

## CHARTER RENEWAL APPLICATION – SIAM SIAG SUPERCOMPUTING

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity on Supercomputing. The SIAM Activity Group (or SIAG) to which this renewal applies was originally formed under the aegis of SIAM on July 16, 1984 by the SIAM Council and July 17, 1984 by the SIAM Board of Trustees. Its initial operating period began January 1, 1985 and ended December 31, 1987. Its charter has been renewed by the Council and Board nine times thereafter. This SIAG has 814 members as of December 31, 2012; of these, 311 were students.

According to its Rules of Procedure, the objectives of the SIAG are provide an environment for interaction between developers of large-scale applications programs, applied mathematicians, algorithm designers, and computer architects, to foster the development of analytic methods, efficient algorithms, and applications software in context with advances in computer architecture as applied to high performance computing.

Its proposed functions are to:

- 1) Organize minisymposium at the SIAM Annual meeting in years when there is no Parallel Processing Conference.
- 2) Organize a track of at least six minisymposia at the SIAM Annual Meeting at least once every five years.
- 3) Organize a biennial SIAM Conference on Parallel Processing.

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The SIAG has complemented SIAM's activities and supported its proposed functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

1. *How is the field covered by the activity group doing? Is it growing, is the focus shifting? What have been the significant advances over the last [two/three] years?*

This field covered by the SIAG-Supercomputing activity group is growing in new dimensions. What was once a niche topic for only the most challenging problems faced by nations and the national laboratories in terms of solving large-scale science problems has now broadened to real-world problems that can be solved on the desktop, to “Big Data” applications in the face of massive data sets.

Industry began hitting the limits on exponential growth of performance on individual microprocessors over a decade ago and is now building commodity processors with increasing numbers of cores. Parallel computing is now ubiquitous and mainstream. Every new machine now has more than one core. Several years ago, Mike Heroux wrote “The supercomputing and larger parallel computing fields that SIAG/SC represent are experiencing a kind of intense interest that is probably as great as ever in the history of this SIAG.” This is still true. There are parallel algorithmic and architectural challenges at the small scale (single desktops, laptops, and servers), middle scale (heterogeneous architectures), large scale (current supercomputers), to future exascale systems.

Although there is still effort to improve the performance of algorithms for GPUs, and to increase the number of applications that run well on such architectures, there has been particular work in recent years on multicore and manycore algorithms and on algorithms for cloud computing based on the map-reduce paradigm such as Hadoop. A growing area for SIAG/SC is large data problems such as storage management, summaries, streaming computations, and general data mining, including complex network analysis.

Designing an exascale computer and making it programmable is still a huge challenge that will drive the highest end of parallel computing in the near future. Recent efforts in hardware/software co-design expose challenges in programming models, architecture, algorithms, applications, and operating systems. There is an increased focus on reliability/resilience in computer software.

2. *How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG stable or increasing? How is the SIAG keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG?*

This SIAG is healthy. Membership grew from 710 members on December 31, 2008 to 888 members on December 31, 2010, a 25% increase. And as of December 31, 2012, there are 814 members. While the membership has a slight decline, there may be some external reasons such as the world-wide economic decline that has limited professional travel (and potential SIAM renewals). Even still, the membership numbers remain strong.

3. *Please list conferences/workshops the activity group has sponsored or co-sponsored over the past [two/three] years, and give a brief (one sentence or phrase) indication of the success or problems with each.*

The Parallel Processing (PP) Biennial Conference has a strong history dating back the early eighties. Numbers at PP12, held February 15-17, 2012, in Savannah, Georgia, have surpassed previous figures of any meeting since 1991 with respect to the total number of registered participants (at around 458), the number of sessions and lectures taking place, and the number of posters presented. This meeting is doing very well, and is still a great place for networking among applied mathematicians, computer scientists, academics, lab experts, etc. As a comparison, the prior PP conference, PP10, had 406 attendees and was held in Seattle, WA. As described above, SIAG/SC's mission space involves fundamental issues in parallel computing which are now fundamental issues in all computing. This SIAG is focused on algorithm development and performance analysis, both mathematical and experimental, on parallel architectures, system software, runtime systems, and user tools. Although some understanding of parallelism is important for many extreme-scale applications, this SIAG's focus explicitly on all things parallel is unique, and complementary to the rest of SIAM's interests.

Several minisymposiums at two 2013 SIAM meetings focused on parallel processing. In 2013, SIAG/SC held sessions at the SIAM Conference on Computational Science and Engineering, February 25 – March 1, 2013, in Boston, MA.

4. *Please indicate the number of minisymposia directly organized by the activity group at the last [two/three] SIAM Annual Meetings. When did the SIAG last organize a track of minisymposia at an annual meeting? On February 15-17, 2012 in Savannah Georgia the last SIAG/SC conference was held with 450 attendees. See other SC conference information at: <http://www.siam.org/meetings/archives.php#PP>*

The activity group last had an official track in the SIAM Annual Meeting in Denver in 2009, and the next official track will be at the SIAM Annual Meeting in 2017.

At the SIAM Annual Meeting 2013, in July 7-13 2013, the following minisymposiums related to areas of parallel processing:

- MS15 Parallel Graph Algorithms on Emerging Architectures
- MS93 Algorithms, Libraries and Frameworks for Scalable Manycore Computations - Part I of II
- MS124 Algorithms, Libraries and Frameworks for Scalable Manycore Computations - Part II of II

5. *Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?*

SIAG/SC maintains a website. We have a monitored mail list to which forwards postings announcing positions, workshops/conferences, books, and other news items that might be of interest to SIAG/SC members. SIAG/SC sponsors two prizes: one for a senior researcher and one for a junior researcher. The first two prizes were presented at PP10, and the second two prizes given at PP12. An awards committee has been formed to selecting the third winners at PP14.

6. *What activities are planned and proposed for the next period of the charter? Please describe scheduled and suggested future activities in detail.*

This SIAG organized sessions at the SIAM annual meeting AN13 and considering sponsoring an official track at AN17.

At the last business meeting, Bader expressed that the SIAG needs more active reporting on what's happening in our community, e.g. via a SIAG newsletter, or blog sites. He asked anyone who is interested in blogging about our SIAG to let the committee know.

7. *How can SIAM help the activity group achieve its goals?*

Perhaps the single largest missing element for SIAG/SC is a natural journal for publication of related research. Certainly SIAM-SISC is a related journal and SIAG/SC members publish in it, but SIAM-SISC has not traditionally published much of the SIAG/SC-related research content. Instead SIAG/SC-related content has been published in other venues such as the Supercomputing conference series proceeding and other high performance computing journals. We think this is a function of two things: SIAM-SISC has a tradition of publishing theoretical and small-scale computing results. Also, the time lag between submission and publication of papers in SIAM-SISC is very long (12-18 months) which is not ideal for SIAG/SC-related research since supercomputing is a fast-paced field.

In the past, SIAG/SC officers have discussed this issue with the SIAM-SISC editorial staff and there is interest on their part to accept more content from SIAG/SC-related work. This was announced at the PP10 business meeting, but there does not (yet) appear to be a surge in large-scale parallel scientific computing research in SISC.

8. *How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?*

SIAG/SC represents the intersection of SIAM with the wider supercomputing and parallel computing communities. Therefore, we can help SIAM understand these communities and recognize opportunities for future interaction. This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2014.

Signed  
David A. Bader, SIAG Supercomputing Chair  
June 30, 2013