ASC14 Student Supercomputer Challenge

-Preliminary Contest Notifications

Dear Participating Teams:

We hereby welcome you again to participate in the ASC14 Students Supercomputer Challenge. This document will provide detailed information about the preliminary round of the contest.

1. Form of the Preliminary Round

In the preliminary round, each registered team is required to submit a set of documents that include a proposal, optimized code files and output files (detailed requirements specified in the Appendix A). The proposal needs to be written in English, and will be reviewed by the ASC evaluation committee.

2. Submission Guideline

All teams should make their submissions to Info@asc-events.org before 9:00 AM, February 27, 2014 (UTC/GMT +8：00）. The submission should include the following items:

a) The proposal file (in .doc or .pdf format), named by the university or college and the contact person (e.g. AAAUniversity_BBB.doc)**.**

b) The additional files packed as a compressed file, also named by the university or college and the contact person (e.g. AAAUniversity_BBB.zip, other compression formats are also OK). The compressed file should at least include:

- Output files of HPL and Quantum Espresso
- Optimized code, Workload2 output files and log files of 3D-EW

3. For any further queries about the contest, please contact the ASC committee through the following emails:

a) Technical support: TechSupport@asc-events.org

b) Contest organization: Info@asc-events.org

c) News and media: Media@asc-events.org

Appendix A: Requirements on the Proposal for the Preliminary Contest of ASC14 Student Supercomputer Challenge

I. A brief background description of the university`s or the department`s supercomputing activities (5 points)

1. supercomputing-related hardware and environment
2. supercomputing-related courses, trainings, and interest groups
3. supercomputing-related research and application
4. a detailed description of one or two key achievements on Supercomputing research (at most 2 items), attached with proof materials (published papers, award certificates, etc.)

II. Introduction of the Team (5 points)

1. Brief description of the team building process (how the team is organized)
2. Brief introduction of each team members (including group photos of the team)

III. Technical proposal requirements (90 points)

1. Proposed design of the system architecture (15 points)

a) The total power consumption of the system should be less than 3,000 W. Within the limit of the power consumption, the team should design the system to achieve the best performance of HPL and the Quantum Espresso application.

b) The design of the system architecture should include cluster software and hardware configuration, interconnection, power consumption and performance evaluation, and the analysis on the advantages and disadvantages of the proposed design.

c) All teams should build their design based on the Inspur NF5280M3 server. The components listed in the table below will be provided by Inspur to the teams that enter the final stage of the contest. The teams can also choose to use other components (except the server itself) at their own costs.

Item	Name	Configuration
Server	Inspur NF5280M3	CPU: Intel Xeon E5-2692v2 x 2，2.2Ghz，12 cores Memory: 16G x8，DDR3，1600Mhz Hard disk: 300G SAS x 1 *Power consumption estimation:* *E5-2692v2 TDP 115W,memory nominal 7.5W, hard disk nominal 10W*

Accelerator card	XEON PHI-31S1P	Intel XEON PHI-31S1P （57 cores, 1.1GHz, 1003GFlops, 8GB GDDR5 Memory） *Power consumption estimation: 270W*
HCA card	FDR	Infiniband Mellanox ConnectX®-3 HCA card, single port QSFP, FDR IB *Power consumption estimation:9W*
Switch	GbE switch	10/100/1000Mb/s，24 ports Ethernet switch *Power consumption estimation:30W*
	FDR-IB switch	SwitchX™ FDR InfiniBand switch, 36 QSFP port *Power consumption estimation:130W*
Cable	Gigabit CAT6 cables	CAT6 copper cable, blue, 3m
	Infiniband cable	Infiniband FDR optical fiber cable, QSFP port, cooperating with the Infiniband switch for use

2. HPL Test (15 points)

Inspur will only provide free hardware for the final stage of the contest. For the HPL test in the preliminary stage, each team can test and optimize the HPL on their own hardware platforms. The target is to achieve the highest efficiency.

The proposal should include descriptions of the software environment (operating system, complier, math library, MPI software and HPL version, etc.), the testing method, performance optimization methods and performance estimation, problem and solution analysis, etc. In-depth analysis into HPL's algorithm and code is highly encouraged.

The HPL software can be downloaded from: http://www.netlib.org/benchmark/hpl/

Successful verification and optimization of HPL on hardware platforms will be given extra credits. However, teams without required hardware platforms are also encouraged to submit their thoughts and analysis.

3. The Quantum Espresso (QE) Test (20 points)

Similar to the HPL test, the team shall run the QE test on their own hardware to verify the correctness and to achieve good performance and efficiency.

The proposal document shall include the description of the testing software environment (operating systems, compliers, math libraries, MPI software and application software, etc. with version information), the testing methods, performance optimization methods and performance estimation, problem and solution analysis, etc. In-depth analysis into QE's algorithm and code is highly encouraged.

The QE software can be downloaded from: http://www.quantum-espresso.org/

As QE provides different workloads that demonstrate different performance features, in this contest, the teams should focus on the two QE workloads that can be downloaded from: **http://www.asc-events.org/ASC14/032123hiacscdioeucoqe92312iasd.pdf**

4. Design and Optimization of 3D-EW on CPU+MIC platform (40 points)

a) Application background

In this test, we require the teams to perform a design and performance optimization of the 3D Elastic Wave Modeling (3D-EW) code on the CPU+MIC hybrid platform.

3D-EW method is a kind of wave field extrapolation method to simulate the propagation of elastic wave in isotropic elastic medium. In this code, the P-wave and S-wave are simulated separately, so as to achieve a better understanding of the P-wave and S-wave propagation in the elastic medium. This method simulates the propagation of elastic waves through high-order finite difference methods.

Key words: elastic wave, P- and S-wave separation, finite difference method

b) Introduction to application program

i. Program download address:

http://www.asc-events.org/ASC14/032123hiacscdioeucoqe92312iasd.pdf

ii.

- 3d2rewq.tar: 3D-EW source code
- verify.tar: result verification code

iii. 3D-EW source code:

- Compilation command: make
- Running command: ./3d2rewq input_file_name output_file_name log_file_name (e.g.: ./3d2rewq para1.in record1.dat log1.txt)
- Test cases:

Workload	Input file
Workload1	para1.in
Workload2	para2.in

- Arrays such as u, v, w, up, vp, wp, us, vs and ws store the computed results. A part of the up values are used to verify the correctness of the program.

iv. Verification:

- Compilation command: make
- Running command: ./verify record1_old.dat record1_new.dat
- Requirements for result correctness: L1 model smaller than 0.00001; RMS model

smaller than 0.00001

c) Requirements for preliminary contest

i. The proposal should include a section to describe the design and optimization of the 3D-EW code on the CPU+MIC platform. The section should include description of the software and hardware environment, parallelization design methods, performance optimization methods, testing process and results, etc. In-depth analysis regarding principles, parallel algorithm and codes are recommended.

ii. After parallelization and optimization, the final code should be tested with the Workload2 case on the computing platform provided by the organization committee. This platform includes 4 computing nodes, each of which has two CPUs and one MIC card. After the test, you should pack and submit your optimized code, Workload2 output file and log file to ASC committee.

d) Specific notes

i. ASC committee provides remote testing platform which includes CPU and MIC cards（Xeon PHI 7110P）. The detailed information of the testing platform is provided in "Appendix B. Description of the remote testing platform". Hardware configuration of the platform is fixed.

ii. The original code is written in C. Revised code should include appropriate comments.

iii. You can run your program either on CPUs or on both CPUs and MICs. You may use some parallel programming methods such as MPI, OpenMP, pThread and OpenCL to write your code, but all these methods should be supported by MIC. If the program utilizes the computing resources of the MIC cards, you must use the MIC offload programming model.

iv. This application will also be tested in the final contest, but on a much larger CPU+MIC cluster.

Appendix B. Description of the remote testing platform

Note: The testing platform is only used for all ASC14 teams to carry out parallel optimization test of the 3D-EW application.

I. Configuration of the remote testing platform

All nodes of the **remote testing platform** are Inspur NF5280M3 servers. The platform consists of login/compiling nodes and cluster nodes. The detailed configuration is as follows:

- 10 login/compiling nodes for login, compiling, doing single-node tests, and submitting multi-node jobs to the cluster nodes. These nodes will be accessed through the same IP address, but the users will be automatically distributed into different nodes;
- 4 cluster nodes that form a small-scale CPU+MIC hybrid cluster. Multi-node tests on this small-scale cluster can only be carried out by submitting jobs to the cluster.

Item	Name	Configuration
Server	Inspur NF5280M3 x 14	CPU：Intel Xeon E5-2692v2 x 2, 2.2Ghz, 12 cores
		Memory: 16G x8, DDR3, 1600Mhz
		Hard disk: 300G SAS x 1
		Accelerator card: Intel XEON PHI-7110P （61 cores, 1.1GHz, 1073.6GFlops, 8GB GDDR5 Memory）

II. Instructions of remote testing platform

1. Login account:

Platform login IP address: 123.127.250.114

The login account and password for users to log in Inspur ASC14 platform shall be allocated and set by system administrator and will be notified to users through E-mail. Users shall change the password after first login. The login account will become automatically invalid after the contest is finished. The same account allows at most 2 users to log in at the same time.

2. Storage space:

Each user will have 20GB storage space by default. Users shall make their own data backup and timely clear the disk space. In case the user needs to use a larger disk space, please contact the ASC administrator directly through info@asc-events.org.

3. Using principles

As mentioned above, the login/compiling nodes shall be used for login, compiling, and doing single-node tests. Multi-node test shall be performed on the cluster nodes by submitting jobs.

For more detailed description, please refer to “ASC14 remote Student Supercomputer

Challenge testing platform manual".

Any problem encountered by users in using the Inspur ACS14 remote testing platform shall be sent to techsupport@asc-events.org, and the system administrator will provide the answer.