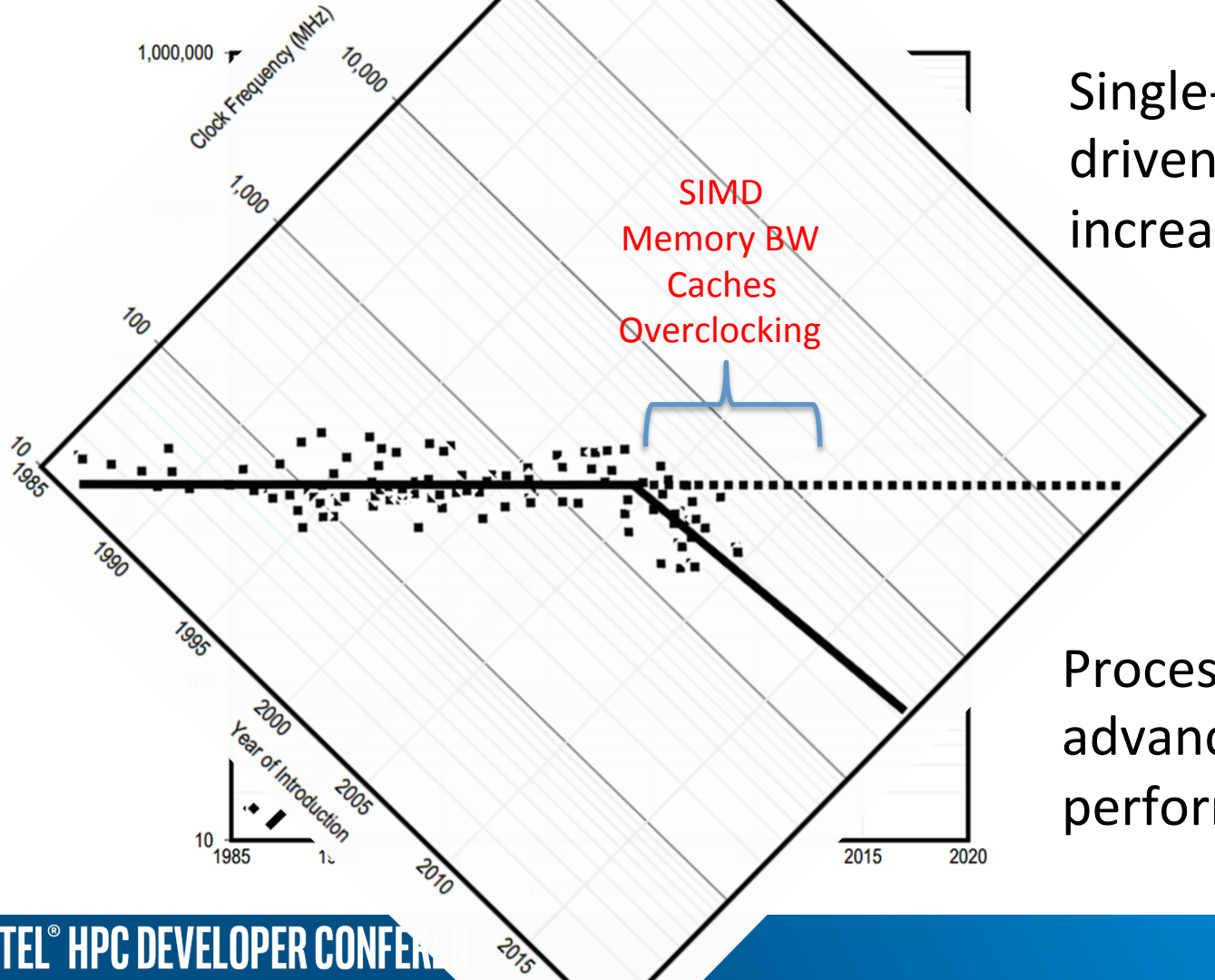
# Success Through Community

Richard Gerber
NERSC HPC Department Head
NERSC Senior Science Advisor
President, Intel Xeon Phi Users Group

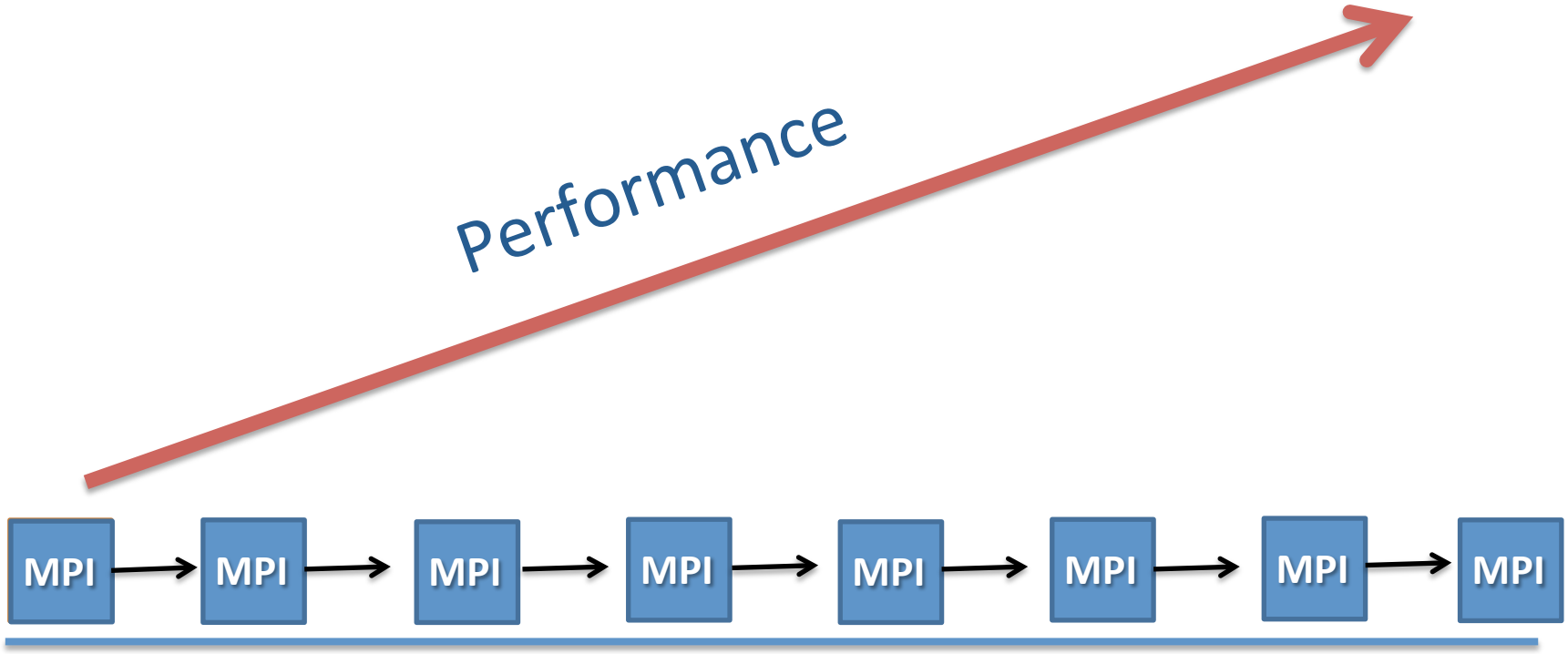
*“The only thing constant is change”*

–Heraclitus of Ephesus




Single-CPU performance driven by clock increasing frequency

Processor, memory advances kept CPU core performance strong


Performance
MPI
MPI
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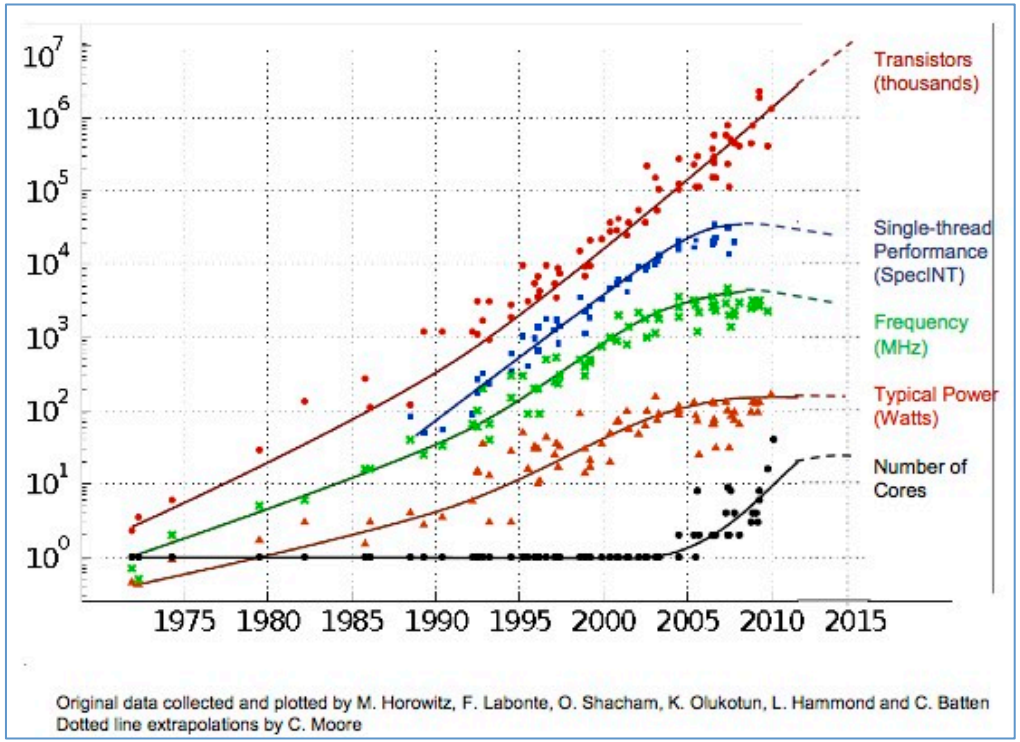
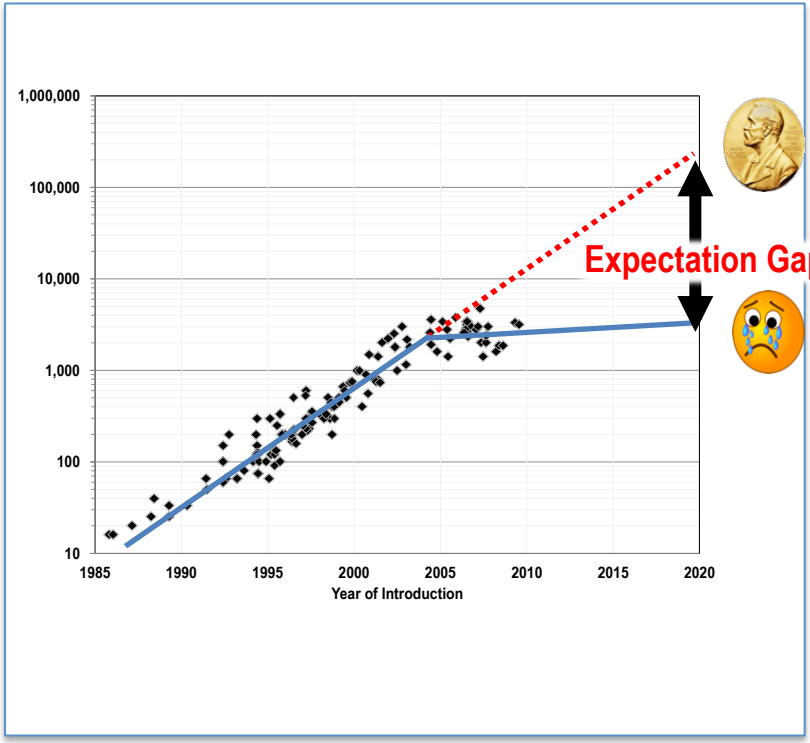
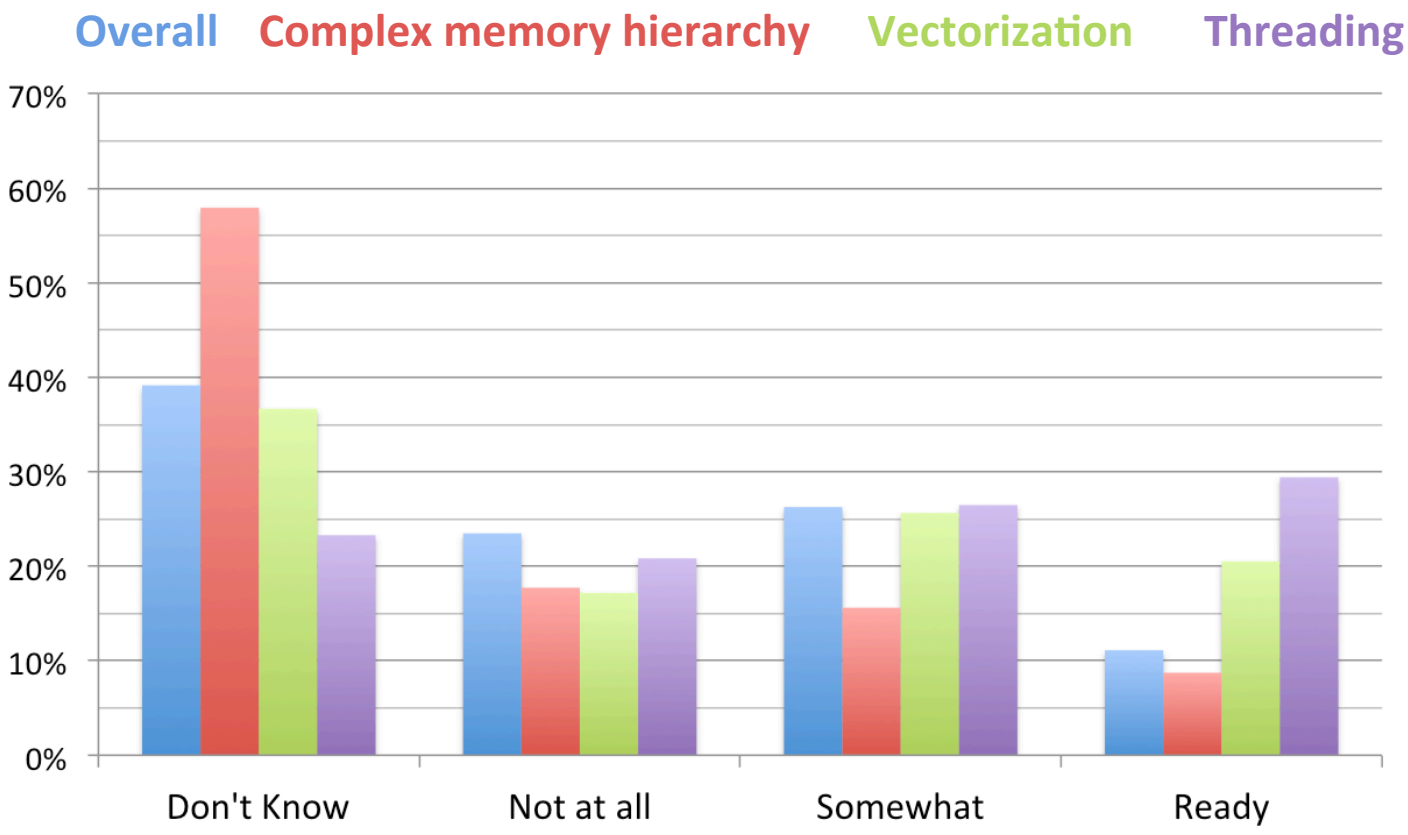
MPI
MPI
MPI
2001
2013

# Change was coming and we kept telling our 6,000 users it was so …



# NERSC User Survey 2013-14: Is Your Code Ready for Manycore?




We don't choose our users or codes. We support all DOE mission science.

HPC wire

January 4, 2014

2.4 Pflop Cray XC30 thrills NERSC's 6,000 users with 5,400 nodes, 100 GB/s memory bandwidth, and 2.4 GHz Intel Xeon "Ivy Bridge" processors, Cray Aries interconnect

*"Edison is one of the best machines in the world," NERSC 2014 User Survey*

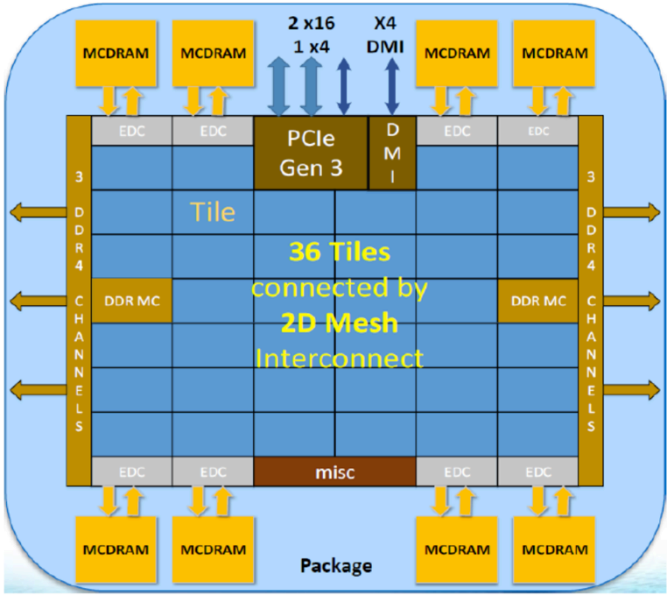
# 2014 Top 500 Supercomputers

| Rank | System | Processor | |
|---|---|---|---|
| 1 | Tianhe-2 | Intel Xeon Phi | lightweight cores |
| 2 | Titan | NVIDIA K20x | lightweight cores |
| 3 | Sequoia | BG/Q | lightweight cores |
| 4 | K Computer | SPARC 64 | |
| 5 | Mira | BG/Q | lightweight cores |
| 6 | Piz Daint | NVIDIA K20x | lightweight cores |
| 7 | Stampede | Intel Xeon Phi | lightweight cores |
| 8 | JUQUEEN | BG/Q | lightweight cores |
| 9 | Vulcan | BG/Q | lightweight cores |
| 10 | Cray CS-Storm | NVIDIA K40 | lightweight cores |

TECHENABLEMENT
Get known for the tech we teach

# NERSC to Procure "Cori" a Knights Landing Based Cray XC Supercomputer

May 2, 2014 by Rob Farber — Leave a Comment




30 PFlop System will be a boon to science because of new capabilities, but the Intel Xeon Phi many-core architecture will require a code modernization effort to use efficiently.

For the first time, NERSC's users will have lower single-thread performance in their next system.

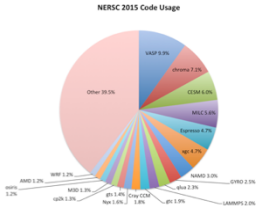
# NERSC's Challenge

Prepare NERSC's diverse community of 6,000 users, 750 projects, and 700 codes to use Cori's Intel Xeon Phi Knights Landing processors at high performance

Business as usual was over

# Solution: Build a Connected Community

**NESAP: 20 codes, >50% workload**

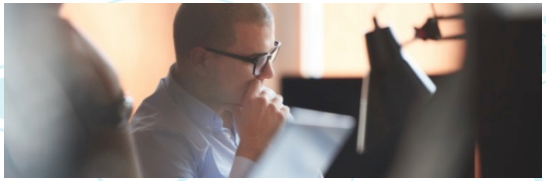



NERSC Application Performance Team

**Staff & Postdocs**

IXPUG
THE INTEL XEON PHI USERS GROUP

Community Confluence



**Robust training programs**

~100s –1,000s of users

**Computational Scientists**

**NESAP, Intel, Cray**

intel Software Developer Zone

MODERN CODE Home

intel Intel® Parallel Computing Centers (Intel® PCC)

FUEL YOUR INSIGHT: INTEL® HPC DEVELOPER CONFERENCE 2016
November 12-13, 2016 - Salt Lake City

NERSC intel CRAY THE SUPERCOMPUTER COMPANY IXPUG THE INTEL XEON PHI USERS GROUP

http://www.ixpug.org/

Optimization of scientific applications
Forum for free exchange of information and ideas
Collaboration among community experts
Independent projects, globally shared knowledge

# Member Locations & Events

400+ members worldwide and growing!

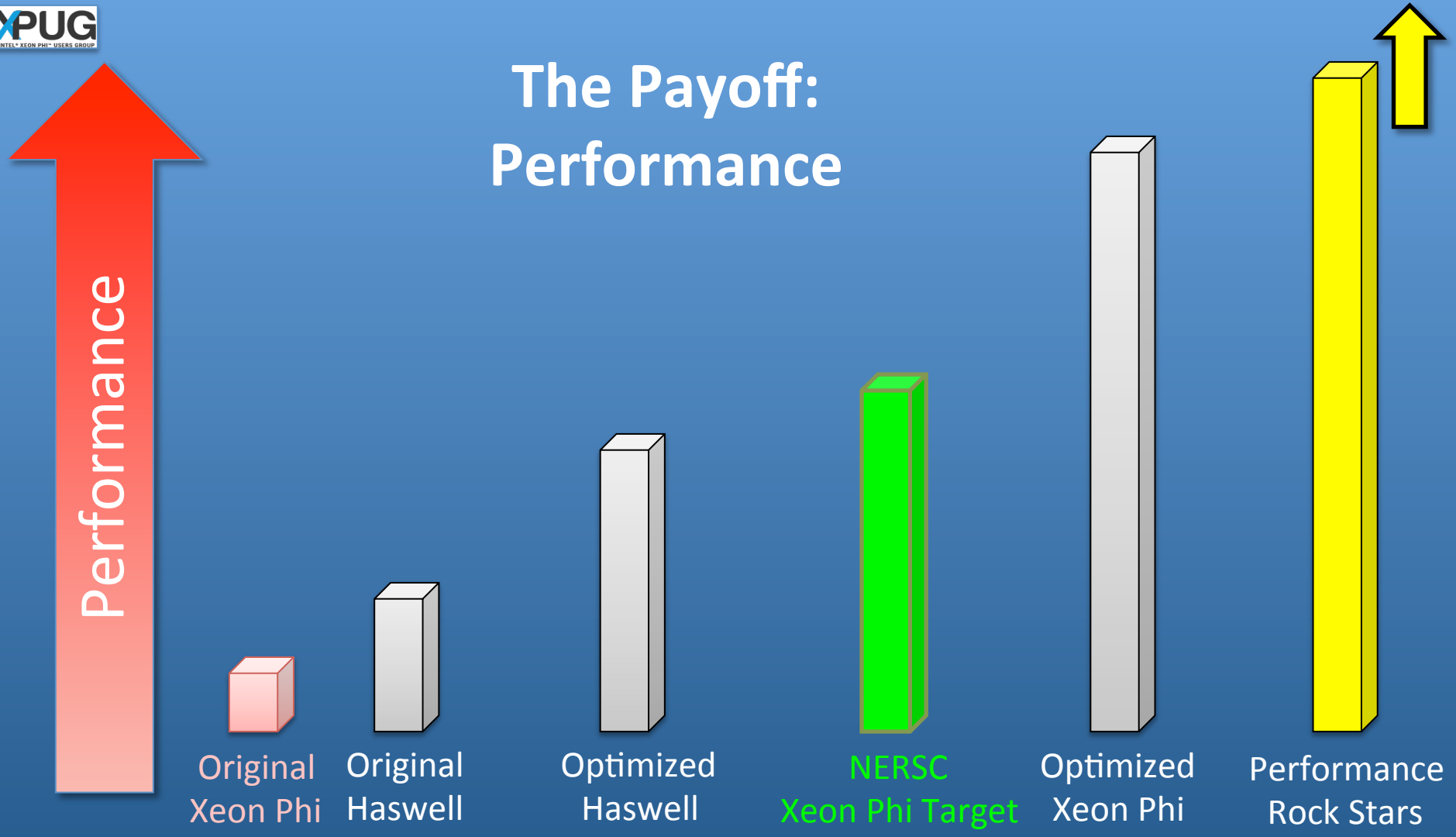
# Monthly Working Groups

| | | |
|---|---|---|
| General Optimization &Tuning | | John Pennycook<br>john.pennycook@intel.com |
| Vectorization | | Georg Zitzlsberger<br>georg.zitzlsberger@intel.com |
| MPI | | Michael Lysaght<br>michael.lysaght@ichec.ie |

Join, attend and/or host a meeting!

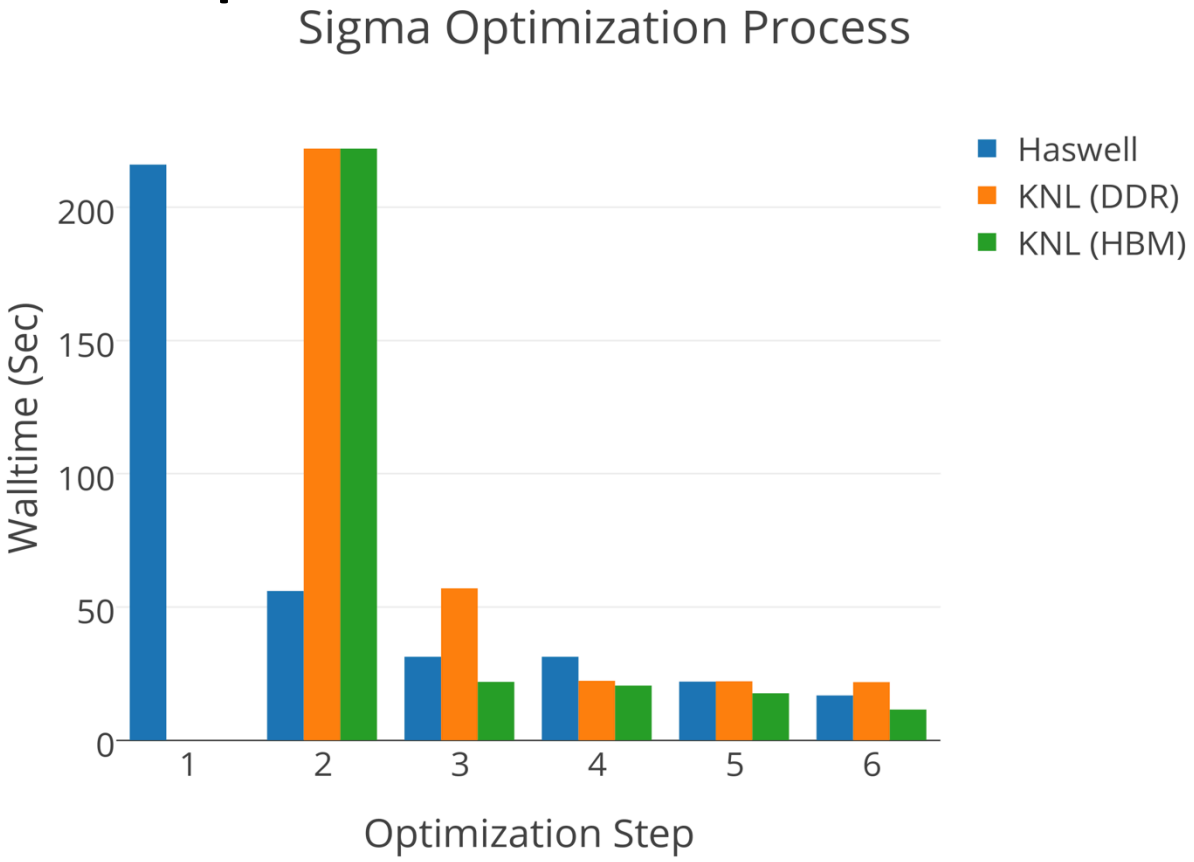
www.ixpug.org/working-groups

# The Payoff: Performance



# BerkeleyGW Optimization Example

1. Refactor (Create loops ready for OpenMP, vector optimizations)
2. Add OpenMP
3. Initial Vectorization (loop reordering, conditional removal)
4. Cache-Blocking
5. Improved Vectorization
6. Hyper-threading



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# We're published!

**IXPUG**


Application Performance on Intel Xeon Phi – Being Prepared for KNL and Beyond . . . . . 304
*Richard A. Gerber, Kent Milfeld, Chris J. Newburn, and Thomas Steinke*

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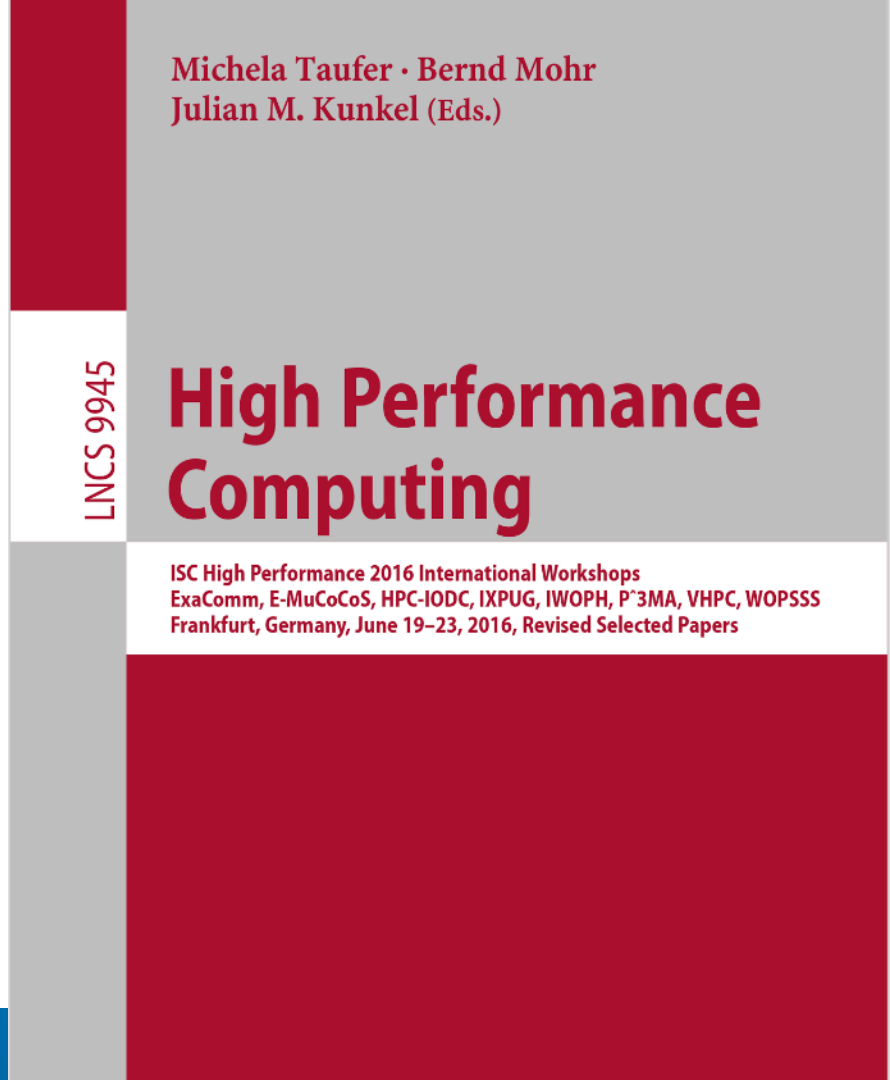

# Leadership

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THE INTEL XEON PHI USERS GROUP

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NERSC / Lawrence Berkeley National Laboratory

Vice-President:
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Zuse Institute Berlin

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Texas Advanced Computing Center, The University of Texas at Austin

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Sandia National Laboratories

**Doug Doerfler**
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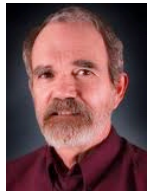
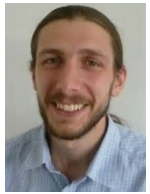
**Michael Lysaght**
Irish Centre for High-End Computing

**David Martin**
Argonne National Laboratory



**Kent Milfeld**
Texas Advanced Computing Center

**Hai Ah Nam**
Los Alamos National Laboratory



**John Pennycook**
Intel

**Estela Suarez**
Jülich Supercomputing Center

**Florian Wende**
Zuse Institute Berlin

# Be Part of the Conversation, Join the Community That's Right for You

Meet them at the
**User Community Social**

Tuesday, Nov 15

4:30pm - 6:00pm

Intel SC16 Booth, #1819

# Birds of a Feather Sessions

**Optimizing Performance on Many-Core Processors: Unleashing the Power of the Intel® Xeon Phi and Beyond**

(KNL clustering/MCDRAM mode discussion)

Wednesday, Nov. 16

12:15pm-1:15pm

Room 355-F

**Omni-Path User Group (OPUG) Meeting**

Thursday, Nov. 17, 2016

1:30pm-3:00pm

Room 155-A

COMING **TOGETHER** IS A BEGINNING

KEEPING **TOGETHER** IS PROGRESS

WORKING **TOGETHER** IS SUCCESS

- Henry Ford

IXPUG

THE INTEL XEON PHI USERS GROUP

Become a member!

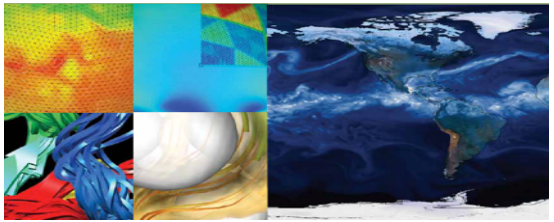
Host a regional meeting!

http://ixpug.org

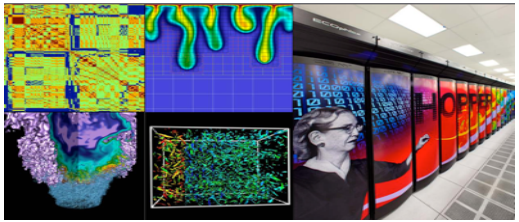
# The Mission HPC Facility for DOE Office of Science Research

U.S. DEPARTMENT OF ENERGY | Office of Science

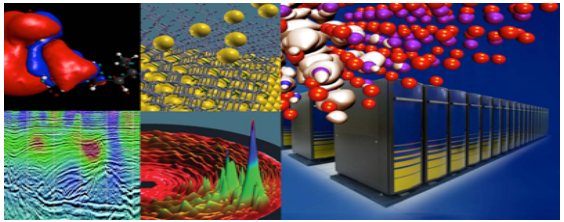
Largest funder of physical science research in U.S.



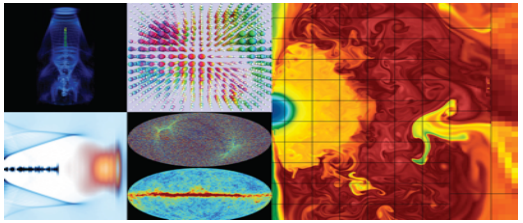
Bio Energy, Environment



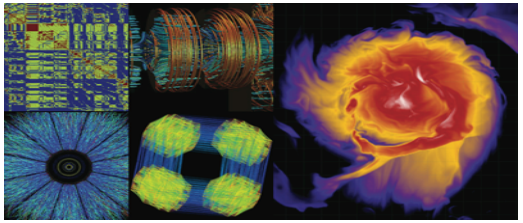
Computing



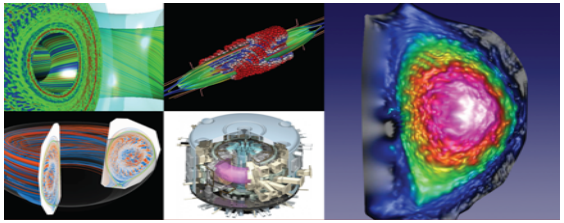
Materials, Chemistry, Geophysics



Particle Physics, Astrophysics



Nuclear Physics



Fusion Energy, Plasma Physics

6,000 users, 700 projects, 700 codes, 48 states, 40 countries, universities & national labs