High Performance Computing  
*The Essential Tool for a Knowledge Economy*

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*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

HPC IS THE TOOL FOR UNLOCKING THE MYSTERIES OF OUR UNIVERSE
Fundamental to: Transforming Business

From Vision to Reality: Designed Without Prototypes!

BETTER & MORE ... FASTER & CHEAPER
Fundamental to: Enabling A Data Driven Science

Traditional HPC Big Data HPC

From Observations To Postulates
From Postulates To Physical Laws
From Physical Laws To Predictions

TRANSFORMING DATA INTO KNOWLEDGE
HPC & Intel: Growing ... With More To Come

Systems are getting larger...

...and Intel’s MSS is rising

Sources: Intel, Top 500.org
Transforming HPC

Circa 2003
- MIPS
- PowerPC
- PA-RISC
- Itanium
- Vector
- SPARC
- ALPHA

Circa 2013
- X86
- INSPUR
- DELL
- HP
- BULL

HPC MSS: 84%
80% of Top 500

Sources: Top 500.org
Intel: Addressing User And Ecosystem Needs

**Hardware Building Blocks**
- **Processors**
  - Intel Xeon processor
  - Focused on Single Thread and Parallel Codes

- **Coprocessors**
  - Focused on Highly Parallel and Vectorized Codes

- **Fabrics**
  - Intel True Scale Fabric
  - New Generation Interconnects

**Software Building Blocks**
- **Linux**
- **Open Fabrics**
- **Compiler**
- **GCC Compiler**
- **Open SHMEM**
- **OpenMPI**
- Many Others

**Systems**
- **Customer Reference Boards**
- **System Validation Boards**
- **Rack Optimized Servers**
- **Pedestals & Workstations**
- **RAID Solutions**

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

**Intel® Ethernet Products**
- intel® Ethernet

**Intel® OpenMP Products**
- Intel® OpenMP

**Intel® Cilk™ Plus**
- Intel® Cilk™ Plus

**Intel® Cluster Ready**
- Intel® Cluster Ready

**OpenFabrics**
- OpenFabrics

**GCC Compiler**
- GCC Compiler

**OpenSHMEM**
- OpenSHMEM

**OpenMPI**
- OpenMPI

**Many Others**
- Many Others
While Redefining Compute
To Deliver Neo-Heterogeneity at Scale

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%

Sources: IDC, Intersect360
Fabric Future: Innovation And Integration

Today:
- More Chips = Higher Cost & Lower Density
- More Chip Crossings = Higher Power

Tomorrow:
- Processor With Integrated Fabric Controller
- 100 GB/s
- 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**
- Intel® MPI Library
- Intel® Cilk™ Plus
- Intel® Threading Building Blocks
- Intel® OpenMP®
- Intel® Math Kernel Library
- Intel® Coarray Fortran

**Circa 2013**
- Intel® Enterprise Edition for Lustre® Software
  - Announced Feb 2013
- Hadoop
  - 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!

20W, 1 Teraflop

Today’s #25 system in a rack!

2W, 100 Gigaflop

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

20 mW, 1 Gigaflop

100x the performance of today’s phone at the same power

HELPING SPONSOR TOMORROW
HPC: Transforming the world of data and information into KNOWLEDGE

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

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