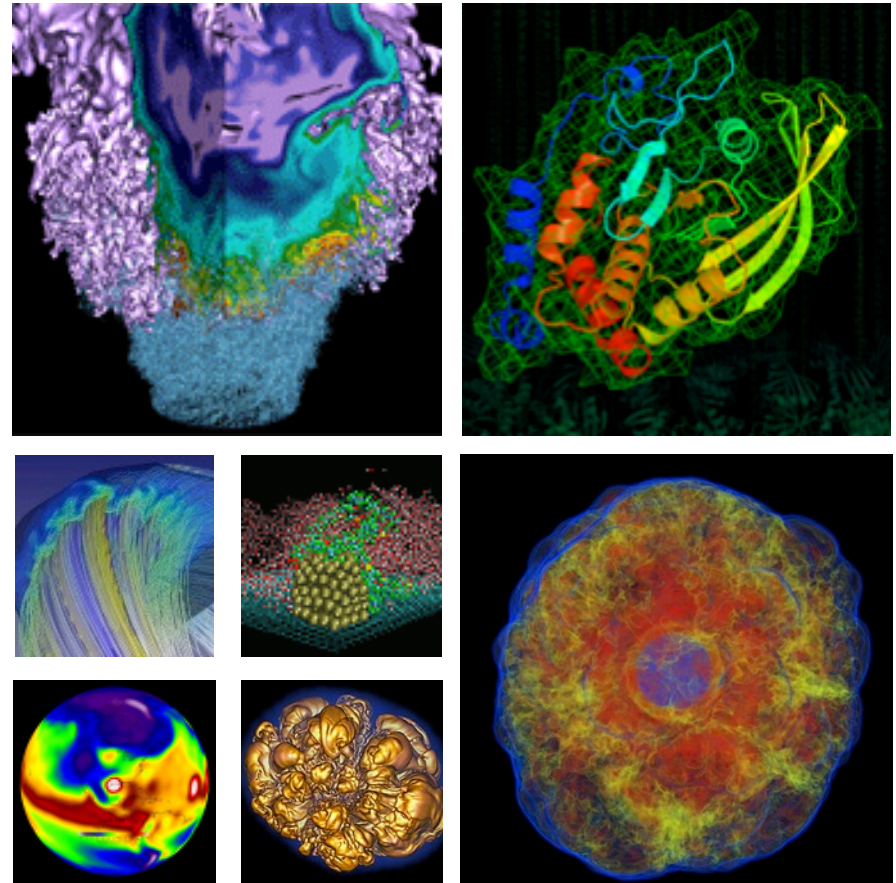# MPI usage at NERSC: Present and Future

Alice Koniges,
Brandon Cook, Jack Deslippe, Thorston Kurth, Hongzhang Shan
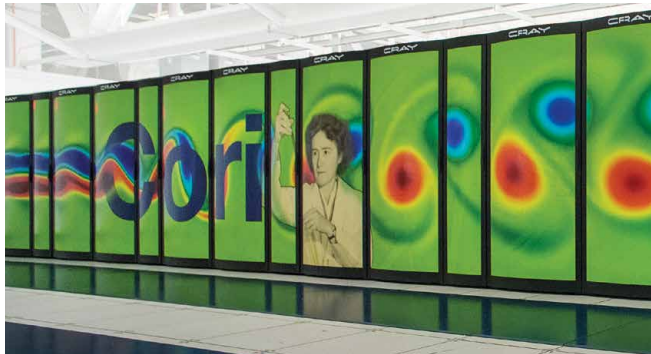
National Energy Research Scientific Computing Center
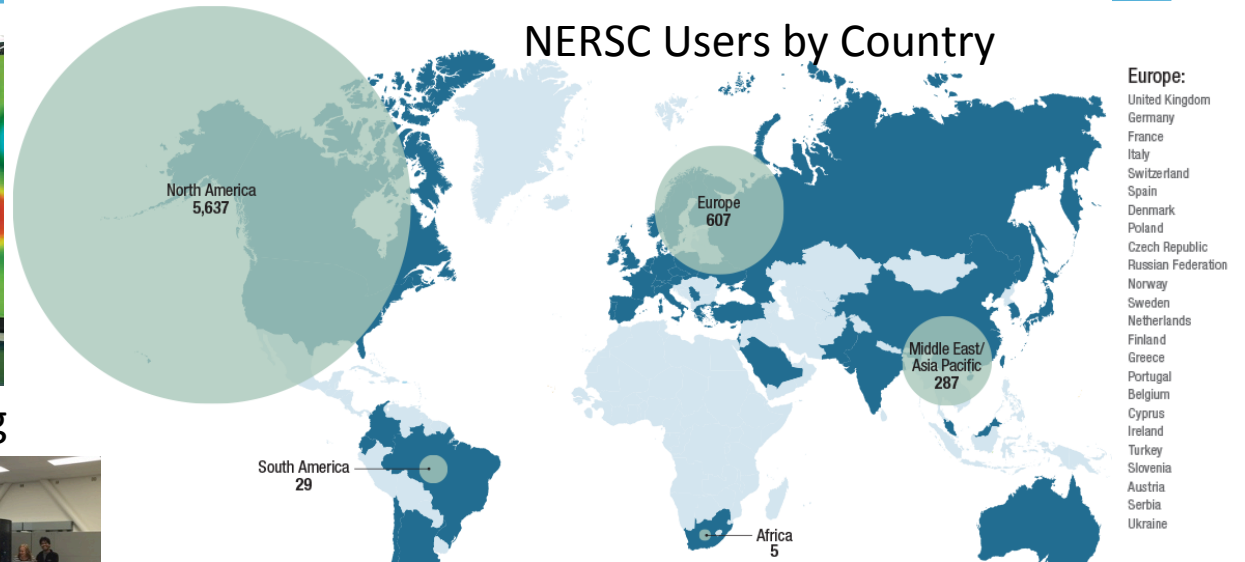*Lawrence Berkeley National Laboratory, USA*

September, 2016

- 1 -

See the results of two user surveys – MPI at NERSC, and MPI Alternatives


Cray XC40 with Knights Landing

Cray XC30

NERSC Users by Country

North America
5,637

Europe
607

Middle East/
Asia Pacific
287

South America
29

Africa
5

Europe:
United Kingdom
Germany
France
Italy
Switzerland
Spain
Denmark
Poland
Czech Republic
Russian Federation
Norway
Sweden
Netherlands
Finland
Greece
Portugal
Belgium
Cyprus
Ireland
Turkey
Slovenia
Austria
Serbia
Ukraine

For Example:

How do you implement point-to-point communication?

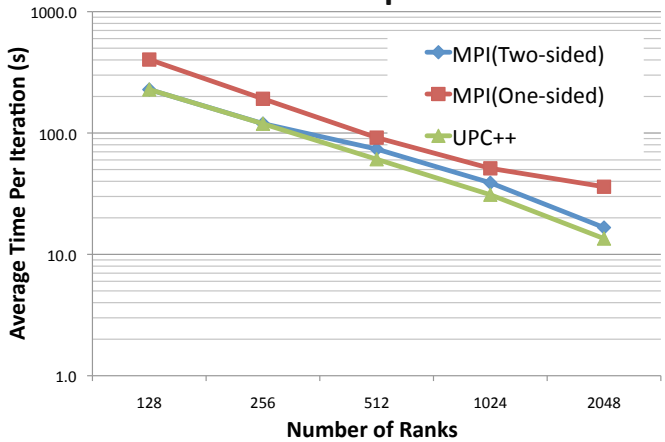|	
Blocking MPI_Send / MPI_Recv	18 (62.1%)
Blocking MPI_Bsend / MPI_Recv	2 (6.9%)
Blocking MPI_Ssend / MPI_Recv	1 (3.4%)
Blocking MPI_SendRecv	5 (17.2%)
Nonblocking MPI_Isend and MPI_Recv	14 (48.3%)
Nonblocking MPI_Send and MPI_Irecv	13 (44.8%)
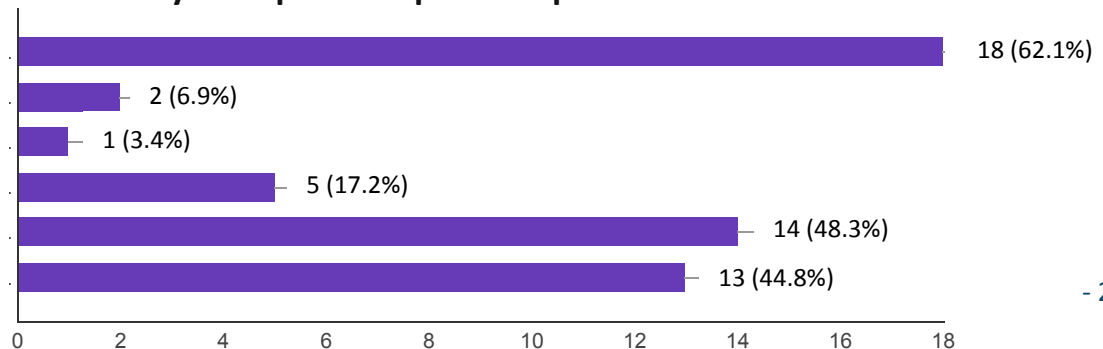
See what MPI alternatives people are using and some recent comparisons with MPI

Which parallel programming model(s)/approach(s) do you use?

Bar chart showing:
- UPC: 8 (30.8%)
- UPC++: 9 (34.6%)
- Charm++: 5 (19.2%)
- Kokkos: 0 (0%)
- Chapel: 1 (3.8%)
- Coarray Fortran: 3 (11.5%)
- HPX: 2 (7.7%)
- OCR -based: 8 (30.8%)
- Legion: 1 (3.8%)
- Parallel Python: 3 (11.5%)
- Hadoop/MapReduce: 1 (3.8%)
- other: 7 (26.9%)
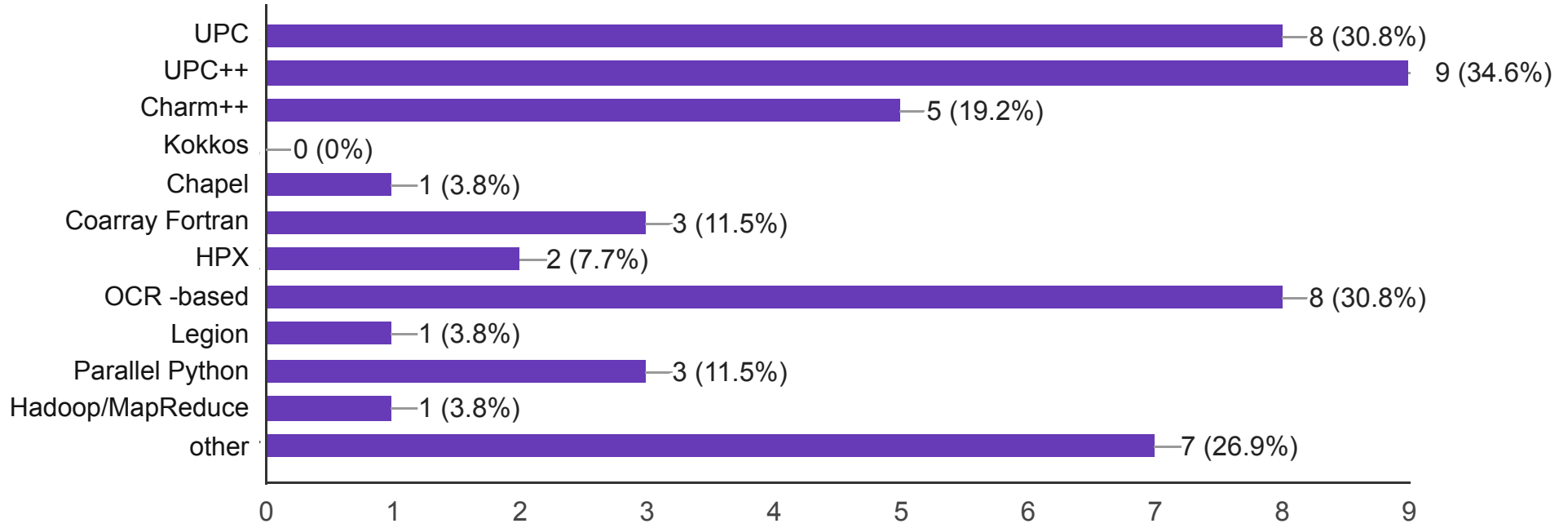
AMR with UPC++ Compared to MPI

Legend: MPI(Two-sided), MPI(One-sided), UPC++. X-axis: Number of Ranks. Y-axis: Average Time Per Iteration (s).

MiniGhost with HPX Compared to MPI

(40 variables - 20 timesteps - 200x200x200 - 10% reduction)

Legend: HPX, MPI/OpenMP, Theoretical Peak. X-axis: Number of Localities (2Localities per Node, 8 Cores each). Y-axis: GFLOPS.