



HPC USER FORUM

Dearborn, MI

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Business & Economic Development

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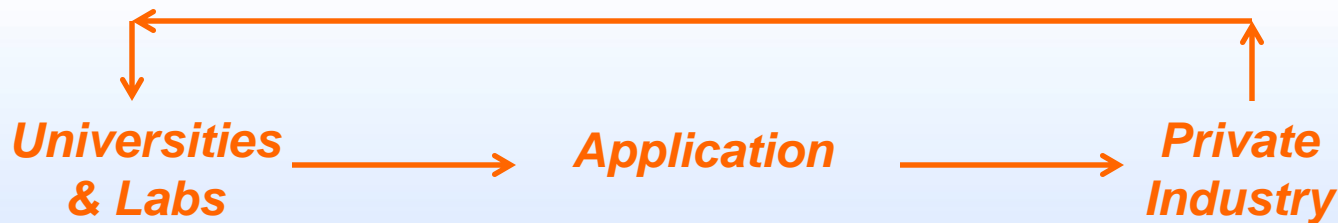
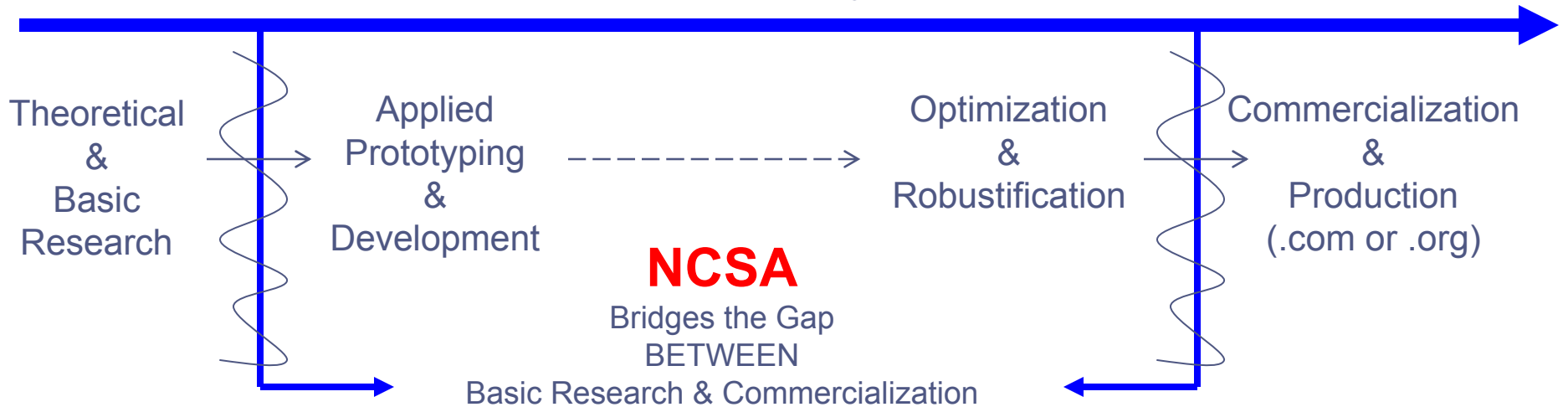


National Center for Supercomputing Applications
University of Illinois at Urbana-Champaign

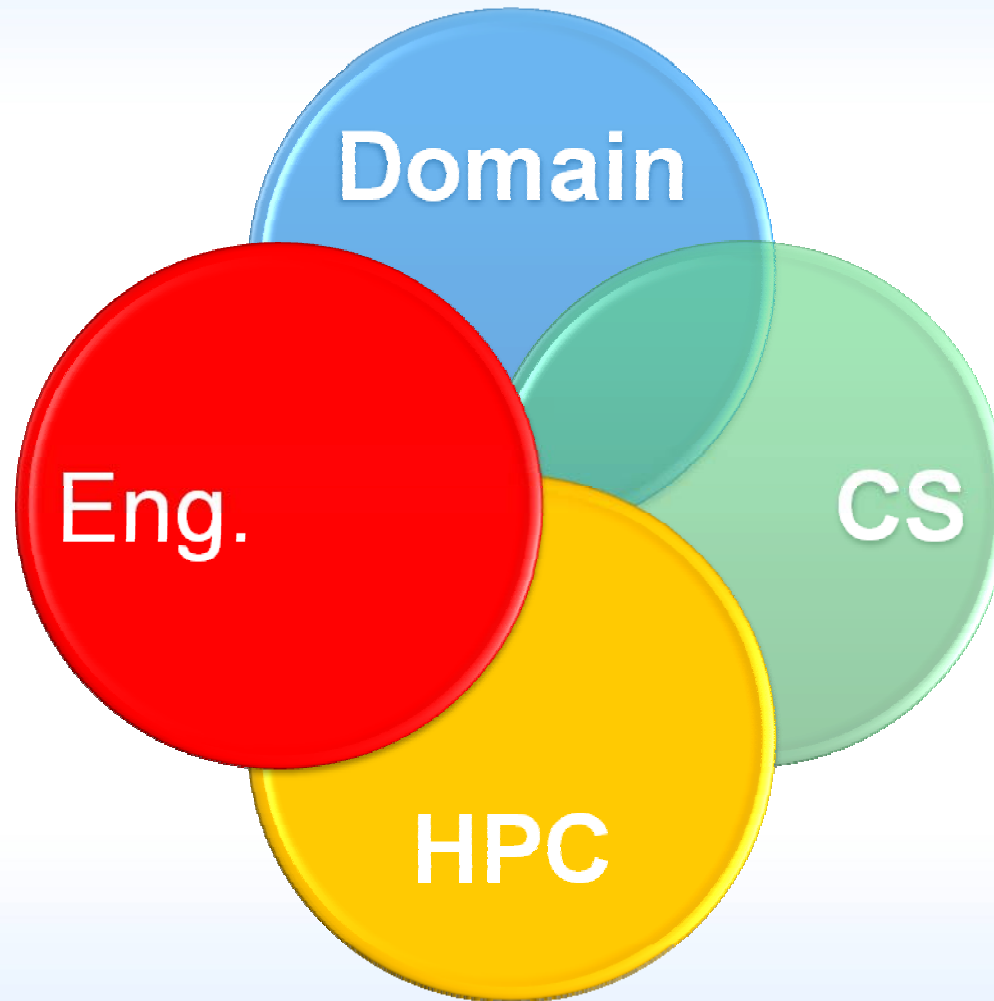
NCSA Bridges Basic Research and Commercialization with Application



Product Life Cycle

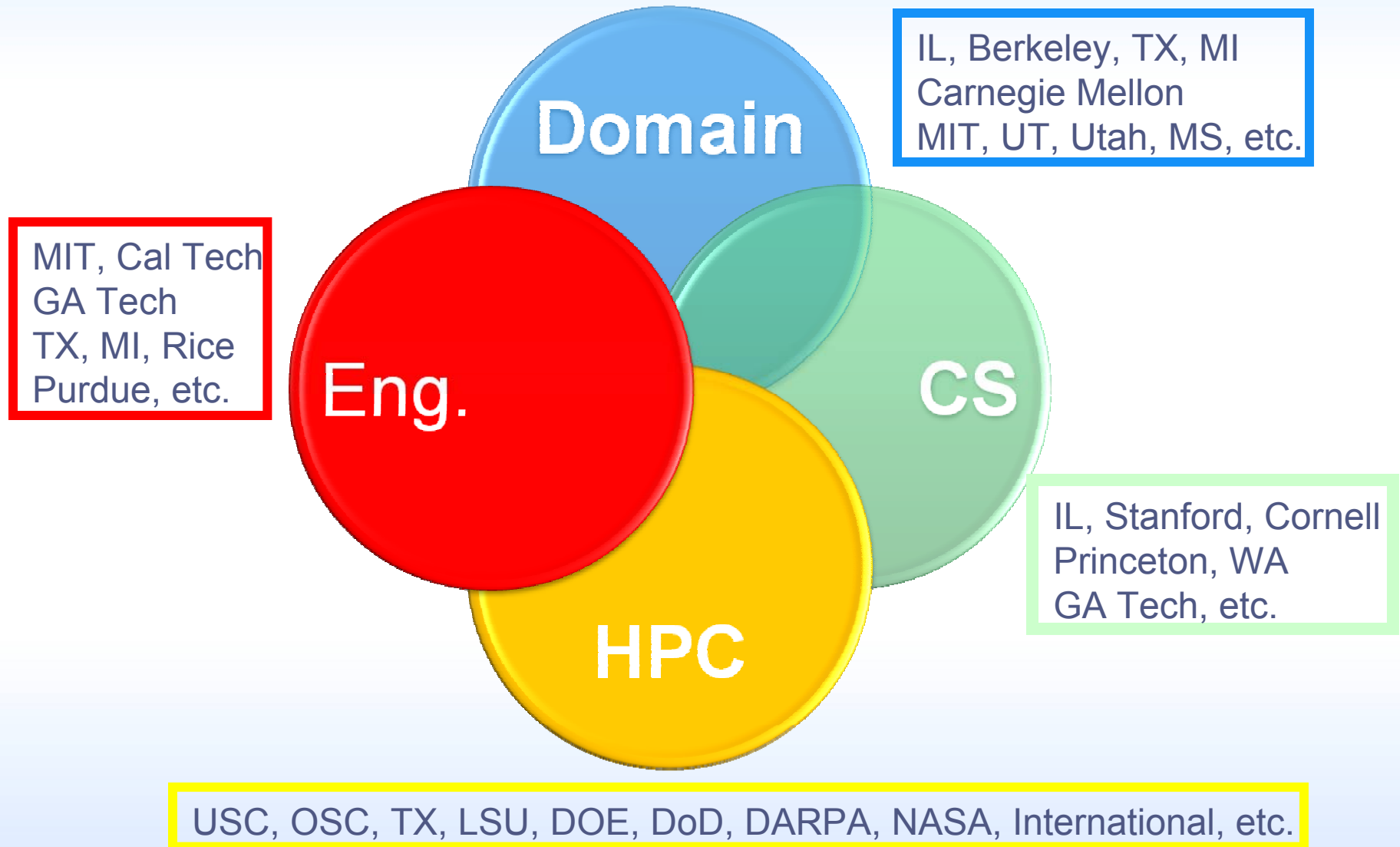


Simulation-Based Modeling & Science requires...



human expertise & HW/SW resources.

SBE&S Leadership Requires Collaboration



18 U.S. FORTUNE100® Manufacturing Companies



JOHN DEERE

Honeywell

GENERAL
DYNAMICS



Raytheon



MOTOROLA



3M



Revenue Range: \$25B - \$185B

GLOBAL100[®] Manufacturing Companies



ThyssenKrupp



TOYOTA



HONDA

HITACHI



Matsushita



HYUNDAI

Range: \$65B - \$230B (5 USA; 6 ASIA; 7 EU)

Imaginations unbound



Compete.

A Government-Manufacturing Partnership in Simulation-Based Modeling & Simulation to Assure U.S. Leadership in Innovation

Meet: Aneesh Chopra, U.S. CTO
Vivek Kundra, U.S. CIO
OSTP, Federal Labs, Dept. of Commerce
December 2009 and February 2010

Working Group:
Boeing, Caterpillar, GE, Procter & Gamble
Council on Competitiveness, NCSA

Goals: HPC Alliance, Supply Chain Impact, Industrial-Strength Bandwidth,
Software Collaboration, Shared Investment (G-U-I), National/Regional scope



G-U-I Collaboration is Needed

- Industrial science \approx Academic science
- Multiphysics
- Energy grids, power plants, fast trains
- Materials modeling & temporal decomposition
- Systems modeling & subsystems integration
- Water droplets & ice formation
- Personalized medicine
- Very large distributed data inputs & networks
- Manufacturing: OEM & supply chain
- Architect/Design/Model/Assess on 1 machine
- Fit R&D more quickly into production workflow

G-U-I User Alliance Candidates



Federal Agencies

+

Universities

+

Industry





EXTREME COMPUTING



National Center for Supercomputing Applications
University of Illinois at Urbana-Champaign

New Performance Driver



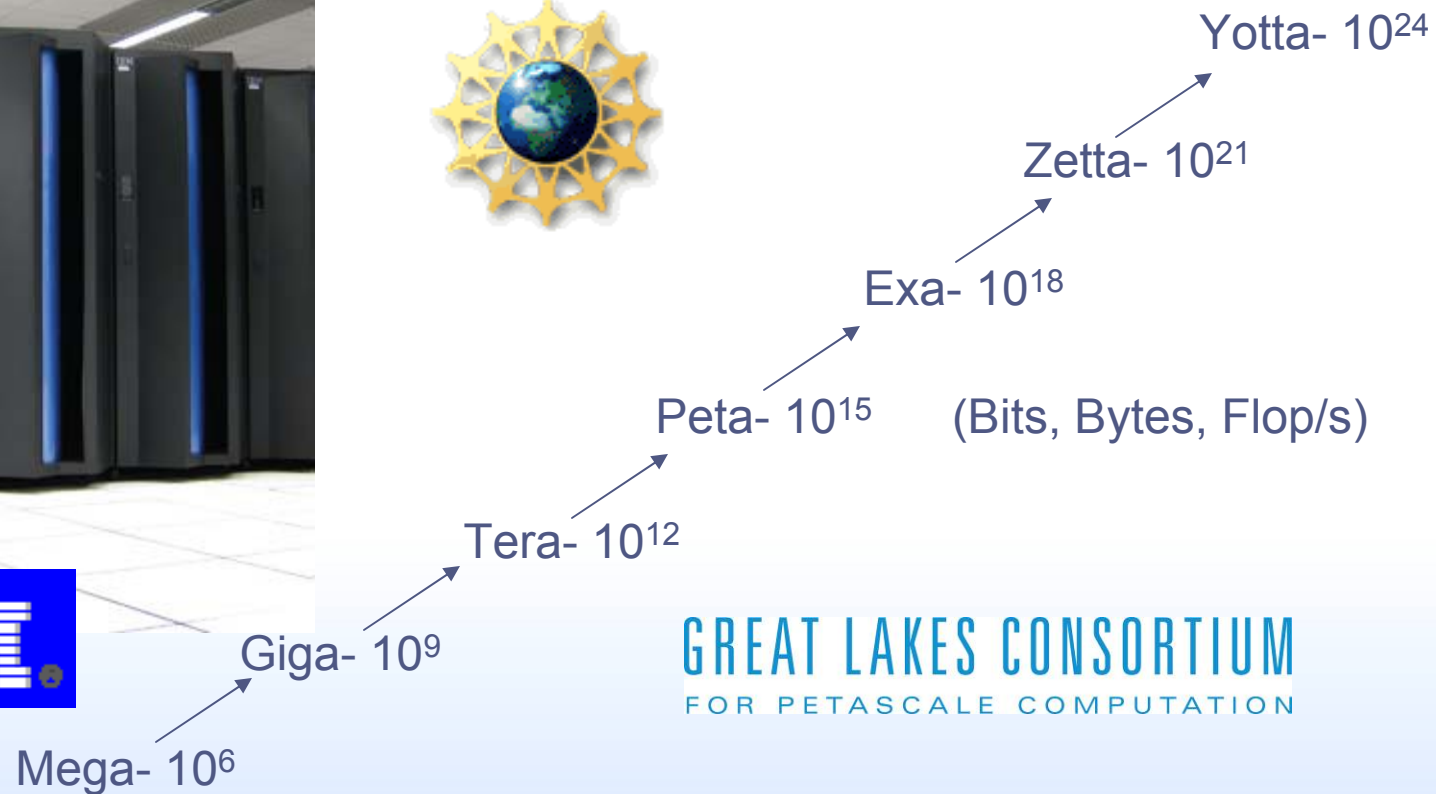
**NCSA's Blue Waters is
the first open-access
system tasked to
achieve ≥ 1 petaflop/s
on *real* applications.**

Leading-Edge Collaboration



BLUE WATERS

BREAKING THROUGH THE LIMITS



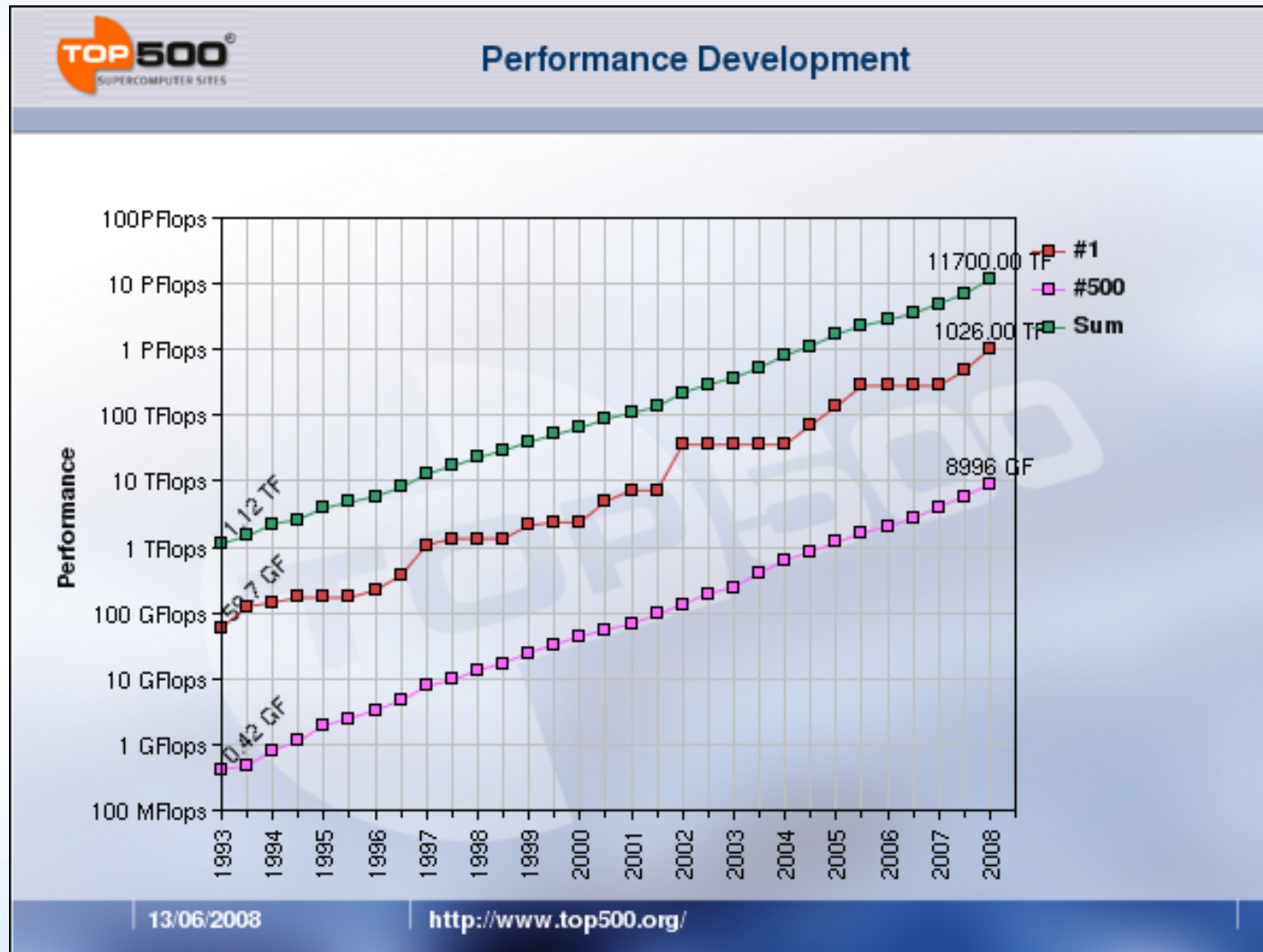
GREAT LAKES CONSORTIUM

FOR PETASCALE COMPUTATION

Imaginations unbound



Blue Waters Expected to Beat 2008's TOP500[®] COMBINED!



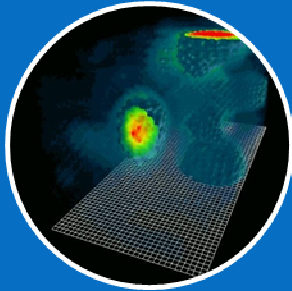
Petaflop/s Comparison

SYSTEM ATTRIBUTE	NCSA ABE	TACC Ranger	NCSA BLUE WATERS
Vendor	Dell	Sun	IBM
Processor	Intel Xeon 5300	AMD	IBM Power7
Peak Performance (Pf/s)	0.088	0.58	~10.0
Sustained Performance (Pf/s)	~.005	~.06	≥1
Number of Cores/Chip	4		8
Number of ProcessorCores	9600	62,976	~300,000
Amount of Memory (TB)	14.4	120	>1000
Amount of Disk Storage (TB)	100	1,730	>10,000
Amount of Archival Storage (PB)	5	2.5	>500
External Bandwidth (Gbps)	40	10	100-400

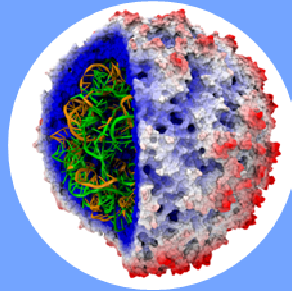
Blue Waters Architecture

SYSTEM ATTRIBUTE	BLUE WATERS
Peak Memory Bandwidth	~5 Pb/s
POWER7 Processor Cores	8
P7 Execution Units	12
Simultaneous Multithreading	≤ 4
Processor Memory	128 GB DDR3 DRAM
Clock Frequency	3.5 – 4.0 GHz
Interconnect	PERCS
File System	IBM GPFS
Software	Linux OS, OpenMP, Charm ++
Lifetime investment	\$1.5 Billion +

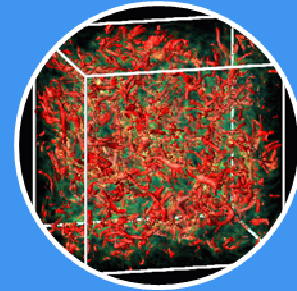
Blue Waters Benchmark Codes



MILC
(lattice
QCD)



NAMD
(molecular
dynamics)



Pseudospectral
Method
(turbulence)

NSF Challenge: ≥ 1 Sustained petaflop/s

Photos courtesy of NERSC, UIUC, IBM

Path to Petascale



USERS

- Aerospace
- Automotive
- Bio/Chemical
- Oil & Gas
- Pharma
- Energy
- Finance
- DOE/DoD



DEVELOPERS

- Proprietary 50%
- Commercial 30%
- Open Source 20%



WORKFORCE

- Corporate
- Technical
- University
- HPC experts
- Domain experts
- Federal labs

2 Paths to Blue Waters



NSF Allocation

- Allocation 80%
- Peer Review
- Faculty
- Labs
- Industry
- FREE



PSP

- Allocation 5%
- Proprietary work
- Supply Chain
- Com'l licensing
- User support
- FEES

National Petascale Computing Facility

**\$72.5M, 88,000 sf, 25MW power, LEED Gold+
Military-Grade Security**



National Petascale Computing Facility

30,000 SF 6' Raised Floor



THANK YOU!

<http://industry.ncsa.illinois.edu>

www.ncsa.illinois.edu/BlueWaters



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