Sustainable Computing

REGISTER

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The IEEE STC on Sustainable Computing

About STCs

In 2011 the IEEE Computer Society started a pilot project to form "Special Technical Communities" or STCs. STCs are intended to be more flexible and dynamic technical communities than have typically formed. They should embrace new or emerging technologies such as online social networks to quickly form STCs around timely topics, while also "sunsetting" when appropriate. STCs should also explore alternate methods to achieve financial sustainability.

Mission

The STC on Sustainable Computing (STC-SC) is one of the initial set of STCs. 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.

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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 computing applications with ecological and societal impacts.

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Resource and Energy Management

by Danilo Ardagna, Politecnico di Milano

In recent years, the energy consumed by information and communication technology (ICT) has increased steadily. The energy consumed by data centers and communication networks alone account for 2-4% of global CO_2 emissions, that means ICT pollutes as much as global air traffic, and it is projected to reach up to 10% in 5-10 years, fuelled by the expected massive adoption of cloud computing.

It is critical that future cloud infrastructures be energy-efficient. However, some predictions suggest that only improving energy efficiency would be insufficient to counterbalance the growth of energy consumption due to new equipment.

One way to reduce ICT's carbon footprint is to exploit green energy sources. Renewable energies promise to mitigate greenhouse gas emission. However, the adoption of green energy sources in modern data centers is also extremely challenging, since the power production of renewable power plants may vary in time, e.g., due to the waxing and waning of the wind or more generally weather conditions.

The paper "Utilizing Green Energy Prediction to Schedule Mixed Batch and Service Jobs in Data Centers" by Baris Aksanli, Jagannathan Venkatesh, Liuyi Zhang, and Tajana Rosing presented at HotPower 2011 proposes the adoption of accurate solar and wind energy predictors more efficient than state-of-the-art time series models. In particular, solar energy is estimated through an extension of weather-conditioned moving average, initially proposed for wireless sensors networks, while wind energy is predicted very efficiently using only information on wind speed and direction by implementing weighted nearest-neighborhood tables. The accuracy achieved by the predictors is on average within 10 and 20%, respectively, with a 30 minutes prediction time horizon.
The authors have also shown through an interesting simulation study mixing Mapreduce jobs and Web workloads, that the green energy efficiency (i.e., the ratio of the green energy doing a useful work versus the total green energy available) can be improved by 3x, with respect to the case of instantaneous use of the green energy at the Cloud data center.

Letter from the Editor:
Computing at the Crossroads: Now is the Time to Push for Sustainability

Let me begin by thanking the chairs, officers, and contributors for their time, support, and commitment to this publication. This is our second issue and it looks like there will be many more to come.

As the reign of Moore's law diminishes, computer designers, builders, and users are looking for new principles, hardware, and applications to guide us into the future. Scale-out datacenters, many core processors, and NoSQL web databases (a la Twitter and Facebook) are just a few of the technologies born from the reality that Moore's law can no longer produce twice-as-fast processors as it once did. The world **is** changing! This is an excellent time to direct the field into a new, positive direction. By putting sustainability principles in place now, we can ensure that tomorrow's designers, builders, and users will have unprecedented control over their energy, ecological, and societal footprints.

Our STC is leading the way. Please visit our Facebook or LinkedIn pages (on the front cover) to join us.
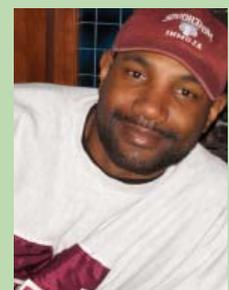
Newsletter Editor
Christopher Stewart

Pick of the Month in Sustainable Computing

by Christopher Stewart, Ohio State University

Recognizing the Research and Researchers that are Shaping our Field

Each issue of the Sustainable Computing Register will feature a Pick of the Month, a research publication that has significantly advanced the field of sustainable computing. This feature has two goals. First, we want to increase awareness within our community about high-impact, transformative research. With so many top-tier venues worldwide accepting papers in the area of sustainable computing, it is easy to miss jewels published in an unfamiliar forum. The second goal is to provide deeper insight into author's thoughts about their own work. Rather than republishing the picks (as many other communities do), we will interview the authors, asking questions that enrich the community's understanding the work as a whole. We hope that this community will embrace the Pick of the Month as a prestigious award of merit.

Minimum 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.
- At least 1 author must agree to be interviewed about the work.
- The paper should reflect an ongoing research interest of at least 1 author.
- The paper must have been published in the last 2 years.
- The paper must have strong intellectual merit or practical consideration.
- Industry projects can be considered in lieu of a publication *if* they have demonstrated significant practical impact or intellectual contribution.
- Industry projects should not be protected from disclosure.

Features that will distinguish top picks:
- The paper was published in one of the most prestigious research forums.
- The paper received an award, such a best paper or best student paper.
- The paper closes an important open problem in sustainable computing.
- The paper bridges the gap between theory and practice in a way that suggests it will have high impact.
- The paper has been cited frequently.
- The industry project has had demonstrable impact on sustainable computing metrics, e.g., reducing carbon footprint, reducing energy consumption, or improving efficiency.

Recognizing the Picks for March and April 2012

To begin this series, the STC-SC editor and co-chairs picked 2 foundational papers as the first honorees. These papers pioneered new avenues for sustainable computing. They were published in top forums and received best paper awards. They set a high bar for future picks of the month. Without further adieu:

March 2012: "Minimizing Data Center SLA Violations and Power Consumption via Hybrid Resource Provisioning" by Anshul Gandhi, Yuan Chen, Daniel Gmach, Martin Arlitt, and Manish Marwah.

This paper advances the state of the art in system management for Internet services, presenting a novel approach to consider energy efficiency, performance (SLA), and cost in 1 framework. It was awarded best paper at the International Green Computing Conference (IGCC) 2011.

April 2012: "Capping the Brown Energy Consumption of Internet Services at Low Cost" by Kien Le, Ozlem Bilgir, Ricardo Bianchini, Thu D. Nguyen, and Margaret Martonosi. (Pending author interview)

This paper identified a convenient, pre-existing mechanism for greening computing: request routing. The practical approach adopted by this paper inspired many other top sustainable-computing papers that will likely be considered for picks of the month. Further, the idea has influenced distributed systems broadly. This paper won the best paper award at IGCC 2010.

Looking Forward, a Democratic Selection Process

Beginning in April, all STC members will have a direct role in the selection process. Anriban Mahanti and I have devised the following Facebook-driven process for selecting picks of the month. We hope that every member will participate, making the pick of the month reflective of our whole community's input.

Proposed 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.

We will keep track of both picks and public-vote nominees on our website (see front page).

Networks & Distributed Systems

by Guillaume Jourjon, NICTA

Edge Versus Core, Where to Store Data?

With the multiplication of online services and the exponential growth of Internet traffic, an important question has arisen in regards to sustainable and green computing, namely, how to deliver the data to the user in an energy efficient way. On this question, as for many networking issues we can see at least two main trends: centralised and decentralised services.

These two different approaches whilst focusing on the same optimization objective, the minimisation of the energy consumed by a certain service (or a set of them), propose two orthogonal architectures. In the case of the centralised set of solutions, the focus is put on the optimization of the datacenter architecture and a better use of the underlying network. This better use is generally accomplished through the instantiation of several datacenters in the core of the network closer to the end user. Being in the core of the network, these datacenters gain access to a very fast networks such as the fiber optic while, if the general architecture is well balanced, being accessible in a few hops by the user.

In the case of the decentralised solution, the main concept is the use of Peer-to-Peer (P2P) networks to provide the service. As an example, in the NanoDatacenter Project (NaDa), researchers proposed to deploy a managed P2P system on top of a network of home gateways. In this context, every home gateway is in turn virtualized and each virtual machine on this computer can host a slice of a larger service such as Video on Demand. Furthermore, every VM on the home gateway would be instantiated in a secured container in order to maintain close boundary between the several services on the same computer. This approach claims to be more energy efficient as it takes advantage of the home gateway in the client premise to host part of the service and therefore the provider can in turn reduce the size of the datacenter which was in charge of the delivery in the legacy solution.

In these two approaches the common brick is the DLAM close to the premises. These networking components are considered, in the centralised architecture, to consume an excessive amount of electricity because of their configuration as opposed to the other network components. In the case of the completely decentralised version, the data is going through the DSLAM only once as oppose to up to three times in the decentralised version.

In order to fully address this problem, recent research proposed an optimization of the use of the line cards in the DSLAM according to the real use at the consumer premises.

Where do you think we should store the data?

STC Updates

by Giuliano Casale, Imperial College

Report from the chair: January saw the release of the first issue of our monthly newsletter. It was delivered on schedule, and has received a lot of positive feedback. We are currently in discussions with the IEEE Computer Society to determine the logistics for technically co-sponsoring conferences and workshops. We intend to use our newsletter, our presence at conferences/workshops, our online groups and traditional social networking to grow our membership base in the remainder of 2012. Lastly, we intend to document the processes we have followed thus far in establishing our STC, to assist other STCs overcome the hurdles we encountered.

- Martin Arlitt

Membership: 24

Report from Secretary/Treasurer (Giuliano Casale):
• Collected officers' activity reports and prepared monthly STC report.

Report from Conferences Chair (Diwakar Krishnamurthy):
• Continued efforts to establish collaborations with conferences in the area of sustainable computing.
• Will be emailing out our newsletter to those conferences that have responded so far.

Report from Academic Chair (Niklas Carlsson):
• Meeting with the industry chair regarding academia-industry partnerships, including a new (general opportunity list) feature for the STC-SC newsletter.

Report from Membership Chair (Anirban Mahanti):
• STC-SC Facebook group has 23 members
• Advertised our inaugural newsletter on a few sustainability-oriented forums.

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):
• P&P draft on its way. It covers purpose, officers, membership, meetings, and publications.

Report from Industry Chair (Canturk Isci):
• Compiling information on industry and academic programs related to SC jointly with Niklas Carlsson.
• Continue to work on the first industry highlight feature of STC-SC.

Report from Information Officers (Danilo Ardagna, Guillaume Jourjon):
• Contributed material for newsletter and blogs.

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
IWQoS 2012	Quality of Service	Coimbra, Portugal	Jun. 4-5, 2012		Feb. 15, 2012	Apr. 5, 2012
SYSTOR 2012	Systems and Storage	Haifa, Israel	Jun. 4-6, 2012		Feb. 20, 2012	Mar. 26, 2012
GreenTech 2012	Eco-Technology and Green Computing	Chennai, India	Aug. 10-11, 2012		Feb. 24, 2012	Apr. 6, 2012
ICCCN'12	Computer Communication Networks	Munich, Germany	Jul. 30-Aug. 2, 2012		Feb. 24, 2012	Apr. 23, 2012
ICT-GLOW'12	ICT against Global Warming	Vienna, Austria	Sep. 3-7, 2012		Mar. 23, 2012	May 15, 2012
HotCloud '12	Hot Topics in Cloud Computing	Boston, MA	Jun. 12–13, 2012		Mar. 8, 2012	Apr. 23, 2012
MobiCom 2012	Mobile Computing and Networking	Istanbul, Turkey	Aug/Sep, 2012	Mar. 2, 2012	Mar. 9, 2012	Jun. 6, 2012
HotStorage '12	Hot Topics in Storage and File Systems	Boston, MA	Jun. 13–14, 2012		Mar. 12, 2012	Apr. 14, 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. 15, 2012		May 1, 2012	May 15, 2012
OSDI'12	Computer Systems	Hollywood, CA	Oct. 8-10, 2012		May 3, 2012	Jul. 10, 2012

Journal and Special Issue Call For Papers

Sustainable Computing					(Open)	

Conference, Workshop & Symposium Call for Participation

Short Name	Main Topic	Location	Dates
FAST'12	File and Storage Technologies	San Jose, CA	Feb. 14-17, 2012
HPCA 2012	Computer Architecture	New Orleans, LA	Feb. 25-29, 2012
ASPLOS 2012	Architectural Support	London, UK	Mar. 3-7, 2012
CCSES'12	Green networking and Smart Grids	Orlando, FL	Mar. 30, 2012
EuroSys 2012	Computer Systems	Bern, Switzerland	Apr. 11-13, 2012
NSDI'12	Networked Systems Design and Imp.	San Jose, CA	Apr. 25-27, 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
Sigmetrics'12	Measurement and Modeling	London, UK	Jun. 11-15, 2012

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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