

# High Performance Computing

*The Essential Tool for a Knowledge Economy*

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July 22<sup>nd</sup> 2013

*TO COMPETE, YOU MUST COMPUTE!*

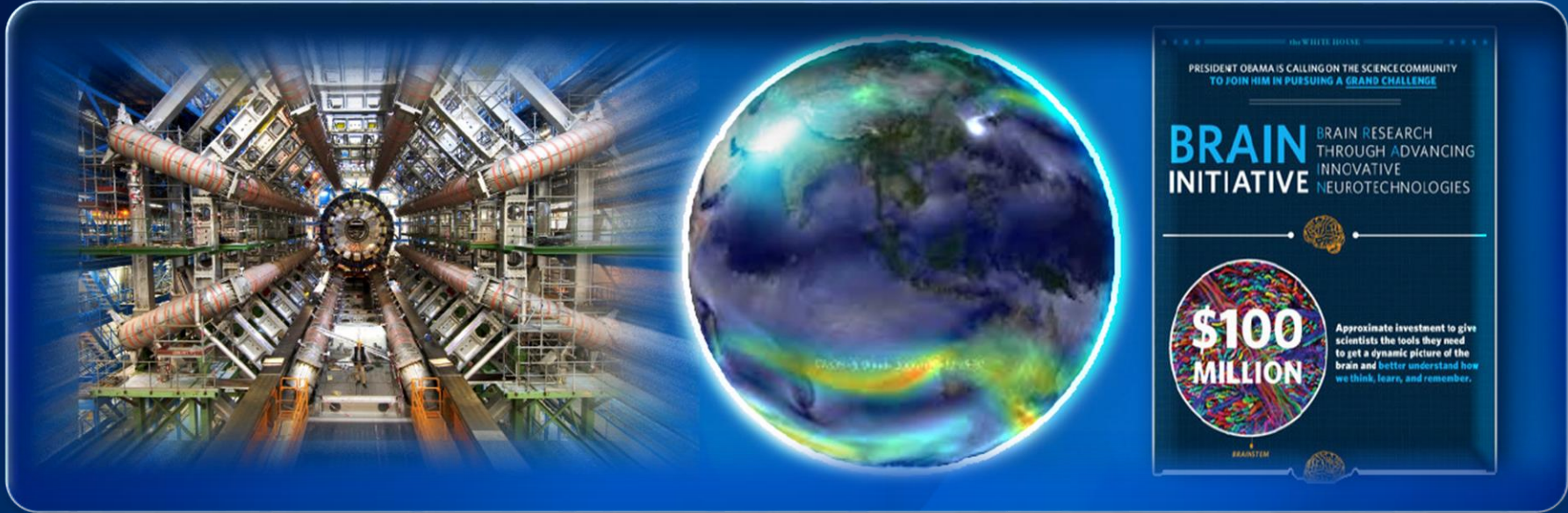


# What You Will Hear From Me Today

- HPC has become a **fundamental** capability: *Discovery & Insight, Business Transformation, and Data Driven Science*
- HPC needs require unprecedented levels of **innovation**: *Energy Efficiency, Reliability, Parallelism*
- Intel is **investing** broadly to address future needs: *Hardware, Software, Ecosystem, and Regulatory Policy*



# Fundamental to: **Discovery** and **Insight**



PRESIDENT OBAMA IS CALLING ON THE SCIENCE COMMUNITY TO JOIN HIM IN PURSUING A GRAND CHALLENGE

## BRAIN INITIATIVE

BRAIN RESEARCH THROUGH ADVANCING INNOVATIVE NEUROTECHNOLOGIES

**\$100 MILLION**

Approximate investment to give scientists the tools they need to get a dynamic picture of the brain and better understand how we think, learn, and remember.

BRAINSTEM

HPC IS **THE** TOOL FOR UNLOCKING THE MYSTERIES OF OUR UNIVERSE



# Fundamental to: **Transforming Business**



From Vision to Reality: Designed Without Prototypes!

 **AUTODESK.**



  
**Audi**  
Vorsprung durch Technik

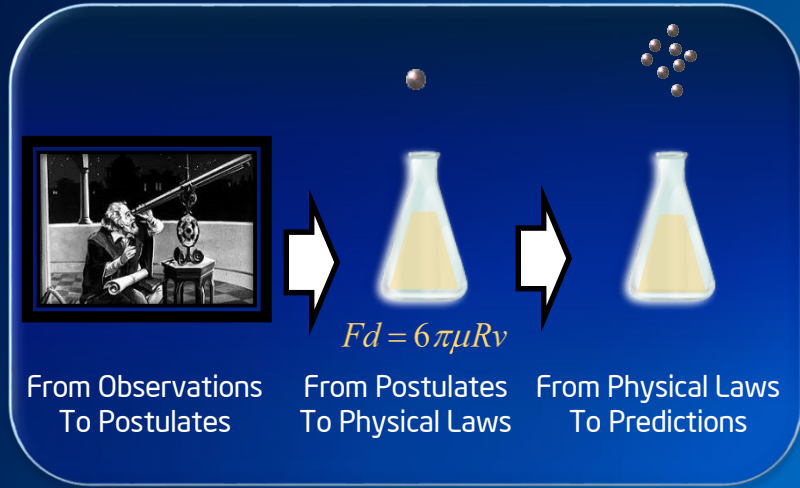


**BETTER & MORE ... FASTER & CHEAPER**

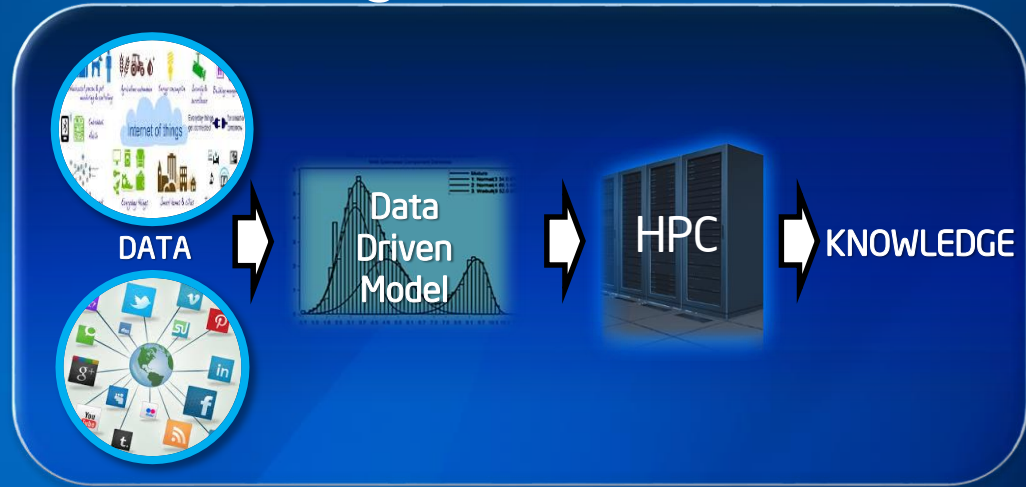


# Fundamental to: Enabling A Data Driven Science

## Traditional HPC



## Big Data HPC

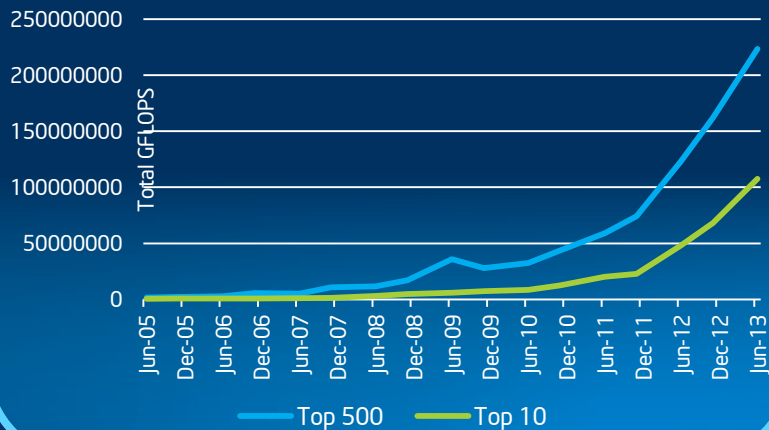


TRANSFORMING *DATA* INTO *KNOWLEDGE*



# HPC & Intel : Growing ... With More To Come

## Top 10 & Top 500 System Growth



*Systems are getting larger...*

## Intel HPC Processor MSS (IDC)



*...and Intel's MSS is rising*

# Transforming HPC

Circa 2003

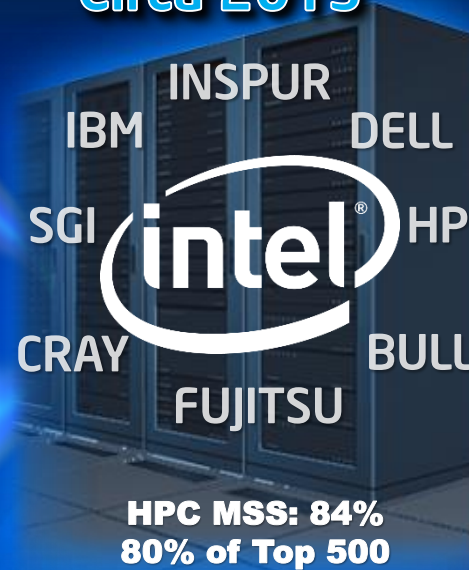
**MIPS** SGI   **PowerPC** IBM   **X86** Dell, HP, IBM

**PA-RISC** HP   **Itanium** HP, SGI, IBM

**Vector** Cray, NEC   **SPARC** Sun   **ALPHA** HP

 ~20% of Top 500

Circa 2013



INSPUR  
IBM   DELL  
SGI   HP  
CRAY   BULL  
FUJITSU

**intel**

**HPC MSS: 84%**  
**80% of Top 500**



# Intel: Addressing User And Ecosystem Needs

## Processors



Focused on Single Thread and Parallel Codes

## Coprocessors



Focused on Highly Parallel and Vectorized Codes

## Fabrics



New Generation Interconnects

Hardware Building Blocks

Software Building Blocks

Systems

End Customers

Linux	Open SHMEM
Open Fabrics Compiler	OpenMPI
GCC Compiler	Many Others

Intel® Cluster Ready  
Intel® OpenMP  
Intel® Cilk™ Plus



Customer Reference Boards  
System Validation Boards



Rack Optimized Servers  
Pedestals & Workstations

Software and Services  
RAID Solutions

POCs, Targeted Services, & Centers of Excellence





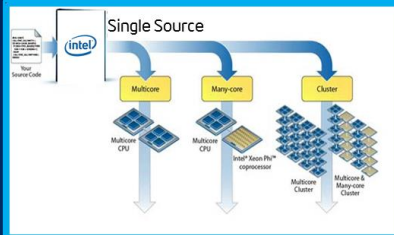
# While Redefining Compute To Deliver Neo-Heterogeneity at Scale

IDC HPC End-User MCS Study:  
Overall Plans For Purchasing Coprocessors

Q: What is your likely accelerator/co-processor purchase plans for your NEXT technical server purchase?

- 78.4% said YES they plan to purchase coprocessors with their next HPC server
- This is more than double the 29.5% from our 2011 HPC End-User MCS study

Heterogeneity is here to stay...  
...and it can be easy



Neo- Heterogeneity =  
Heterogeneous system  
with a single programming model

IDC Intersect360

Increasing Intel Xeon Phi  
user preference for future buys

IDC:

Intel 32%, nVidia: 26%

Intersect360:

2011: nVidia – 90%, Intel: 36%

2012: nVidia – 86%, Intel: 70%

# Fabric Future: Innovation And Integration

Today



More Chips = Higher Cost & Lower Density  
More Chip Crossings = Higher Power

Tomorrow

Cray  
Fabric IP

Fulcrum

Qlogic



Fewer Chips = Lower Cost & Higher Performance & Density  
Fewer Chip Crossings = Lower Power

INTEGRATION IS THE GAME CHANGER



# From Basic Compilers & Libraries to Tools & System Software

Circa 2003



Circa 2013



*Intel® MPI Library  
Intel® Cilk™ Plus  
Intel® Threading Building Blocks  
Intel® OpenMP\*  
Intel® Math Kernel Library  
Intel® Coarray Fortran*



## Hadoop

Announced  
Feb 2013

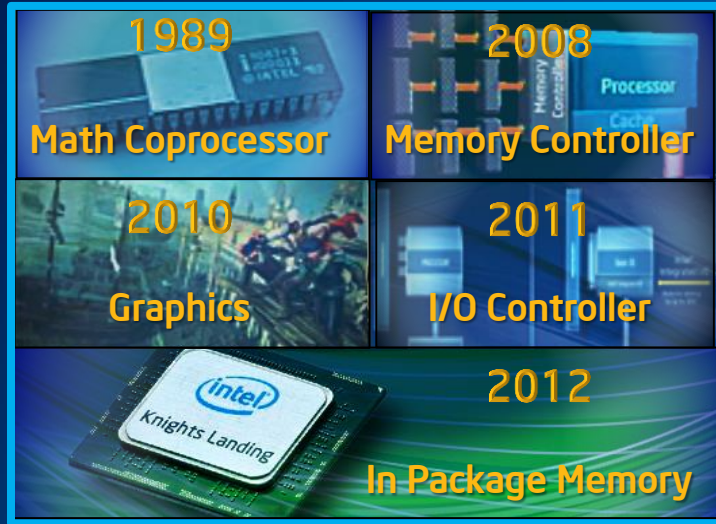
## Intel® Enterprise Edition for Lustre\* Software

Announced  
Jun 2013

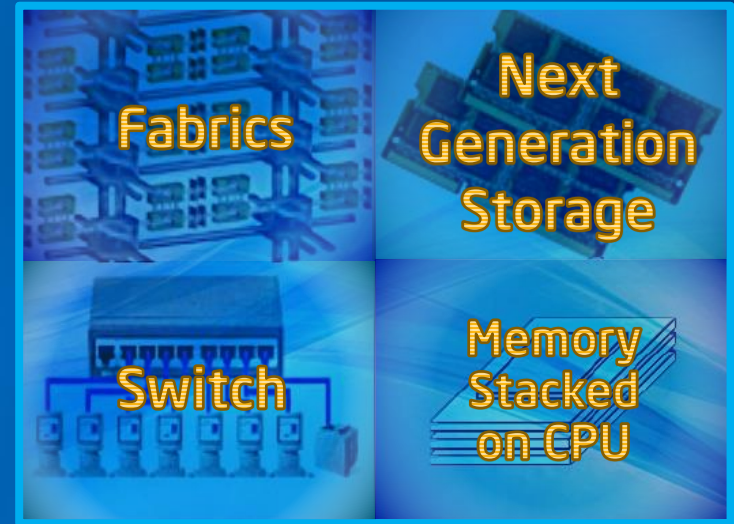


# Driving Innovation and Integration

*Unprecedented Innovations Only Enabled by the Leading Edge Process Technology*



Integrated Today



Coming Tomorrow

SYSTEM LEVEL BENEFITS IN COST, POWER,  
DENSITY, SCALABILITY, & PERFORMANCE



# Extending & Expanding HPC's Benefits

20MW, 1 Exaflop



20KW, 1 Petaflop



*A Supercomputer  
In a rack!*

*Today's #25 system  
in a rack!*

DEMOCRATIZING HPC

# Extending & Expanding HPC's Benefits

20MW, 1 Exaflop



20KW, 1 Petaflop



*A Supercomputer  
In a rack!*

*Today's #25 system  
in a rack!*

20W, 1 Teraflop



*10x the performance  
of today's tablet with  
a 2x power increase*

2W, 100 Gigaflop



*100x the performance  
of today's phone at the  
same power*

20 mW, 1 Gigaflop



HELPING SPONSOR TOMORROW

## Technical Computing Continues Its Rapid Growth *To Compete, You Must Compute*

**Governments & Research**  
The Human Brain Project  
"My goal is stable, it's...  
concrete, under scrutiny  
of the scientific community  
at the highest levels."  
Stephen Hawking  
Fundamental Discovery to  
Gain Fundamental Insights

**Commercial/Industrial**  
Better Products  
Faster Time to Market  
Reduced R&D  
Business Transformation

**New Users - New Uses**  
From  
diagnoses to  
personalized  
treatments  
quickly  
Genomics  
Clinical  
Intervention  
Big Data Analytics Enabling  
Data Driven Science



# HPC: Transforming the world of data and information into KNOWLEDGE

## Intel: Addressing User And Ecosystem Needs

**Hardware Building Blocks**  
Processors: Focused on Single Thread and Parallel Loads  
Coprorocessors: Focused on High Parallel and Vector Codes  
Fabrics: Intel® Trans Scale Fabric, Intel® Ethernet 7500 Series, Next Generation Interconnects

**Software Building Blocks**  
Linux, Open SHMEM, Open Fabrics Compiler, Open MPI, GCC Compiler, Many Others  
Intel® Cluster Ready, Intel® Analytics, Intel® Cloud

**Systems**  
Customer Reference Boards, System Validation Boards, Rack Optimized Servers, Pedestals & Workstations, Software and Services, R&D Solutions

**End Customers**  
POCs, Targeted Services, & Centers of Excellence



# Intel is taking a system's view and investing broadly to address future needs

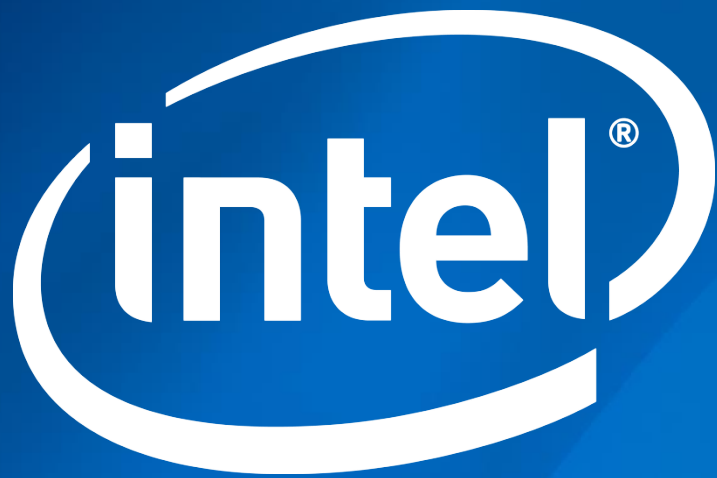
## Extending & Expanding HPC's Benefits

20MW, 1 Exaflop  
20KW, 1 Petaflop  
A Supercomputer in a rack  
Today's #25 system in a rack  
20W, 1 Teraflop  
2W, 100 Gigaflop  
20 mW, 1 Gigaflop  
10x the performance of today's server with a 25 power increase  
100x the performance of today's server at the same power!

HELPING SPONSOR TOMORROW

# This decade we will create and extend computing technology to connect and enrich the lives of every person on earth







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