

Sustainable C[★]omputing

REGISTER

Monthly newsletter of the IEEE Computer Society Special Technical Community on Sustainable Computing
Providing quick access to timely information on sustainable computing.

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The IEEE STC on Sustainable Computing

Mission

The STC on Sustainable Computing (STC-SC) is one of the initial set of IEEE Special Technical Committees (STC). The STC-SC takes a holistic view of information technology (IT). Any domain that uses or could potentially benefit from using IT is relevant to STC-SC. The two primary goals of STC-SC are: (1) to promote the design and implementation of sustainable computing; and (2) to facilitate computing for sustainability. With respect to these goals, topics relevant to STC-SC include (but are not limited to):

- Energy efficient design and operation of IT equipment (servers, storage and networks).
- Sustainability across the life cycle of IT equipment and processes.
- Measurement and evaluation of the sustainability of existing IT infrastructures.
- Models or methods that facilitate sustainable computing.
- Use of computing to systematically improve the sustainability of non-IT processes.



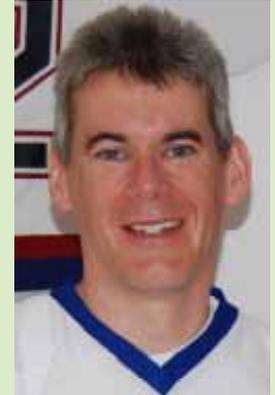
Report from the chair: To streamline the creation of our newsletter, the editor, secretary-treasurer and I have documented a monthly timeline to capture the tasks that need to be completed for each issue, and when they need to be completed by. We will refine this over time, as we learn what works well and what does not.

Our membership numbers are not growing as quickly as we would like, so a main focus in the coming months will be on addressing that. In addition to the steps that will be taken by the officers, we encourage the members of STC-SC to recruit their colleagues/students. Only through a combined effort will we achieve the level of growth that we desire.

- Martin Arlitt

Co-Chair: Ishfaq Ahmad
U. of Texas at Arlington

Co-Chair: Martin Arlitt
HP Labs/U. of Calgary



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Resource and Energy Management

By Danilo Ardagna, Politecnico di Milano



SPECpower benchmark new release

SPECpower_ssj2008 is the first industry-standard benchmark to evaluate power and performance characteristics of volume-server and multi-node class computers. While many vendors self report energy efficiency figures, these figures are hard to compare due to differences in workload, configuration, and test environment. SPECpower_ssj2008 provides a means to measure power (at the AC input) in conjunction with a performance metric. This should help IT managers to consider power characteristics along with other selection criteria to increase the efficiency of data centers.

Focusing on server side Java applications, SPECpower_ssj2008 exercises the CPUs, caches, memory hierarchy and the scalability of shared memory processors (SMPs) as well as the implementations of the JVM (Java Virtual Machine), JIT (Just-In-Time) compiler, garbage collection, threads and some aspects of the operating system. It reports power consumption for servers at different performance levels, from 100-percent to idle in 10-percent segments. By measuring multiple levels, SPEC recognized the fact that processing loads and power consumption on servers vary substantially over the day. To compute a power-performance metric across all levels, measured transaction throughputs for each segment are added together, then divided by the sum of the average power consumed for each segment. The result is a figure of merit called “overall ssj_ops/watt.”

Official results with this benchmark yield valuable insight into the energy efficiency of competing systems and hardware components. Specifically, on the hardware side, there has been almost a 6x improvement over the last four years. Further, the gap between peak and idle power consumption has increased. In other words, the power consumption under idle conditions contributes less to whole-server power consumption. Current hardware development is moving in the direction to build energy proportional systems. Ideally, future systems will consume almost no power when idle and gradually consume more power as the activity level increases.

The newest version V1.11 of the benchmark was been released in September. It includes several enhancements and code changes to all software components, documentation updates, and reporting rules enhancements. All SPECpower_ssj2008 results published after December 2011 must use version 1.11. All existing licensees will receive a notice on how to get a free update.

Also, the first beta version of the Server Efficiency Rating Tool (SERT) has been released. SERT is a comprehensive toolset that addresses requirements of the Environmental Protection Agency’s ENERGY STAR for Servers v2.0 specification. SERT is not comparable with SPECpower_ssj2008, since it does not provide a composite power/performance score. Instead, it produces detailed information about the influence of CPU, memory and storage I/O configurations on the power consumption of servers.

PICK OF THE MONTH APRIL 2012

Capping the Brown Energy Consumption of Internet Services at Low Cost by Kien Le, Ozlem Bilgir, Ricardo Bianchini, Margaret Martonosi, and Thu D. Nguyen published in the Proceedings of the First International Green Computing Conference.

The Pick of the Month winner received the Best Paper Award at IGCC 2010. At a time when sustainable computing and energy efficiency were synonymous, this paper exposed a qualitatively different challenge: Increasing the ratio of clean energy to dirty (brown) energy used to power an Internet service. Two years after the publication of this paper, research groups worldwide have taken on the challenge; many exploit the request distribution mechanism introduced by the Pick of the Month. Prestigious venues ranging from SIGMETRICS to ASPLOS to Middleware have published papers inspired by this pioneering work. We are fortunate to have all of the authors involved in the interview for this month's article.

Christopher Stewart: First of all, congratulations on receiving the best paper award at IGCC. That is quite an honor. How did that award compare to any prior awards that you've received?

Authors: : The IGCC award was a great honor. Having our paper selected as a Pick of the Month is also very special, since the committee has had time to evaluate the potential impact of our work almost two years after its original publication. We very much appreciate this recognition.

Christopher Stewart: By any definition, this was a pioneering work. Even the motivational description , where you describe cap-and-trade, cap-and-pay, and cap-as-target, was novel in the context of datacenters. Now, two years later, can you discuss some of the broader impacts from this work?

Authors: Since the publication of our work, we have seen many more academic works on performance- and cost-aware load distribution across datacenters, which was perhaps the most general aspect of our paper.

We are also now seeing more interest, in both academia and industry, in replacing some brown energy consumption in datacenters with green energy consumption. The recent announcement that Apple is building a 20MW solar array for its datacenter in North Carolina is an example of this increased interest.

Christopher Stewart: Cap and trade legislation has stalled in congress. Do you see a way forward for carbon footprint management in tomorrow's Internet services and datacenters?

Authors: Initiatives like Apple's suggest that, with or without legislation, industry will remain interested in approaches for managing their carbon footprints. Our work identifies what software infrastructure is needed and what optimization opportunities exist... to lower the carbon footprints of Internet services.

Disclaimer: Comments in this article reflect the personal views of the interviewed authors only. These views may not reflect the views of other authors, affiliated institutions, or the publishing organization.

Nominations are Open!

Each issue of the Sustainable Computing Register features a Pick of the Month, a research publication or industry project that has significantly advanced the field of sustainable computing. The goal is to increase awareness within our community about high-impact, transformative research.

Selection Process:

1. Members can submit worthy papers and industry projects by emailing me.
2. Submissions endorsed by 2 STC-SC officers will advance to public vote on Facebook.
3. By visiting our Facebook page, all members can vote for their favorite paper. At the end of each month, the paper with the most votes will become a Pick of the Month (provided the authors agree to be interviewed). Papers nominated but not selected for more than four (4) months will be removed.

Requirements for nominees:

- The paper must have been published in a peer-reviewed, research forum.
- The paper must be related to sustainable computing, e.g., energy efficiency, renewable-powered computing, smart grid, life cycle of ICT, smart buildings, etc.
- The paper must have been published in the last 2 years.
- Industry projects must have shown significant practical impact or intellectual contribution.

Christopher Stewart: Let's talk about some of the technical highlights of the paper. Section 3A describes a very realistic system setup while covering a lot of details like contract lengths with electric utilities, energy accounting periods, and SLA enforcement policies. Did it take a long time for you all to come to a consensus on these details? Was there industry involvement?

Authors: Well, we believe that there was industry involvement through reviews that we received for an earlier version of the paper. *Smiles*

Christopher Stewart: Humility seems to be a common trait among best paper award winners nowadays.

Authors: We simply selected a set of guidelines that seemed reasonable and realistic, and demonstrated our approach for them.

Christopher Stewart: The paper proposes simulated annealing to find the best hourly request distribution policies over a week. However, a week is a long time for a real application. Have you tailored this aspect of your approach when talking to industry partners, e.g., Google, etc? Are there other changes that you have been forced to make for practitioners?

Authors: The duration of the SLA was one of the controversial aspects of our work. Interactive services often are not willing to degrade response time at all. When they are amenable, they may object to a long duration to provide guarantees, such as one week. We focused on one week for two reasons: (1) many services have less stringent requirements on performance; and (2) it demonstrates an upper bound on the benefits of our approach. Nevertheless, we also studied variations in which our systems guaranteed that the SLA would be satisfied every hour.

Christopher Stewart: From this paper, I learned that (at least some) Internet services can invest in clean energy without losing too much performance or spending too much money. However, an important open question is how much should each service invest? In particular, how should a voluntary initiative, like Apple's, set a carbon footprint target? Any ideas?

Continued on page 6

Networks & Distributed Systems

By Guillaume Jourjon, NICTA



Another Kind of Green Network

For some time, I wanted to talk about this subject that I first heard about through a French radio show called Place de la Toile (in French only from France Culture). Many of you may have already heard of it from Wired. The topic is the Botanicalls Initiative. For those haven't heard of it yet, the Botanicalls Initiative aims to build an information channel between you and your garden. Well, in a way.

This project, in the style of “Do-It-Yourself” projects, is a kit to build a sensor network for your garden. In a nutshell, the kit consists of a hydrometer that connects to your local area network (LAN) by Ethernet. Once you have built the complete kit, you “plant” the hydrometer next to your beloved tomato and when it detects a low level of moisture, it will communicate to you via SMS or a tweet. You can also make the tweets public so other people can follow. Presumably, if they are next to your home and you give them an access, they can come and water your plant for you, creating a new kind of green network where the green is brought by the plants.

This kind of initiative as many of the new uses of the so-called social media is a very interesting example of “reducing societal energy use”. Nevertheless, this kind of solution presents large challenges for the networking and to certain extents to the CS community; indeed the question is now how to measure its impact and its benefits? On one hand, you have a simple gadget which must have cost in terms of Green House Gas emission to produce and that consumes some electricity everyday but on the other hand, the service of this tool is manifold. On the agriculture level, this tool could potentially increase the productivity of home-grown vegetable and fruit and therefore reduce the need of industrious agriculture. Eventually, we can also consider the benefit of this green network, constituted of a heterogeneous aggregate of plants, machines and humans, on the social interactions of the different persons involved.

April Pick of the Month (continued from page 5)

Authors: This is a very difficult question. We believe that there are [many] dimensions that affect this decision: Is the investment required by legislation or voluntary? How much direct and indirect benefit is the investment likely to produce? How aggressive can the service be about degrading performance? These questions can only be answered in a case-by-case fashion.

Christopher Stewart: Finally, the classic questions for pioneers. What advice do you have for sustainability researchers considering research in the area?

Authors: We would encourage those researchers who have already started in this direction to keep at it, regardless of the political winds of the moment. To those researchers considering whether to enter this area, we would say “join us”; there are many interesting research challenges in load distribution across datacenters and, especially, in leveraging green energy in these installations.

Christopher Stewart: Thank you all for contributing to this interview. I hope that you will join us, the Sustainable Computing STC. I'll be sending a facebook and linkedin request to each of you.

STC Updates

By Giuliano Casale, Imperial College



Membership: 73

Report from Secretary/Treasurer (Giuliano Casale):

- Collected officers' activity reports and prepared monthly STC report.

Report from Conferences Chair (Diwakar Krishnamurthy):

- Continued to update master list of conferences based on suggestions from other officers.
- Solicited collaborations from organizers of sustainability-themed conferences to be held in April.

Report from Academic Chair (Niklas Carlsson):

- Sketching on a potential short-feature that may help showcase academic and industry groups/people. This effort will be coordinated with industry chair.

Report from Membership Chair (Anirban Mahanti):

- As the membership grows, the process of determining unique memberships is becoming more difficult. The officers are trying to figure out a process for making membership management easier.

Report from Communications Chair (Abhishek Chandra):

- Continued to identify conferences, workshops and journals relevant to sustainable computing.
- Prepared a spreadsheet with information about upcoming call for papers and call for participation, for inclusion in the monthly newsletter and website.

Report from Policies and Procedures Chair (Stephen Dawson):

- Documenting currently implemented STC-SC processes and gathering requirements for future processes.

Report from Industry Chair (Canturk Isci):

- Working on finalizing the industry feature focusing on research on sustainability in IBM.
- Coordinate with Academic Chair on the industry/academy showcase features.

Report from Information Officers (Danilo Ardagna, Guillaume Jourjon):

- Contributed material for newsletter and blogs.

Report from the Newsletter Editor (Christopher Stewart):

- Finished setting up online voting for the pick of the month
- Brought in more regular contributors to the newsletter

Upcoming Events

By Abhishek Chandra, University of Minnesota



The following venues are all requesting submissions on subtopics related to sustainable computing or IT for sustainability.

Conference, Workshop & Symposium Call For Papers

Short Name	Main Topic	Location	Dates	Abstracts Due	Papers Due	Notification
GreenCom	Green Communications	Online	Sep. 25-28, 2012		Apr. 3, 2012	Jun. 15, 2012
SustainIT	Sustainable Internet	Pisa, Italy	Oct. 4-5, 2012		Apr. 16, 2012	Jun. 30, 2012
ICEP	Energy and Performance	London, UK	May 29-Jun. 1, 2012	Apr. 14, 2012	Apr. 20, 2012	Apr. 27, 2012
SC'12	Supercomputing	Salt Lake City, UT	Nov. 10-16, 2012	Apr. 20, 2012	Apr. 27, 2012	
EnA-HPC 2012	Energy-aware HPC	Hamburg, Germany	Sep. 12-14, 2012		Apr 29, 2012	May 21, 2012
GreenMetrics 2012	Sustainable computing	London, UK	Jun. 11, 2012		May 1, 2012	May 15, 2012
	Green Communications and Net-					
GreenNETS 2012	working	Gandia, Spain	Oct. 24-26, 2012		May 1, 2012	Jun. 11, 2012
OSDI'12	Computer Systems	Hollywood, CA	Oct. 8-10, 2012		May 3, 2012	Jul. 10, 2012
SustKDD	Data Mining for Sustainability	Beijing, China	Aug. 12, 2012		May 9, 2012	May 21, 2012
Middleware 2012	Middleware Systems	Montreal, Canada	Dec. 3-7, 2012	May 18, 2012	May 25, 2012	Aug. 10, 2012

Journal and Special Issue Call For Papers

Journal

Sustainable Computing

Papers Due

(Open)

Conference, Workshop & Symposium Call for Participation

Short Name	Main Topic	Location	Dates
EuroSys 2012	Computer Systems	Bern, Switzerland	Apr. 11-13, 2012
WWW 2012	World Wide Web	Lyon, France	Apr. 16-20, 2012
SmartGreens	Smart Grids and Green IT	Porto, Portugal	Apr. 19-20, 2012
ICPE'12	Performance Engineering	Boston, MA	Apr. 22-25, 2012
	Networked Systems Design and		
NSDI'12	Imp.	San Jose, CA	Apr. 25-27, 2012
e-Energy 2012	Future Energy Systems	Madrid, Spain	May 9-11, 2012
CCGrid 2012	Cluster, Grid and Cloud Computing	Ottawa, Canada	May 13-16, 2012
IPDPS'12	Parallel and Distributed Systems	Shanghai, China	May 21-25, 2012
IGCC'12	Green Computing	San Jose, CA	Jun. 5-8, 2012
Sigmetrics'12	Measurement and Modeling	London, UK	Jun. 11-15, 2012
USENIX ATC'12	Computer Systems	Boston, MA	Jun. 13-15, 2012
	Green Communications and		
GCC'12	Networking	Ottawa, Canada	Jun. 15, 2012
	High Performance Distributed		
HPDC'12	Computing	Delft, Netherlands	Jun. 18-22, 2012

Sustainable Computing: Informatics and Systems

The journal for sustainable
computing research

Sustainable computing research spans computer science, electrical engineering, sustainability science, and many other engineering disciplines. SUSCOM publishes research findings related to energy-aware and thermal-aware management of computing resources, as well as research on the ecological and societal impacts of computing.

Submit your article at
<http://ees.elsevier.com/suscom/>

Visit <http://stc-sustainable-computing.ieee.net/venues> for more information about these events.

To advertise a relevant venue, email Abhishek Chandra at chandra@cs.umn.edu.

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