



# ***DARPA*Tech**

## ***2002 Symposium***

*Transforming*  
***Fantasy***



**Robert B. Graybill**  
Program Manager



# Today's High End "Capability" Architectures

Communication  
Programming Models

Shared-Memory  
Multi-Processing

Distributed-Memory  
Multi-Computing

Custom Vector

Parallel  
Vector

Scalable  
Vector

Vector  
Supercomputer

Microprocessor

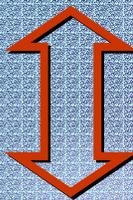
Symmetric  
Multiprocessors  
Distributed Shared  
Memory

Massively  
Parallel  
Processors

Commodity  
HPC

# HPCS: Fill the High-End Computing Technology and Capability Gap

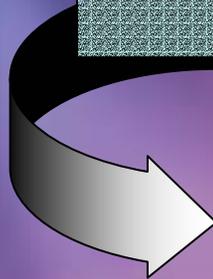
Vector



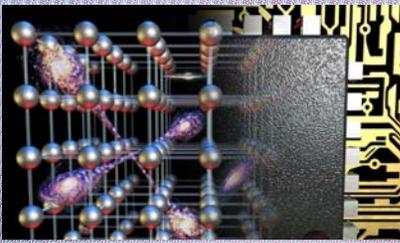
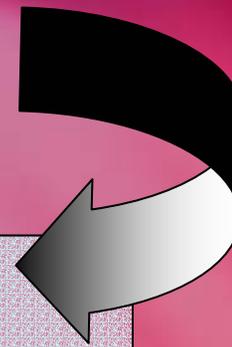
Scalar



1980's



**HP** *Productivity* **CS**



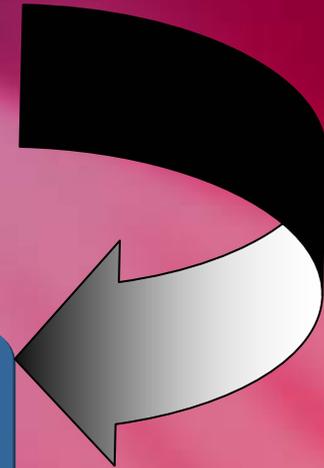
*Quantum Computing*

# Moving Beyond Moore's Law

*Moore's Law:  
Double Raw  
Performance every 18  
Months*

*2010 High-End  
Computing Solutions*

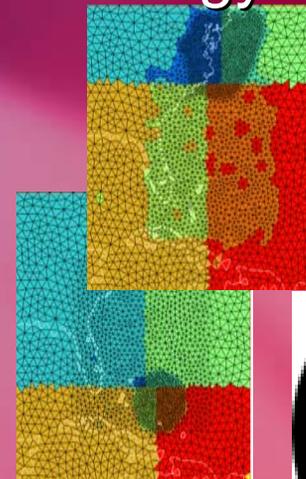
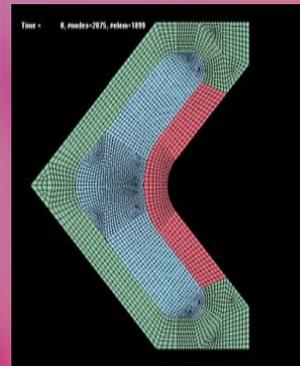
*New Goal:  
Double Value Every  
18 Months*



# DoD Application Drivers

## Applications:

- ▶ Weather Forecasting
- ▶ Cryptanalysis
- ▶ Airborne contaminant modeling
- ▶ Weapons analysis
- ▶ Survivability
- ▶ Intelligence/surveillance
- ▶ Reconnaissance
- ▶ Biotechnology

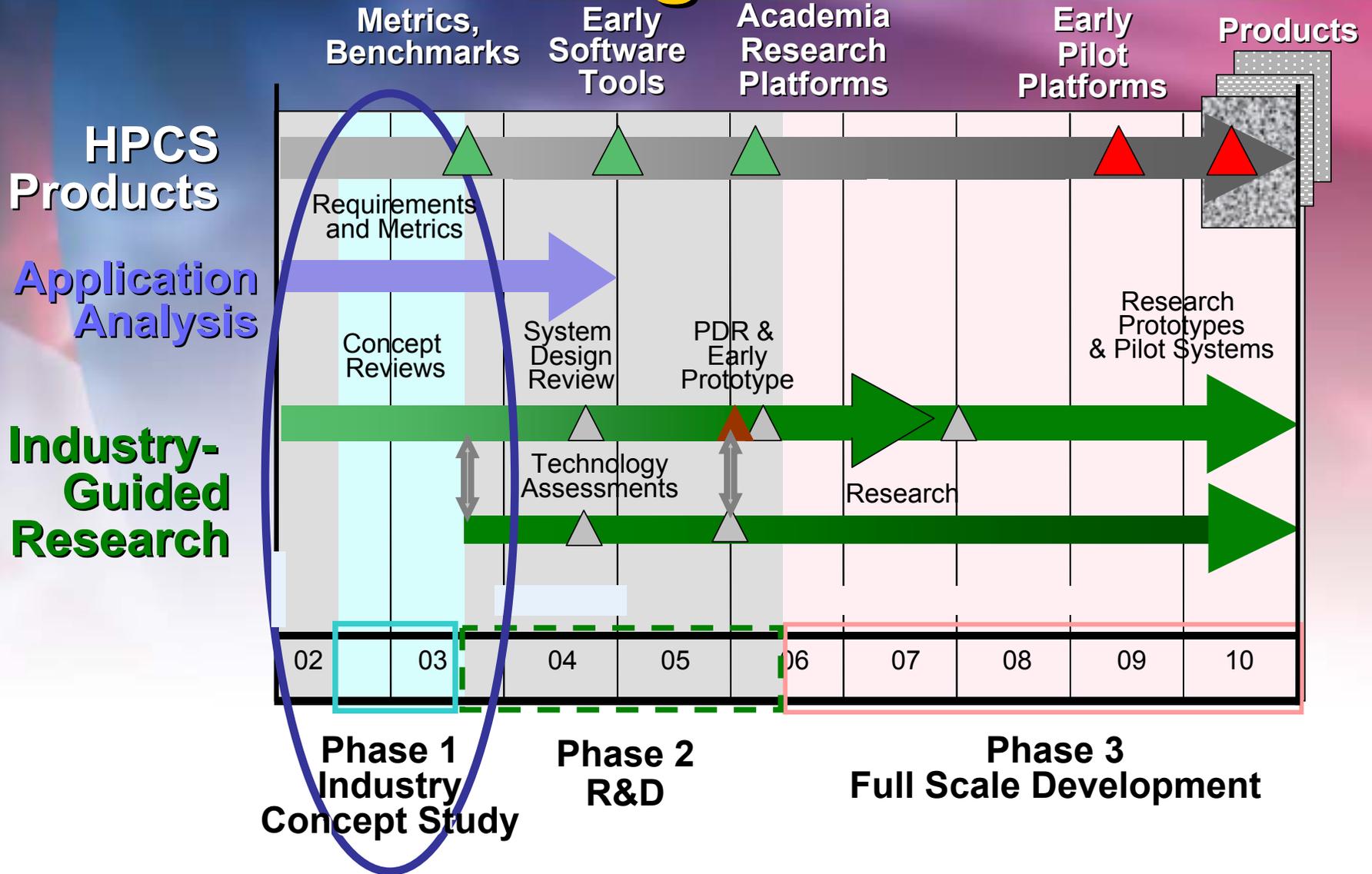


# Goals

- ▶ **Performance** (efficiency): critical national security applications by a factor of 10 to 40 times.
- ▶ **Productivity** (idea-to-solution): 10 times improvement
- ▶ **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.**



# Program Phases 1-3



# Phase I HPCS Industry Teams

❖ Cray, Incorporated



❖ Hewlett-Packard Company



❖ International Business Machines Corporation (IBM)



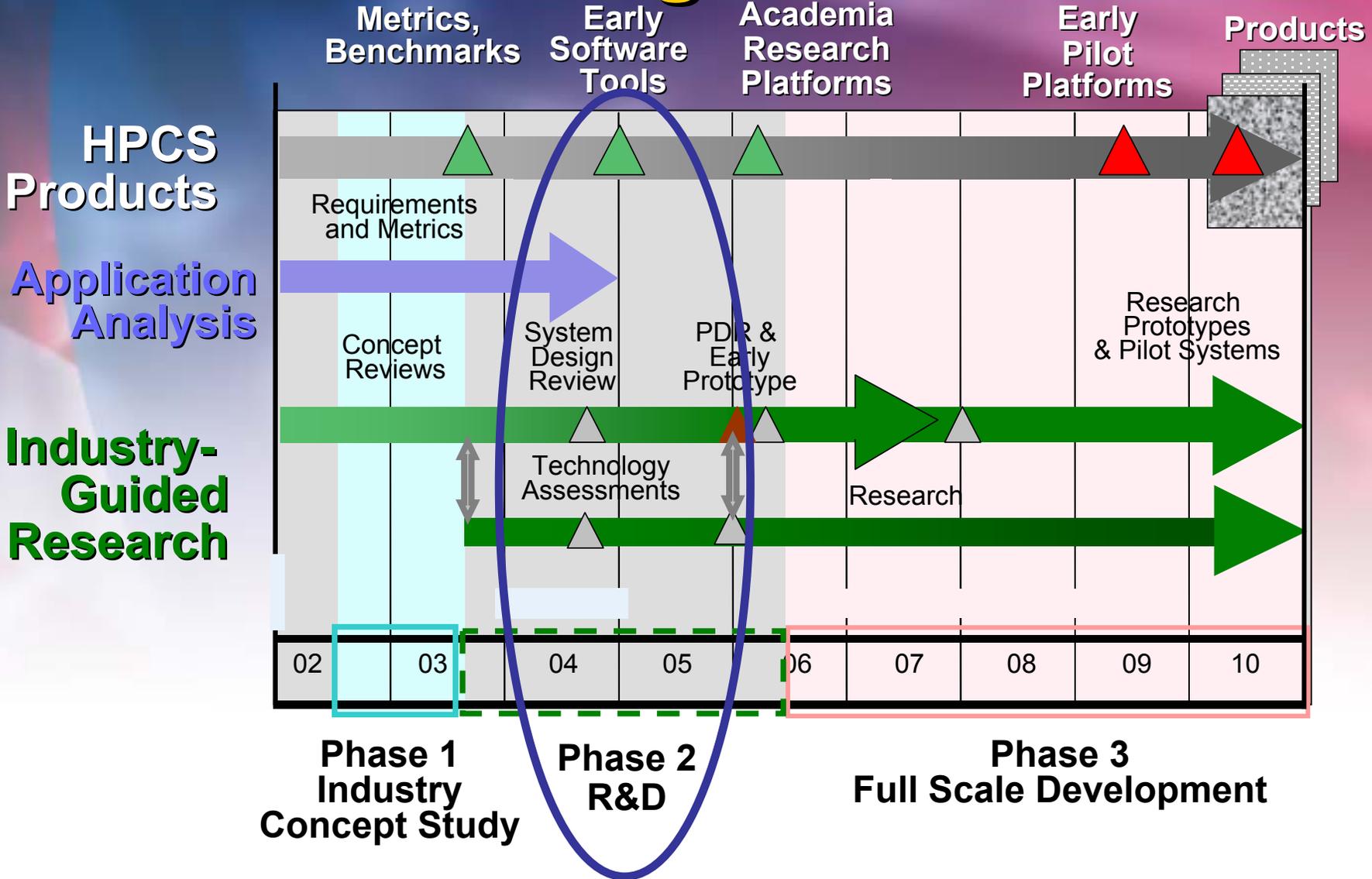
❖ Silicon Graphics, Inc. (SGI)



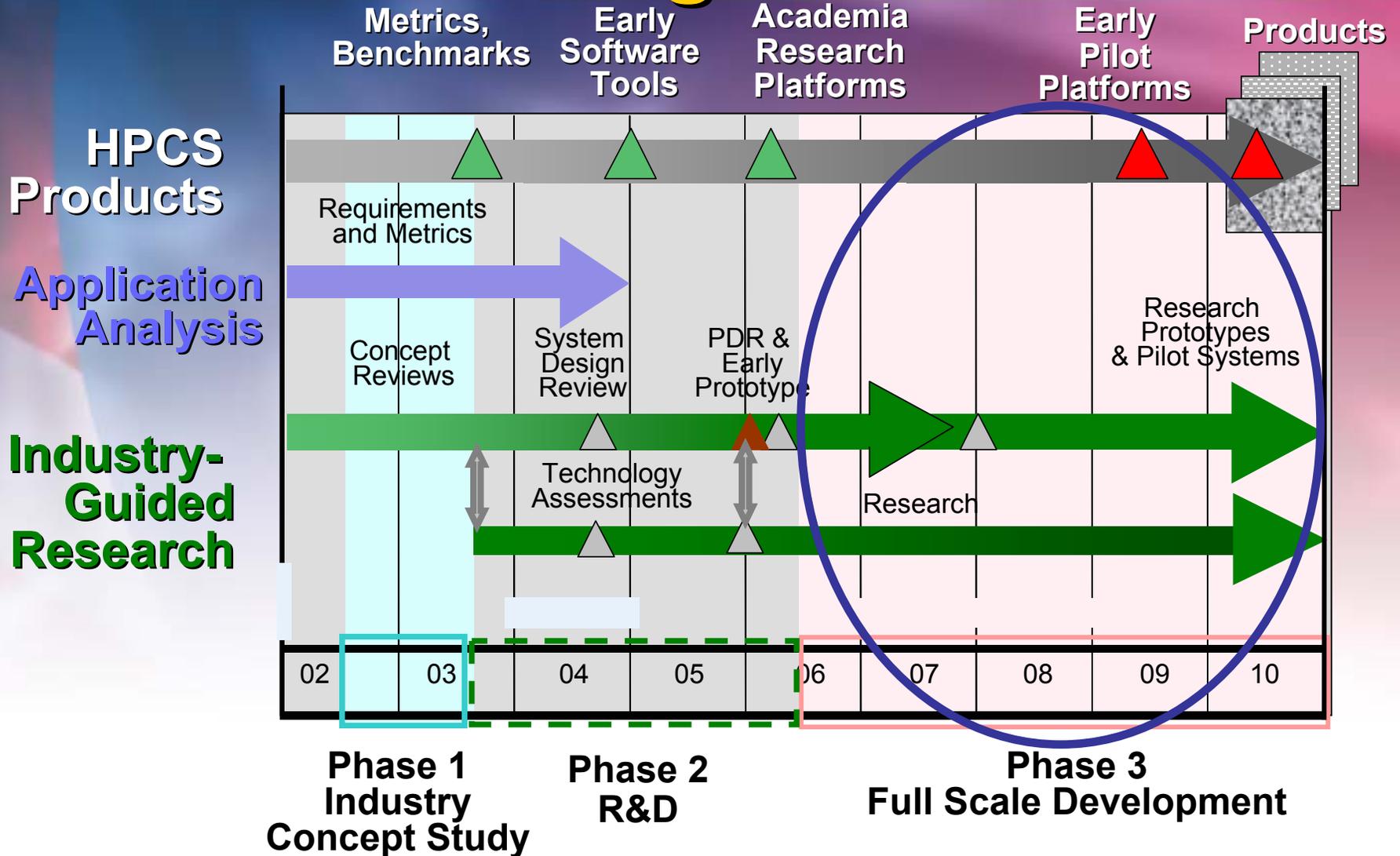
❖ Sun Microsystems, Inc.



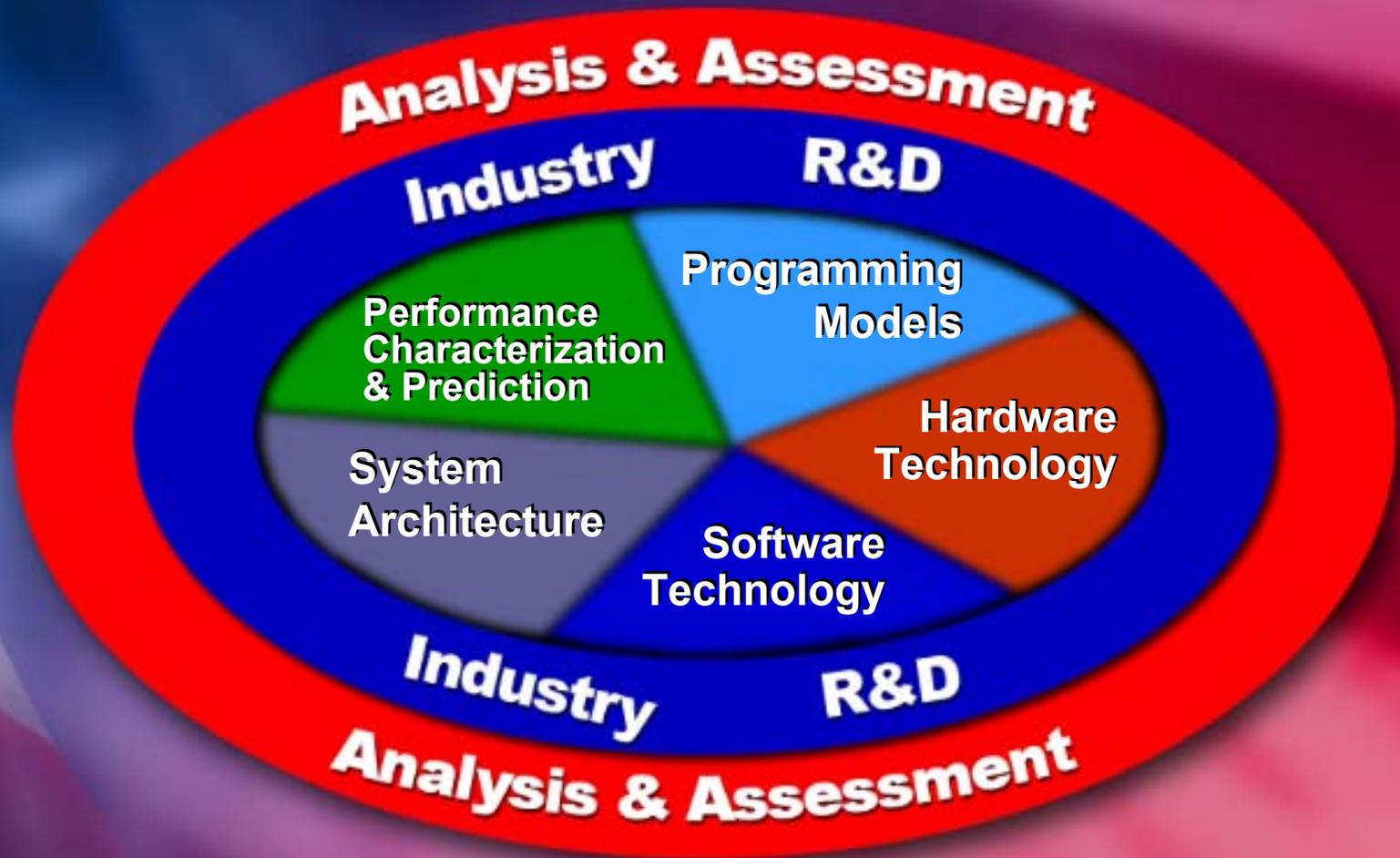
# Program Phases 1-3



# Program Phases 1-3



# Technical Focus Areas



# DARPA Related Research



- ▶ **DIS - Data Intensive Systems**  
Big Idea: Move the memory wall



- ▶ **PAC/C - Power Aware Computing / Communication**  
Big Idea: System energy management



- ▶ **PCA - Polymorphous Computing Architecture**  
Big Idea: Selectable virtual machine architecture





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