Center for High-Performance Computing @ the University of Utah

News

University of Utah Spring 2008

Article

MAKER: An easy-to-use Annotation Pipeline

By Janet Ellingson, Ph.D., Center for High Performance Computing, University of Utah

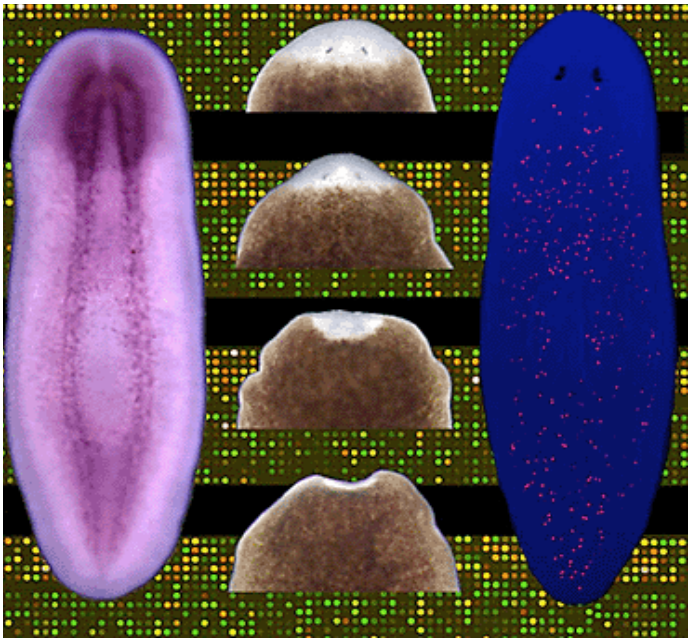
The planarian, a small flatworm found in water throughout the world, has a very useful skill. If its head is cut off, within seven days the body of the decapitated planarian will grow a new head, fully functional and complete. In fact, the planarian has the ability to completely regenerate itself from a fragment as small as 1/279th of its original body. All planarian cells seem to function as stem cells. Because of this remarkable ability, the lowly planarian is a vital tool in the study of body tissue regeneration. It was also the inspiration for MAKER, a software package that aids in the annotation of genomes.

Alejandro Sánchez Alvarado, Ph.D., University of Utah School of Medicine professor and Howard Hughes Medical Institute investigator, has used the species *Schmidtea mediterranea* to study the molecular processes of regeneration. Once the genome of *S. mediterranea* was sequenced, Dr. Sánchez Alvarado set out to identify which genes are involved in regeneration and the precise role each plays. He has learned, for example, that Beta Catenin, a gene that facilitates the replacement of tissues lost to injury and/or amputation, along with another gene Adenomatous polyposis coli (APC) are both essential in determining what type of tissue is grown. If researchers suppress the Beta Catenin gene, the planarian will grow a head at any site of injury. If the APC gene is suppressed, the injured site will regenerate a tail (Kyle A. Gurley, Jochen C. Rink and Alejandro Sánchez Alvarado (2007). ß-Catenin Defines Head Versus Tail Identity During Planarian Regeneration and Homeostasis. Science, 319:323-327). But, how does the planarian know whether it needs a new tail or a new head? Uncovering that mystery of molecular regeneration requires mining huge quantities of genetic data. High performance computing is essential to this task.

Genetic research includes the difficult task of describing the structure, function and location of the genes within the genome and linking them to the particular proteins involved in disease processes. This annotation requires the analysis of an enormous volume of data. Researchers must locate within the genome the small fraction of sequences that encodes genes These regions of the genome must then be assembled into usable gene models, which in turn provide the basis for experiments. For example, the planarian genome appears to contain around 15,570 protein-coding genes hidden among its 1 billion or so bases of DNA. Although we would like to think of ourselves as far more complicated organisms, the human genome has only around 22,000 protein coding genes within its 3 billion or so base pairs of DNA .

With the aid of CHPC computing resources and the genome sequence of the planarian, Mark Yandell, Ph.D., at the University of Utah's Eccles Institute of Human Genetics, developed MAKER, a program that allows researchers working with the genomes of complex organisms to annotate the genes of their sequenced genomes and make that information available to the biomedical research community.

There are currently thousands of genomes being sequenced around the world, and the overwhelming task of annotating genomes has created a bottleneck in genetic research. This is especially true for smaller research communities which often lack bioinformatics expertise. In an attempt to meet



The planarian *S. mediterranea* with florescent-stained neoblasts. The middle images shows the regeneration of the head. From http://www.hhmi.org/research/investigators/sanchezalvarado.html.

their needs, Dr. Yandell created “an easy-to-use annotation pipeline.” He identified several design constraints: since it would be used by researchers with limited bioinformatics and computer resources, it must be truly easy to use; and, since every genome is different, researchers must be able to configure and train the program to suit their needs. MAKER meets these constraints.

In a “proof-of-principle” collaboration with Dr. Sánchez Alvarado, MAKER was used successfully to annotate the planarian genome and the output has been compiled into SmedGD, the planarian’s genome database now available to genetic researchers, who may use the planarian as “a model organism for the study of regeneration, tissue homeostatis and stem cell biology.” [For more information on SmedGD, go to http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=1788131. For the full description of MAKER go to http://www.genome.org/cgi/doi/10.1101/gr.6743907. MAKER is available for download from http://www.yandelllab.org/downloads/maker/maker.tar.gz.]

Article

New problem tracking system at CHPC

By Julia Harrison, Center for High Performance Computing, University of Utah

In February 2008 CHPC installed JIRA, a new software package to track questions and issues reported by our users. Users may still submit questions as usual by sending email to issues@chpc.utah.edu.

Users may also interact directly with the new software by creating their own accounts. The first step is to visit http://jira.chpc.utah.edu and click on “Signup” found near the bottom of the Login area of the web page.

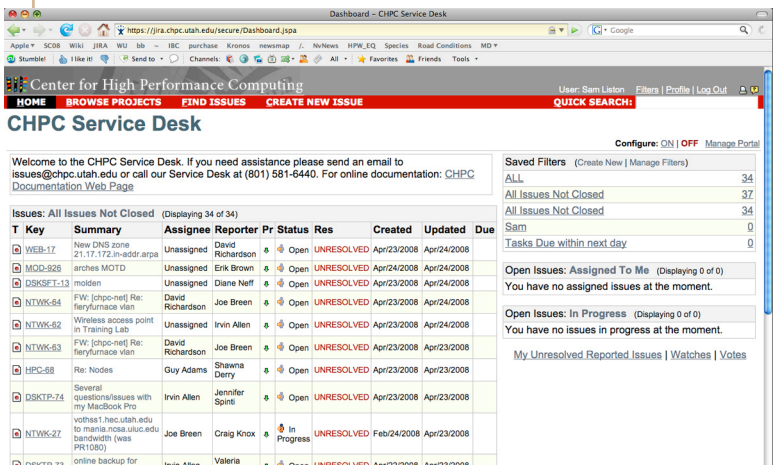
The system will ask you for a username, password (twice), your fullname, email address and a challenge word to insure you are really a person (this filters out automated messages; i.e., spam). Once your account is created, you can login to the system and begin to track the question(s) you submitted to us.

If you elect not to create your account ahead of time, an account will be created for you by the system the first time you send in a question. After sending in your question, you will receive two emails back from the system. One will be an acknowledgement that the issue was received and the second will be your account information. You may either continue interacting with the system via email, or you may go to the link in the second email and view your question. Below is a screen shot of the Home page of the system. You can see the list of open issues and problems on the left hand box, and some other convenient links along the right side.

At the top of the list of open issues you may select “All issues Not Closed,” which takes you to the full list of open issues. From there you can sort on any column you choose by clicking on the heading. You may select which field to display by creating your own customized listing or filter. To do this, start by choosing “Create new filter from current” in the left column. Give your new filter a name, and then to customize it, select “Filter: Edit” (on the left). There you can select which issues you wish to display. By saving these filters, you may customize your home page to display only what you choose.

To customize the look of your JIRA home page, click on “Manage Portal” near the top right of the page. From that page select “Full Configure” then “Add”. This will take you to the “Add Portlet” page. From there find the last choice in the right column “Show Saved Filter with Columns”. Select this one and you will be presented a list of your saved filters. Choose the one you want, click save, and voila, your customized listing is now part of your home page.

If you have questions about using JIRA -- you guessed it, send a note to issues@chpc.utah.edu. Enjoy!



Article

InterPlay - Six Seasons of Access Grid Performance Research

By Beth A. Miklavcic, Jimmy Miklavcic, Mike Daley, Joe Geigel, Marla Schweppe, Joe Reitzer

InterPlay is a multifaceted, real-time, collaborative digital performance event that occurs simultaneously at multiple sites throughout the world. Artists and technologists from several institutions synchronously perform and collaborate in real time, utilizing media and technologies of various forms, such as Access Grid®, streaming digital cinema and audio, computer animation, remote MIDI control, motion capture, and interactive distributed virtual reality.

Electronic and acoustic musicians, dancers, actors, digital graphic artists, virtual reality designers, video artists, motion control engineers, a variety of technologists and others come together, integrating their ideas into this large scale distributed performance. Each site generates two or more video and audio streams that are then transmited onto Internet2. At the host site, these video streams are collected, processed, combined into the digital mix and then transmitted back onto the network. This multimedia content is integrated into each site's local live performance, creating a live distributed cinematic performance event, a richly woven audio-visual tapestry.

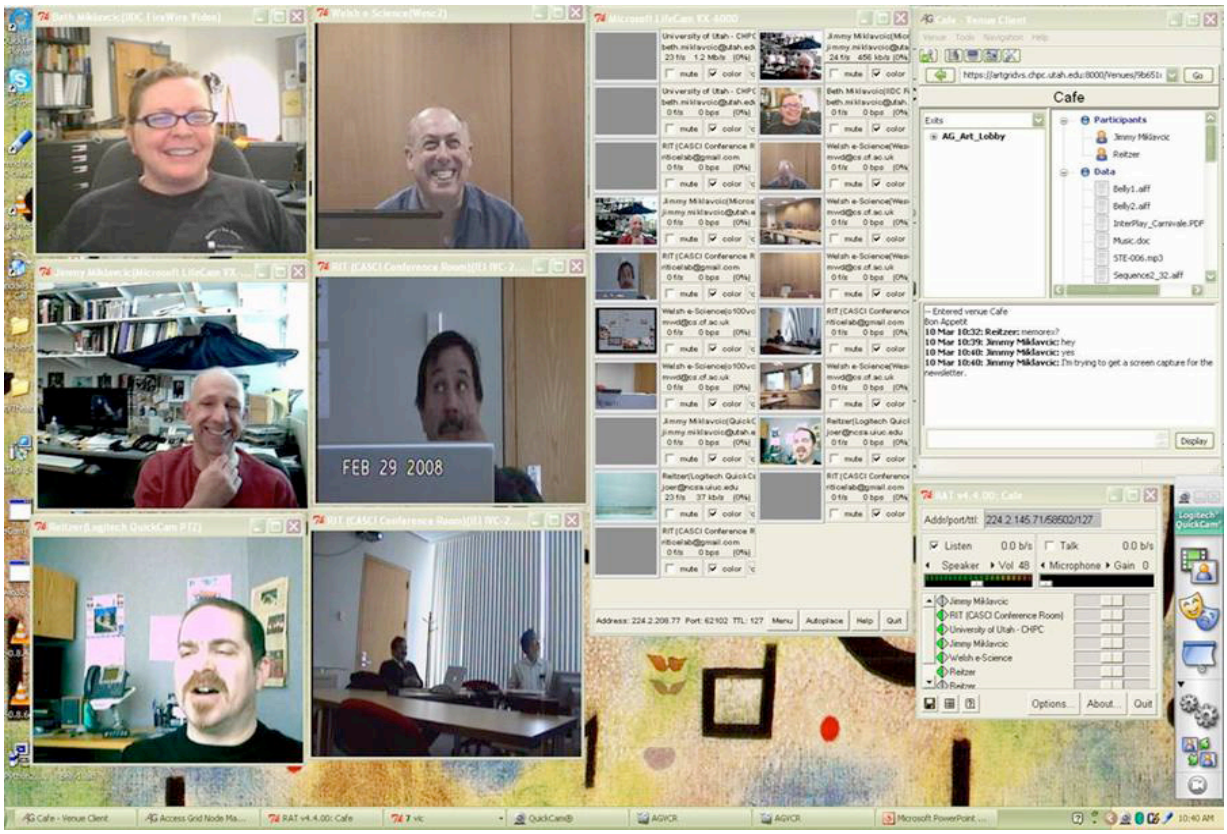
Access Grid Research at the University of Utah Center for High Performance Computing

Currently there are three Access Grid nodes on the University of Utah campus. They include the Center for High Performance Computing, Eccles Health Sciences Library, and the College of Humanities.

The Access Grid was developed by Argonne National Laboratories and is an integrated system of computers, display technology, video/audio devices and open source software that form a high quality videoconference system. More than 246 educational and research institutions from 27 countries throughout the world have adopted the Access Grid technology for their interdisciplinary and collaborative research needs.

The boundaries of its original purpose were stretched by redefining the original Access Grid from standard video conference meetings and using it as the tool to present, create and collaborate during live, distributed performances. By keeping up on the latest improvements and finding the best ways possible to use what is available, we, along with other users have influenced its refinement within the Access Grid Community, and have fostered its development at the University of Utah.

This year, the exciting developments in AGtk 3.1 is the incorporation of H.264 and MPEG-4 codecs developed by the SUMOVER Project, now known as AVATS, at the



University College of London, England. Tom Uram, of Argonne National Laboratories has recently made available a beta version of the new video services. It is available for Windows XP, Linux and Mac OS. The H.264/MPEG-4 codec is a huge improvement over the previous H.261 video compression schema and lends itself to sending full resolution video streams without consuming precious network resources compared to other types of high quality video streaming technology such as DVTS or HDVTS. One issue currently being hammered out with the H.264 codec is flashing white vertical lines when using the IEEE 1394 interface. USB and standard composite video interfaces work fine. The new codec also adds additional load onto the processors, sometimes pushing them to eighty percent of utilization. Currently this affects the AGVCR recording system, developed by Derek Piper of Indiana University School of Informatics, when recording the new video streams.

Network Infrastructure

Internet2 is the foremost U.S. advanced networking consortium. Led by the research and education community since 1996, Internet2 promotes the missions of its members by providing both leading-edge network capabilities and unique partnership opportunities that together facilitate the development, deployment and use of revolutionary Internet technologies.

We have been pushing the network capabilities to its limits and by doing so we have encouraged consistent improvements in multicast networking on campus. Through the dedicated work of Joe Breen, Assistant Director of Networking at the CHPC, and network engineers at both Utah's NetCom and the Utah Education Network (UEN), multicast has been adopted as a vital protocol and is now considered to be integral to the network infrastructure throughout the campus.

Interplay: Carnivale

On March 28-30, 2008 the 6th InterPlay was presented to the public. An annual event since 2003, the development and performance research format has been fostered under Julio Facelli, Director of the Center for High Performance Computing.

InterPlay: Carnivale directed by Jimmy and Beth Miklavcic, is an examination of the mystery of the performing soul through an amalgamation of a variety of celebratory performance mediums such as circus, Mardi Gras, carnival, amusement park, fair and arcade. This live, distributed, real-time, surrealist, cinematic performance unfolds as if walking into a memory of by-gone circuses, carnivals, parks and fairs. The InterPlay begins as if frozen in time, then the carnival awakens and the parade begins.

The collaboration includes content contributed by Mike Daley of Cardiff University, Wales, UK. Mike is the senior technician for the Department of Computer Science at Cardiff University. He has built, operated and maintained several Access Grid Nodes and he supports the Visualization and Augmented Reality group. His contribution to *InterPlay: Carnivale* is the AGCarousel, a program written in pure JAVA that utilizes the Java Media Framework (JMF) to receive multiple video streams and display them in a carousel style around the screen. The program can utilize any screen resolution for its layout. Clicking the mouse on any one of the video streams promotes that video to the front by rotating the carousel around. The program can readily cope with multicast streams. The latest version differs from the original because it no longer requires its own container; therefore the background is always visible.

Marla Schweppe and Joe Giegel from Rochester Institute of Technology in Rochester, New York along with their students designed clowns, jesters and other characters using the Maya 3D modeling and animation package. These characters are viewed and controlled in a shared virtual 3D space that employs a modified gaming engine, adapted specifically for theatrical use. This "virtual theatre" system enables theatrical performances to be shared over the Internet by participants in different physical locales. In *Carnivale*, the character models are controlled, in real-time, by a human

Ring Master Barney Carnacle, played by Travis Eberhard in this year's InterPlay performance.

director, who responds to the whole performance as it is being performed. Marla is a full professor in the School of Design at the Rochester Institute of Technology (RIT). She serves as head of the digital studio and director of visualization. Joe is an associate professor in the Computer Science Department of B. Thomas Golisano College of Computing and Information Sciences at the Rochester Institute of Technology.

Joe Reitzer from the University of Illinois at Urbana-Champaign and the Technology, Research, Education and Commercialization Center (TRECC), West Chicago, Illinois created the score for *Carnivale.* He utilized audio files created using commercially available software, including Ableton Live 6, Apple Logic 7, Spectrasonics Stylus RMX, and some of the Waves Plug-Ins. The actual content is a combination of MIDI files from the Internet and scanned sheet music translated into MIDI files; they were integrated with original sound design and music created via synthesizers and sound modules. The event utilized Ableton Live as the audio engine to deliver scene scores performed by Joe at TRECC, allowing for real-time mixing and processing.

Utah Contributions to Carnivale

The script, written and directed by Beth Miklavcic, focuses on the stories behind the performers as if the audience was back stage with the "carnies," observing them moving from moments of performance to behind the scenes. The carnies interact with each other and their own demons, providing insight into the motivation behind the carnies presence in the carnival. The live performance interaction that took place in Utah consisted of a series of carnival characters: Madame Flambé - The Bearded Woman (Ryan Lucas); Soliloquy -The Sword Fighting Harlequin Soldier (Hanelle Miklavcic); Mystique Francesca Futura - The Gypsy Fortune Teller (Elizabeth A. Miklavcic); RaqsSharqi - The Belly Dancer (Maia Taylor); Ballistrina Helium - The Balloon Peddler (Priscilla Steed); and, Mr. Barney Carnacle -The Ring Master (Travis Eberhard).

In addition to being the co-director of the InterPlay performance series, Beth is the founding artistic director of Another Language Performing Arts Company established 1985. She is a choreographer, actress, filmmaker and performance artist, as well as a multi-media specialist at CHPC. She created the background flash animations and slide shows for several scenes in the *InterPlay: Carnival* performance.

Sam Liston, digital communication and visualization specialist at CHPC, created a background animation in flash for the opening parade scene as the Carnivale wakes up and comes into town.

Jimmy Miklavcic drives the video interactions among the variety of offerings from the participating sites by processing and mixing them into a composite digital mash-up that is integrated back into the local performance, as well as onto the Internet2 to the other sites. The digital mix is a dynamic real-time visual interpretation of the live events happening concurrently at all three performing sites. As a form of extended cinema, this real-time, distributed, surrealistic cinematic event crosses various artistic forms and helps bring about a highly interdisciplinary collaboration to life.

Jimmy is the founding executive director of Another Language Performing Arts Company and the co-director of the InterPlay series. He is currently the multimedia specialist for the Center for High Performance Computing and an adjunct assistant professor in the Department of Communications at the University of Utah. He is the founder of ArtGrid, an informal consortium of artists and technologists that utilize the Access Grid technology for artistic pursuits.

You can view *Interplay: Carnivale* at **www.anotherlanguage.org/interplay/carnivale/video/video.html**. For additional information email info@anotherlanguage.org or call 801.585.9335.

Beth Miklavcic as the gypsy fortune teller in Interplay: Carnivale.

FYI

CHPC maintains on its web site a listing of publications and talks that acknowledge the use of CHPC's resources. You can find the current listing at the following address:

http://www.chpc.utah.edu/docs/research/CHPCBibliography.pdf

If you utilize CHPC resources in your research, please include an acknowledgement in your publications and presentations. Also, please give us a copy for our records.

Utah Advanced Computing Summer Institute

Hosted by Southern Utah University

August 12-15, 2008 - Cedar City, UT

High performance computing
Powerful product design and analysis
More effective research strategies
Bottom line impact
Network with your peers
Learn from the experts

Thanks to our corporate sponsors!

What you'll find at the Institute:

- Put HPC to work in research, teaching, design, and production
- Improve the bottom line, competitiveness, and speed to market
- Introductory sessions
- Best practices in commercial applications
- Share the best worldwide experience in HPC
- Foster stronger links between industry and academia
- Systems administration techniques
- Problem-solving networking sessions

Keynote speakers and industry experts:

- Michael Resch, HPC Center Stuttgart
- Suzy Tichenor, HPC Initiative, Council of Competitiveness
- Tom Lange, Proctor & Gamble
- Pete Bradley, Pratt & Whitney
- Stanley Ahalt, Ohio Supercomputer Center
- Clifford Hutton, Whirlpool

Mikhail Bouniaev | Thomas Hauser | Julio Facelli | Keith Olson | John Armstrong | James Stewart | Stephen Hess

Register online at WWW.UTAHCI.ORG

CHPC Staff Directory

Administrative Staff	Title	Phone	Email	Location
Julio Facelli	Director	585-3791	julio.facelli@utah.edu	410 INSCC
Julia D. Harrison	Associate Director	652-0019	julia.harrison@utah.edu	430 INSCC
Guy Adams	Assistant Director, Systems	554-0125	guy.adams@utah.edu	424 INSCC
Joe Breen	Assistant Director, Networking	550-9172	joe.breen@utah.edu	426 INSCC
DeeAnn Raynor	Administrative Officer	581-5253	dee.raynor@utah.edu	412 INSCC
Janet Ellingson	Admin. Program Coordinator	585-3791	janet.ellingson@utah.edu	405-2 INSCC

Scientific Staff	Expertise	Phone	Email	Location
Martin Cuma	Scientific Applications	587-7770	m.cuma@utah.edu	418 INSCC
Byron L. Davis	Statistics	585-5604	byron.davis@utah.edu	416 INSCC
Julio Facelli	Molecular Sciences	556-2426	julio.facelli@utah.edu	410 INSCC
Robert McDermott	Visualization	581-4370	robert.mcdermott@utah.edu	420 INSCC
Anita Orendt	Molecular Sciences	231-2762	anita.orendt@utah.edu	422 INSCC
Ron Price	Software Engineer & Grid Architect	560-2305	ronald.charles.price@gmail.com	405-4 INSCC

Systems/Network Staff	Title	Phone	Email	Location
Irvin Allen	System Administrator	231-3194	irvin.allen@utah.edu	405-40 INSCC
Thomas Ammon	Network Assistant	674-9273	thomas.ammon@utah.edu	405-22 INSCC
Wayne Bradford	System Administrator	243-8655	wayne.bradford@utah.edu	405-41 INSCC
Erik Brown	System Administrator	824-4996	erik.brown@utah.edu	405-29 INSCC
Steve Harper	System Administrator	541-3514	s.harper@utah.edu	405-31 INSCC
Brian Haymore	Lead, Comp. Cluster Admin.	558-1150	brian.haymore@utah.edu	428 INSCC
Samuel T. Liston	Digital Communication & Visualization	232-6932	sam.liston@utah.edu	405-39 INSCC
Jimmy Miklavcic	Multimedia, Telematic & Digital Communication	585-9335	jimmy.miklavcic@utah.edu	296 INSCC
David Richardson	Computer Technician	550-3788	david.richardson@utah.edu	405-38 INSCC
Walter Scott	Network Assistant	309-0763	walter.scott@utah.edu	405-13 INSCC
Steve Smith	System Administration	581-7552	steve.smith@utah.edu	405-25 INSCC
Neal Todd	System Administrator	201-1761	neal.todd@utah.edu	405-30 INSCC
Alan Wisniewski	Network Engineer	580-5835	alan.wisniewski@utah.edu	405-21 INSCC

User Services Staff	Title	Phone	Email	Location
Connor Duffy	Systems Assistant	N/A	jason.duhaine@utah.edu	405-28 INSCC
Derick Huth	Technical Assistant	N/A	derick.huth@utah.edu	405-19 INSCC
Beth Miklavcic	Multimedia Design, Digital Video	585-1067	beth.miklavcic@utah.edu	111 INSCC
Paul Vandersteen	Technical Assistant	N/A	N/A	405 INSCC
Victor Morales	Technical Assistant	N/A	N/A	405-14 INSCC

The University of Utah seeks to provide equal access to its programs, services, and activities to people with disabilities. Reasonable prior notice is needed to arrange accommodations.

UNIVERSITY OF UTAH
Center for High Performance Computing
155 South 1452 East, RM #405
SALT LAKE CITY, UT 84112-0190

Welcome to CHPC News!

If you would like to be added to our mailing list, please fill out this form and return it to:

Janet Ellingson
UNIVERSITY OF UTAH
Center For High Performance Computing
155 S 1452 E ROOM 405
SALT LAKE CITY, UT 84112-0190
FAX: (801)585-5366

(room 405 of the INSCC Building)

Name:
Phone:

Department or Affiliation:
Email:

Address:
(UofU campus or U.S. Mail)

Thank you for using our Systems!

Please help us to continue to provide you with access to cutting edge equipment.

ACKNOWLEDGEMENTS

If you use CHPC computer time or staff resources, we request that you acknowledge this in technical reports, publications, and dissertations. Here is an example of what we ask you to include in your acknowledgements:

"*A grant of computer time from the Center for High Performance Computing is gratefully acknowledged.*"

If you use the NIH portion of Arches (delicatearch, marchingmen or tunnelarch), please add: "partially supported by NIH-NCRR grant # 1S10RR17214."

Please submit copies of dissertations, reports, preprints, and reprints in which the CHPC is acknowledged to: Center for High Performance Computing, 155 South 1452 East, Rm #405, University of Utah, Salt Lake City, Utah 84112-0190