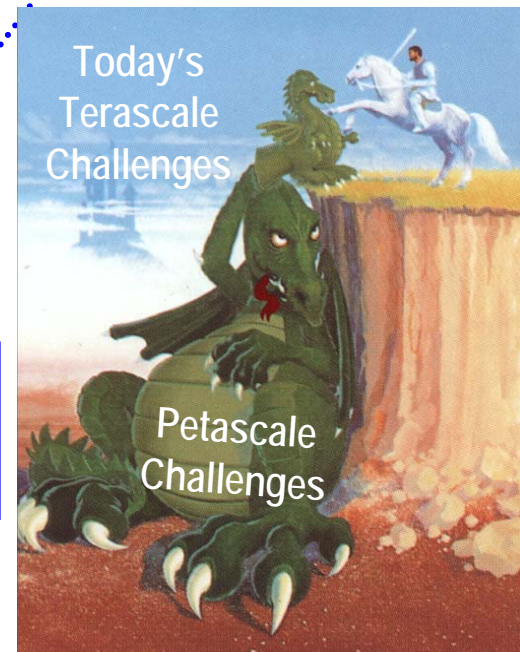
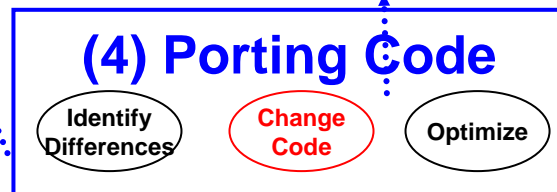
Challenge: Mission Partner Application Workflows



Today
100 – 1000
Processors



Future
10K – 100K
Processors



HPCS Goal: 10X Productivity Improvement