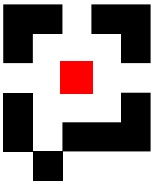
Pervasive Technology Labs at Indiana University
Report to the Lilly Endowment, Inc.
Grant Number 1999 2280-000



pervasive technology labs

AT INDIANA UNIVERSITY

96-Month Program Report
(July-December 2008)

January, 2008

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I. Executive Summary and Introduction

It is now eight years since the Lilly Endowment, Inc. funded the Indiana Pervasive Computing Research Initiative grant that established Pervasive Technology Labs and fueled the implementation of the new IU School of Informatics. It is seven years since the establishment of the first PTL Lab, and five years since the establishment of the sixth.

In that time, Pervasive Technology Labs and the IU School of Informatics have led a dramatic and fundamental change in IU's capabilities and accomplishments in advanced computing and pervasive information technology. In these areas, IU is seen as a leader in the state, nation, and world as never before.

As Indiana University nears completion of the Indiana Pervasive Computing Research Initiative grant (IPCRES), it seems appropriate to look back at the aggregate accomplishments of Pervasive Technology Labs to date:

- $109,681,208 in grant funding brought into Indiana University:
  - $24,407,789 in funding through 79 grants secured from sources other than the Lilly Endowment, Inc. directly to Pervasive Technology Labs.
  - $85,273,419 in funding through 97 grants secured from sources other than the Lilly Endowment, Inc. by Indiana University through grants led by PTL or grants that involved PTL.
- 656 peer-reviewed academic publications.
- 38 license disclosures, including 2 patent applications currently under review.
- 79 open source software packages distributed by PTL.
- 182 online services are provided by PTL.
- More than 1,000 papers and presentations in total.
- Thousands of Indiana residents and students have attended PTL technology demonstrations.

During the past reporting period alone, PTL leaders and staff published 57 peer reviewed scientific papers or technical reports. PTL disclosed two (2) new inventions to the IU Research Technology Corporation, and released 15 new open source software packages. PTL added seven (7) new online services during the reporting period. This scientific innovation and intellectual output of PTL is translating into strong grant success. During the reporting period, Pervasive Technology Labs was collectively awarded seven (7) new grants totaling $1,852,598. Sixteen (16) new grants were received by other units of IU working in collaboration with PTL during the reporting period, totaling $4,500,553. Grants totaling $17,776,098 have been submitted during the reporting period or are under continuing review from prior reporting periods.

The impact of the IPCRES grant on Indiana University and the State of Indiana, and its support for PTL and the IU School of Informatics, cannot be overstated. The impact on Indiana University is indeed pervasive, and has resulted in a transformation of IU, and of IU's national and international reputation. For example, during November of 2007, Indiana University, led by PTL, received tremendous national and international attention at the annual SuperComputing (SC07) conference. Key highlights include:

- A team led by Indiana University (including University Information Technology Services, Pervasive Technology Labs, and the IU School of Informatics) won a prestigious Bandwidth Challenge award at the SC07 conference.
- A team of students led by OSL Director Andrew Lumsdaine participated admirably in the SuperComputing Cluster Challenge.
- The PTL-led PolarGrid project received significant attention at the SC07 conference; CGL Director Geoffrey C. Fox hosted a kickoff dinner of IU and Elizabeth City State University.

In the eight years since the beginning of the IPCRES grant, enough time has transpired to begin to see patterns in the outcomes of investments made by the PTL Capital Investment Fund. Investments in two companies – the Haelan Group and Chartlogix, Inc. (formerly Dynomed) – were absolutely critical to the success of these Indiana-based businesses. Those investments have paid off in terms of high quality jobs in the State of Indiana for some time. Both companies are doing well. Among the companies started via transfer of technology from PTL Labs, or started by PTL personnel, Anabas Inc. has done particularly well, and is growing at a deliberate pace through Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants. As mentioned in earlier reports, PTL has significant and very direct impact on the Indiana economy through the creation of high-quality jobs and the hiring of skilled technical and academic staff to fill grant-funded positions.

In addition to these overall accomplishments of PTL, particularly notable accomplishments of Pervasive Technology Labs are summarized below, on a lab-by-lab basis:

- **The Open Systems Lab (OSL)** continues their core research in the development of OpenMPI with version 1.2.4 released in September. The lab had a productive period with eight open-source software releases. OSL researchers have been working to transfer the benefits of Generic Programming and metaprogramming from the realm of research computing to everyday usage by programmers in industry. They have had success in this area during the period and they anticipate that two of their extensions to the C++ language will be included in the upcoming International Standards Organization (ISO) C++ standard due in 2009. OSL Director Andrew Lumsdaine also served as faculty sponsor for a team of IU undergraduates during the reporting period, who competed in the first annual Cluster Challenge at the SuperComputing (SC07) conference in November.
- **The Advanced Network Management Lab (ANML)** continued collaboration with the University of Michigan during the period on the Department of Homeland Security-sponsored “botnet” detection system. ANML also worked with the Research and Education Network Information Sharing and Analysis Center (REN-ISAC) on the “shared darknet” project. ANML continued its ongoing efforts with the Honeynet project and conducted significant community outreach, including an educational and engaging display at the 2007 Indiana State Fair to teach Indiana residents how to choose safe and secure online passwords.

- **The Community Grids Lab (CGL)** had another very successful period, seeing the start of two major projects that received funding from the National Science Foundation. The Polar Grid polar science cyberinfrastructure project, is funded by a $1.96 million NSF award. Polar Grid had its kickoff meeting at the SC07 conference and project members gave several well-received talks at the conference. The Open Grid Computing Environments project received a second round of funding from the NSF totaling $1.69 million during the period to support ongoing research into science gateways – online tools meant to make supercomputers easier to use and access. CGL Director Geoffrey Fox, along with PTL Science Director Dennis Gannon made a successful bid for IU to host the fourth annual IEEE eScience conference. This is the first time the event will be held in the US, and will bring hundreds of top scientists from across the globe to the IUPUI campus in December of 2008.
- **The Visualization and Interactive Spaces Lab (VIS Lab)** continued to develop new tools for the program Discovering the Science of the Environment (DSE). In October, VIS Lab researchers field-tested one of these tools during the Eagle Creek Watershed Alliance Water Quality Awareness Day, with 190 students participating. Under a grant provided by the National Institutes of Health (NIH), Dr. Kay Connelly has been studying how mobile devices, such as Personal Digital Asssitants (PDA), can support patients with kidney disease by providing ubiquitous access to information about food contents. This work is conducted in conjunction with researchers from the School of Nursing. A new award of $821,000 from the National Science Foundation, will allow Dr. Connelly to study the role of ubiquitous computing and technology in supporting independent living among aging individuals.
- **The Scientific Data Analysis Lab (SDA Lab)** Associate Director Randy Heiland continues his interim role as Acting Manager for the High Performance Applications (HPA) group within the Research Technologies (RT) Division of University Information Technology Services (UITS). During this reporting period, a grant from the National Institutes of Health (NIH) was awarded to the Biocomplexity Institute at Indiana University. Mr. Heiland is the Co-PI and Project Manager on this grant. Heiland continues his work providing visualization tools a variety of life science research projects on the Bloomington and IUPUI campuses.
- **The Knowledge Acquisition and Projection Lab (KAP Lab)** expanded its leadership role in the NSF-funded CrystalGrid Framework crystallography project during the period, as an extension of its work on the Common Instrument Middleware Applications (CIMA) project. Another notable activity is KAP Lab participation in the previously mentioned PolarGrid project with the CGL, which began during the reporting period. The KAP Lab also played an important role raising IU's stature in the international SuperComputing community in November, with KAP Lab Director Rick McMullen serving as a member of the victorious IU Bandwidth Challenge team.

The overall summary of IU's accomplishments based on funding by the Lilly Endowment, Inc. of the Indiana Pervasive Computing Research Initiative is simple: a transformation of IU capabilities, accomplishments, and increased stature among universities in the US and worldwide, significant impact on the Indiana economy…and support forPervasive Technology Labs that has them well on the path to self-sustainability - though not quite there yet.

II. Lab Reports

II.I Open Systems Lab

Andrew Lumsdaine, *Director*

Lab Mission

The mission of the Open Systems Lab (OSL) is to develop science and technology for computing with large-scale and pervasive hardware and software systems, to enable more productive computing and software development, and to foster economic development in the State of Indiana. Work in the OSL is motivated by the changing nature of modern information technology systems. The OSL advocates open standards and open source software as technologies for enabling modern pervasive systems to seamlessly interoperate.

Summary of Key Lab Activities

Current research projects at the OSL remain focused in the following core areas:

• Next generation programming tools & languages

The OSL is creating tools to enable large-scale pervasive software applications. Key OSL activities in this area include continued research into the theory of generic programming as well as its practical application in programming languages, software libraries, and software applications.

• Parallel and distributed computing

The OSL is currently spearheading several efforts in high-performance parallel and distributed computing to improve reliability, availability, and scalability of these environments, including the Open MPI and OSCAR projects.

• Scientific software

As computation becomes an increasingly important tool for science and informatics, the OSL is developing tools, practices, and curricula that allow scientists and informaticians to effectively produce software while maintaining a primary focus on their research.

• Applications

The OSL is collaborating with several research groups at IU and other institutions to apply its research results to other scientific projects. Collaborators include the IU Biocomplexity Institute, School of Informatics, School of Library and Infomation Science (SLIS), and University Information Technology Services (UITS).

Research and Development Activity

The Message Passing Interface (MPI) library standard defines the most critical tools in existence for programming supercomputers. The Open Systems Lab's Open MPI project remains at the forefront of the High Performance Computing community in research and development of a production-quality, open source version of this important standard. In addition, Open MPI provides many new research-produced features and performance enhancements not previously available in an open-source MPI implementation. Open MPI enables robust scientific computing across thousands of computers, allowing scientists and engineers to focus on their work rather than the mechanics of parallel computing. Version 1.2.4 of Open MPI was released in September.

The MPI Testing Tool (MTT) continued to be used and enhanced during this period, performing automatic regression testing of the Open MPI code base on several computer clusters at Indiana University. As a large and complex code base, Open MPI requires continual testing to ensure that both new development and routine maintenance do not create unintended side effects. The MPI Testing Tool (MTT) is a flexible framework specifically designed for automatically (and fully) testing MPI implementations across multiple organizations and environments. The MTT offers a unique combination of features not available in any individual testing framework, including a built-in generator for creating and running tests, historical correctness and performance analysis, and support for multiple cluster resource managers.

The Open Systems Laboratory is pursuing several projects that modernize and simplify parallel programming interfaces in mainstream languages, particularly for multi-core computing and cluster computing. The MPI.NET provides a high-level, high-performance approach to the Message Passing Interface (MPI, as implemented by Open MPI) within C#, an important programming language being developed under the leadership of Microsoft, Inc. MPI.NET drastically simplifies many common parallel-programming tasks in a cluster computing environment, making it easier to build efficient, scalable applications for large-scale data analysis on clusters and supercomputers.

With multi-core home and desktop computers becoming commonplace, the Open Systems Laboratory is applying the programming techniques that have been successful in cluster computing to multi-core computing. OSL researchers are investigating simplifications that modernize OpenMP, an industry standard for programming multiple processors that share a common memory. This approach was developed for one particular kind of computing, but now may be generally useful for multicore computing. OSL's extensions to OpenMP aim to provide a simpler interface that will enable the parallelization of many more existing applications than OpenMP supports today using a more intuitive, light-weight mechanism. OSL researchers are working with the OpenMP Architecture Review Board (ARB) to introduce their OpenMP extensions into the OpenMP standard, making them available to a much larger audience in industry and academia. Vhb g synthetic programming can be used to create applications that achieve near-peak performance on a given platform without the use of compiled languages.

The OSL has been working to transfer the benefits of Generic Programming and metaprogramming from the realm of research computing to everyday usage by professional programmers in industry. These programming paradigms have been shown to produce greatly improved software libraries, offerering high performance along with high-level, flexible, and intuitive interfaces that intemperate well with existing applications. Working with the ANSI/ISO C++ committee, the OSL team has introduced extensions into the C++ language that bring these software methodologies into the mainstream, to benefit the millions of programmers already using C++. Two extensions in particular - variadic templates and concepts - are expected to be in the upcoming ISO C++ standard, due in 2009.

Intellectual and Artistic Accomplishments

Below are brief summaries of the intellectual and artistic accomplishments of the OSL during the reporting period.

Please note: detailed lists and descriptions of all invention disclosures, software releases, online services, hardware applications, grant funding, and lists of publications and presentations described in this report can be found in the Appendices section. Numbers and counts included in this report have been adjusted based on the most current information available and may be inconsistent with counts given in prior reports.

- **New Technology Disclosures to IURTC**
  - There was one (1) new technology disclosures during the reporting period.
  - To date, the lab has disclosed fourteen (14) inventions to IURTC.

- **New Software Distributed**
  - Eight (8) new packages of open source software were distributed, as follows:
    - Open MPI v1.2.4 released September, 2007
    - Open MPI v1.2.5 released December, 2007
    - LibNBC v0.8.2 released September, 2007
    - LibNBC v0.9.1 released October, 2007
    - NetGauge v2.Orc2 released October, 2007
    - MPI.NET v0.5.0 Technology Preview released November, 2007
    - Boost v1.34.1 released July, 2007
    - OSCAR v5.1 released November, 2007
  - The lab has distributed, to date, thirty-one (39) open source software packages.

- **Online Services Created**
  - The lab now delivers fourteen (14) online services.

- **Publications and Presentations**
  - The lab had fourteen (14) new peer-reviewed publications appear in print during the reporting period.
  - The lab had one (1) new Ph.D. dissertation completed during the reporting period.
  - To date, the lab has now published a total of two-hundred-fourteen (214) peer-reviewed scientific papers, and students in the lab have completed a total of six (6) Ph.D. Dissertations, and one (1) Masters Thesis.
  - The lab gave a total of four (4) presentations during the reporting period.

Creating the 21st Century Workforce

- The OSL currently employs five (5) full-time lab staff member, and supports seven (7) additional graduate students, affiliated faculty, and two part-time employees.

- During the reporting period the following changes in lab personnel occurred:
  - Chris Mueller was hired as a full-time Post Doc during the reporting period.

- During the reporting period, one (1) student affiliated with the lab achieved the following degree:
  - Jeremiah Willcock, PhD in Computer Science

Educating the Residents of Indiana and Beyond

A team of students organized by the OSL entered the inaugural "Cluster Challenge" at the 2007 SuperComputing Conference (SC07) held in Reno, NV. For the SC'07 Cluster Challenge, teams of undergraduate students assembled small computing cluster on the exhibit floor and ran selected benchmarks and applications. Judging was based on the speed of benchmarks and the throughput of application runs over the first three days of the conference.

The IU 2007 Cluster Challenge team worked and studied with members of the Open Systems Lab.

The IU effort was based on a semester-long independent-study course on cluster computing that was offered during the Fall semester of 2007. The team was

made up of six undergraduate students from the IU Computer Science Department. Several members of the OSL provided instruction for the course and support to the IU team members during the Cluster Challenge. Sponsorship for the Cluster Challenge was provided by Apple, Myricom, Fujitsu, Intel, and the Lilly Endowment.

The Cluster Challenge was a unique and valuable opportunity for all of the students involved. It provided undergraduate students with hands-on experience with state-of-the art supercomputing technologies and applications---experience not typically received in an undergraduate program. The IU students were also able to travel to a large and prestigious technical conference and gain exposure to the entire supercomputing research community.

Although the IU team finished as a runner-up, it is notable that many of the other teams in the Cluster Challenge (including the winning team) were using OSL-developed software (Open MPI and OSCAR) to support their clusters.

Research results from OSL-based projects are being directly incorporated into classroom education, training, and outreach in a number of ways. For example, OSL's work on generic programming has been directly incorporated into courses currently being offered at Indiana University, Texas A&M University, and Rensselaer Polytechnic Institute. As the OSL contributions to C++ (and other programming languages) become standardized parts of these languages, they will further be incorporated into the basic programming curriculum at numerous institutions.

Accelerating Economic Growth

White River Labs, a spin-off of the Open Systems Lab created to commercialize technology based on synthetic programming, continues to grow since its inception earlier in 2007. Synthetic programming is a novel paradigm for creating high-performance applications from scripting languages, enabling a high level of developer productivity without sacrificing run-time performance. CorePy, the first programming package created for synthetic programming, uses the Python programming language to provide a synthetic programming environment for IBM's PowerPC and Cell/B.E. processors. Research conducted in the OSL led to the development and validation of CorePy and synthetic programming. White River Labs' founders are Christopher Mueller, a recent PhD graduate of IU, and Andrew Lumsdaine, the director of the OSL.

Bringing Distinction to Indiana University and the State of Indiana

The OSL continues to help IU's Big Red Supercomputer achieve maximum parallel processing efficiency with their Open MPI implementation of the Message Passing Interface (MPI). OpenMPI was created by an international consortium of several major research labs including the Open Systems Lab. With help from OpenMPI, Big Red remains among the world's fastest supercomputers keeping Indiana University among the nation's leaders in cyberinfrastructure capabilities, and allowing Indiana scientists to

conduct leading-edge research in the life sciences and a variety of disciplines. The OSL and OpenMPI are fundamental to IU's success in high performance computing.

The OSL continues its strong track record of developing and releasing high-quality software, and several OSL tools have come to be widely used. The OSL also actively participates in a number of software-related standardization efforts, including the ISO C++ committee, the OpenMP Architecture Review Board, and the MPI Forum. As a member of the ISO C++ standardization committee, the OSL is leading the effort to introduce improved support for generic programming into the C++ programming language, enabling the creation of simpler, more efficient software libraries by millions of C++ programmers. Within the Message Passing Interface (MPI) Forum, OSL is contributing improvements to the upcoming MPI standard that will help programmers improve the performance of parallel programs to solve real-world problems more efficiently on large-scale clusters and supercomputers. Through research and participation in various standardization committees, the OSL has helped IU become a widely respected leader in these areas.

External Funding

- **Grants Awarded**
  - Total funding from lab grants to date is $4,072,498 all of which flows into lab's budgets.
  - During the reporting period the OSL received notification of a $50,0000 award from Sandia National Laboratories to be received early in 2008.

- **Grants Submitted During Reporting Period**
  - Two (2) grant proposals were submitted during the reporting period totaling $517,540.

Lab Outlook, January-June 2008

Throughout the next six months, the OSL will continue efforts to simplify parallel programming tasks for multi-core and cluster computers, by releasing their parallel programming libraries as open-source. The OSL team anticipates that, during this time-frame, their work to bring Generic Programming support into the C++ language will be completed, with the introduction of Concepts into the ISO C++0x Working Draft.

The MPI Forum has recently reconvened with the purpose of clarifying the current MPI standard and defining the next version. MPI is the de-facto standard for high-performance scientific computing and the Forum's work will have far-reaching impact in the entire scientific computing community. The OSL has significant involvement in this important multi-year effort. A number of personnel from the OSL will be participating and Professor Lumsdaine is a member of the steering committee for the MPI Forum and is chairing a sub-committee on non-blocking collective communication operations. http://www.mpi-forum.org/

The Scalable Tools Communication Infrastructure is a collaborative effort to develop a common communication infrastructure for software tools used on large-scale supercomputing systems. The STCI is intended to amortize the cost of developing and maintaining parallel tools infrastructure across a broad community, while at the same time providing a framework for for the development of next-generation tools http://www.scalabletools.org/

The Open Systems Lab anticipates both future Open MPI maintenance releases and new research initiatives in the areas of fault tolerance, one-sided communications, additional high-performance transport technologies, collective communication algorithms, and enhanced run-time systems support. Open MPI version 1.3 is expected to be released in the first half of 2008, incorporating significant work from the Open Systems Laboratory in the area of fault tolerance.

The OSL will continue development on its OSCAR project and also to continue work in synthetic programming to include important emerging hardware platforms. OSL researchers will apply the synthetic programming approach to applications in bioinformatics and network analysis and will also seek new application areas. During the next year the Open Systems Lab will continue to increase the scope of its interactions with other research groups and hopes to expand collaborations in application areas while aggressively expanding existing collaborations.

II.2 Advanced Network Management Lab

Steven Wallace, *Director*

Lab Mission

The mission of the Advanced Network Management Lab (ANML) is to perform research in the fields of network performance, management, and security; to use this research to develop new high-tech business opportunities in Indiana; and to contribute to IU's mission by collaborating with the School of Informatics, the Research and Education Networking Information Sharing and Analysis Center (REN-ISAC), the Center for Applied Cybersecurity Research (CACR), and the Global Research Network Operations Center (Global NOC). ANML provides support for facility research, including partnering on grant applications, network security education in support of CACR, network forensics assistance to the REN-ISAC, and the development of new tools for the Global NOC. ANML meets this mission with a combination of basic research, applied research and development, education, and entrepreneurial development.

Summary of Key Lab Activities

Lab activities during the period included continued collaboration with the University of Michigan on the Department of Homeland Security-sponsored "botnet" detection system, designed to identify malicious or illegal online activity. ANML also continued its collaboration with the Research and Education Network Information Sharing and Analysis Center (REN-ISAC) on the "shared darknet" project, meant to track activity on the portion of internet space that is currently unassigned. Activity conducted to or from this "darknet" space should immediately be considered suspicious, and the tracking system helps security professionals begin their investigations.

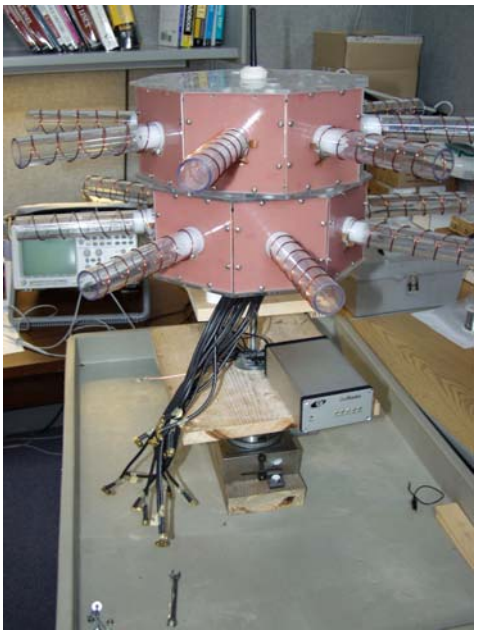
Other activities include continued collaboration with the Honeynet project and significant community outreach, particularly ANML's display at this year's Indiana State Fair.

These activities are described in detail in the following sections.

Research and Development Activity

ANML continues to develop its wireless device location system. This system is designed to detect and locate wireless devices, such as laptops, PDAs, and cellphones for purposes such as emergency response, incident handling, and cybersecurity.

Activities during the reporting period included refinements to the integrated radiolocation functions of the IU radiolocator (the "Porcupine," pictured at the left) with hardware components developed by the University of California ("Calradio"). The entire integrated



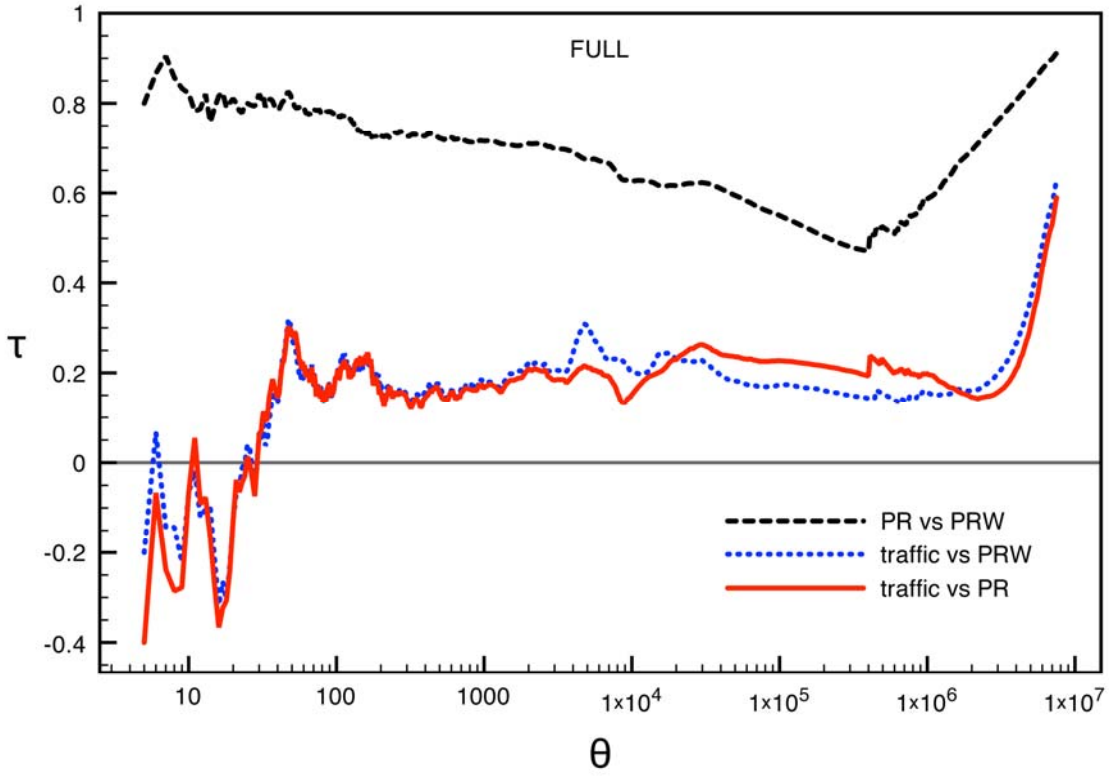
ANML's custom designed and built wireless locator antenna

system has been functionally tested and the intellectual property results of those tests -- including directional accuracy -- have been filed with the Indiana University Research and Technology Corporation (IURTC).

Cybersecurity

Network Flows & Communities

The ANML team has continued research into structural analysis of network flow data for use in characterizing traffic patterns and identifying anomalous behavior that cannot be detected through conventional threshold-based methods. Anomalous behavior can sometimes just be an anomaly. An ANML paper describing their specialized analysis techniques - which organize network applications into a taxonomy based on their observed behavior while discovering unknown applications - has been accepted for publication by Physical Review. ANML researchers are currently conducting measurements to quantify the effects of netflow packet sampling on the graph structures induced by the data; working to implement algorithms for calculating more statistical properties of the graph structures derived from flow data; and beginning to evaluate the predictive capabilities of spectral analysis of the connectivity matrix of these graphs. The latter is a new collaborative effort being pursued in conjunction with researchers from Purdue University.



[Graph illustrating a structure measure of rank similarity for Web servers observed in analysis of click data. There are three methods of ranking Web servers: (1) raw traffic counts; (2) traditional Google PageRank; and (3) a weighted version of Google PageRank that includes data on the relative amount of traffic passing through each link. Distance along the x-axis indicates the number of sites considered; for example, at x=10000, ANML is measuring the similarities of the lists of the top 10,000 sites in terms of traffic, PageRank, and weighted PageRank. Distance along the y-axis measures the degree of similarity: 1 indicates perfect agreement; 0, total lack of correlation; and -1, perfect disagreement. The data show significant disagreement between measured traffic and both versions of PageRank, making them a surprisingly weak predictor of how much traffic a site actually receives. The difference between standard and weighted PageRank is not sufficient to account for this poor performance; it must come from other features of the data. ANML conjectures that it is related to other aspects of user behavior not accounted for in a simple random surfer model, such as bookmarks, tabbed browsing, and which pages are destinations as opposed to through-roads.]

The ANML analysis of the host graphs generated by the Web-browsing behavior of Indiana University users also continues as collaborative work with faculty from the IU School of Informatics and the Institute for Scientific Interchange (ISI) Foundation in Torino, Italy. ANML researchers were invited to give a presentation on this work at a workshop for the Institute for Pure and Applied Mathematics (IPAM) facility at the University of California Los Angeles (UCLA) in fall of 2007, and a paper describing the early findings has been accepted to the first annual conference on Web Search and Data Mining, to be held at Stanford University in February of 2008. Significant findings include a smaller than expected level of traffic generated directly by search engines; extreme heterogeneity in all observed traffic properties, including among links present on the same site; and non-uniform traffic distributions that call into question the accuracy of the unbiased random-surfer as a suitable model for Web traffic. Current avenues of research include developing more accurate generative models for Web traffic; estimating

the proportion of traffic related to various categories of Web server; and examining more properties of the graph, such as clustering coefficients and "betweenness" centrality.

The ANML is also initiating a project in conjunction with Professor Jean Camp of the IU School of Informatics to gather finer-grained click data from one of the Halls of Residence at Indiana University. The aim of this study is to quantify the degree of heterogeneity in the browsing patterns of individual users: how much browsing data is required to distinguish the behavior of different users, and how readily identifiable is the typical user based on their browsing habits?

Honeynets

ANML, a founding member of the Honeynet Alliance, continues to work with a consortium of research institutions and government agencies involved in the development of software to create, and study "Honeynets". Honeynets are collections of computers known to have either a high value for attackers (i.e. computers with financial or personnel data on them), or idle machines that ordinarily do not exhibit any signs of activity. Honeynets are heavily monitored, allowing researchers to study hacker behavior without the intruders knowing that they are being watched.

ANML's contribution to this research has been primarily through its Sebek intrusion recording technology and its hflow2 intrusion correlation software. ANML researchers continue development in both areas and gave an invited presentation on the latter this December in Costa Rica.

University of Michigan Botnet Detector

ANML is a partner in a successful grant with the University of Michigan and the Michigan Educational and Research Information Triad (MERIT), funded by the Department of Homeland Security. ANML began formally operating under, and funded in part by, this grant in June of 2007.

The technologies being developed under the grant include an incident correlation and detection system for the United States Computer Emergency Readiness Team (US-CERT). This system correlates activities known to be associated with "Botnet" activity and compiles them into a report. "Botnets" are networks of infected or otherwise compromised computers, under the control of an unauthorized individual or individuals. They are most often used to launch "denial of service" attacks against important hosts, such as network nameservers, popular search engines, and other critical aspects of cyberinfrastructure. They can also be used as illegitimate sources of email "spam" and other similar disruptions. Reports generated by the botnet detection system can then be used to take action against these perpetrators.

ANML has deployed the botnet software within Indiana University's network and it is currently being used to monitor for compromised computers within that network.

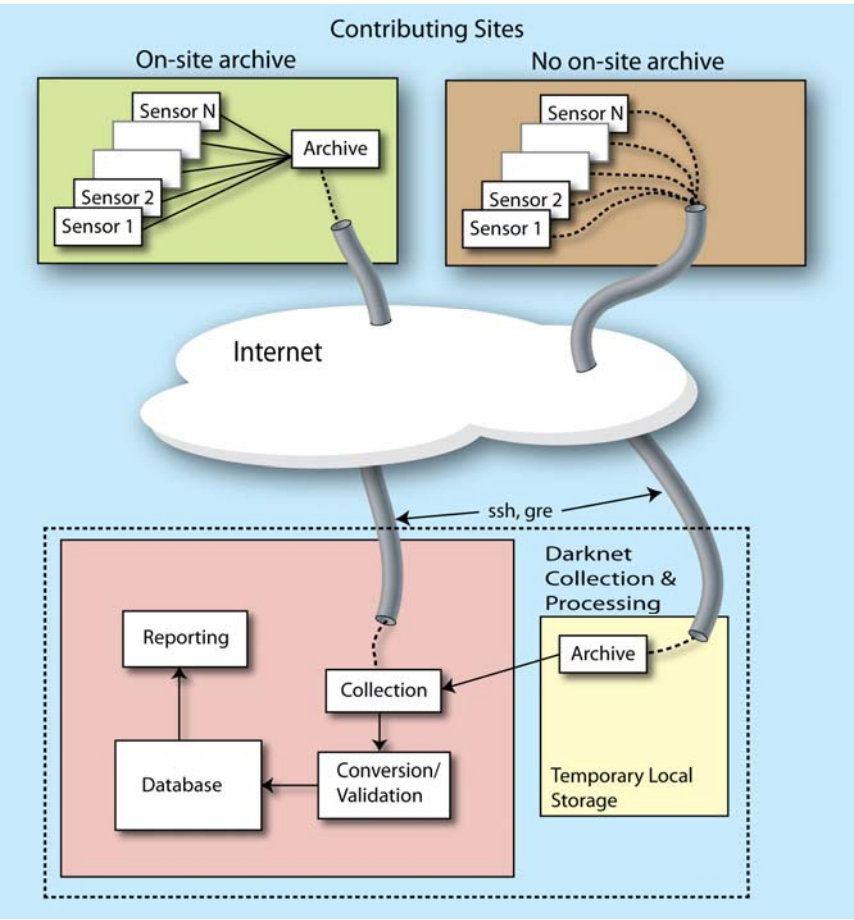
Additionally, ANML researchers are contributing to the design and interface of the software in order to make it more useful to the primary US government user, US-CERT.

Darknets

"Darknets" are portions of the Internet address space known to be unoccupied by any legitimate computing resource. Like an unassigned telephone area code, any "calls" made to or from a darknet should immediately raise suspicion.

ANML has been involved in a loose federation of institutions who have made their unassigned Internet address space available for instrumentation to detect and monitor "illicit calls" originating to or from their unassigned space.

In collaboration with the REN-ISAC and an increasing number of partnering institutions, including New York University, Worcester Polytechnic Institute, The University of Auckland, Cornell University, and The Missouri Research & Education Network (MOREnet), ANML continued development of a Shared Darknet. Enhancements to the data collection system allow data contribution to be supported in a wider range of formats, and the addition of a prototype analysis and reporting system provide descriptive statistics derived from darknet traffic to test participants.



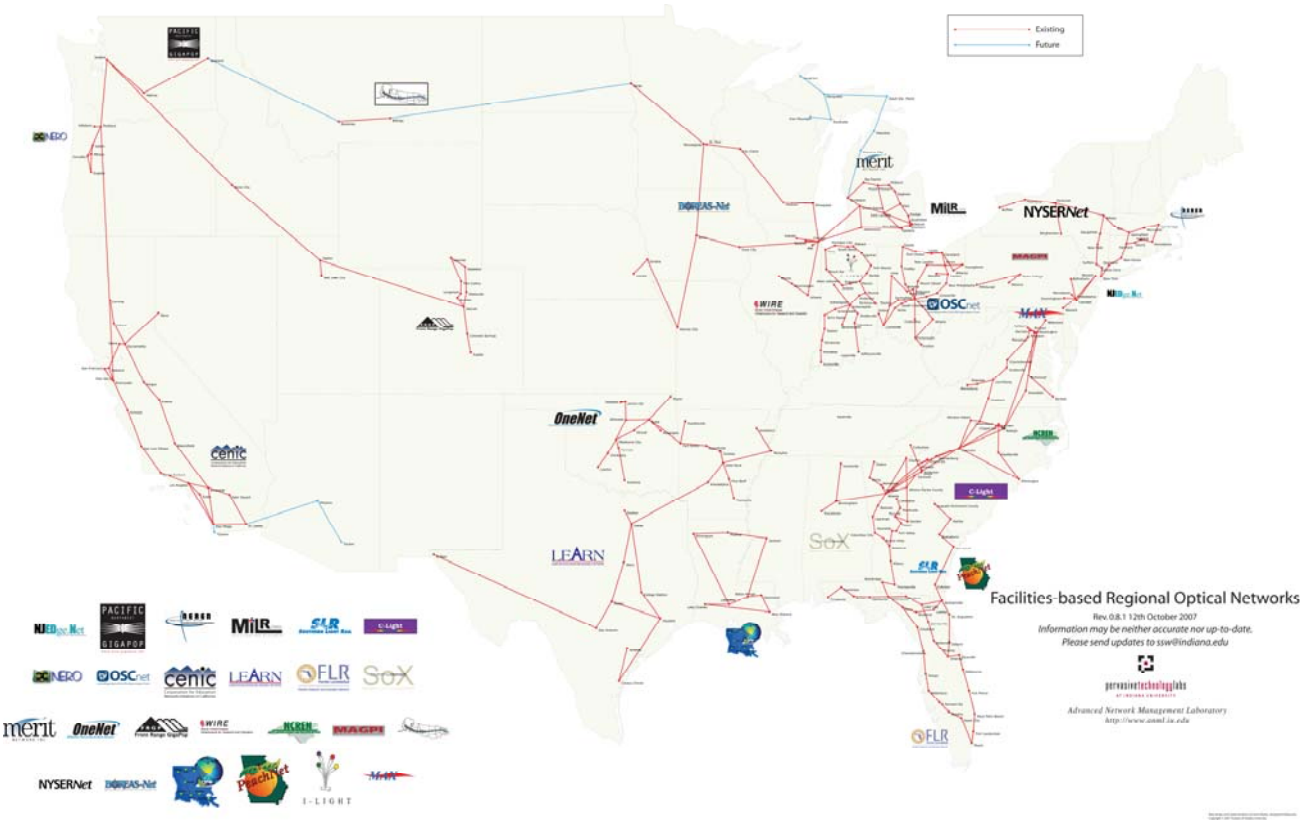
Advanced Network Management

The ANML continued its work in network management functions, particularly the identification and mapping of regional optical networks (RONs). RONs consist of those statewide and other networks which exist across the nation. Together they represent a significant opportunity to aggregate, and thereby serve either as a redundant backup to the existing long-haul national networks, such as Internet2's network, or to emerge as stand-alone entities.

An updated version of the ANML's Regional Optical Networks map was published in October, reflecting changes in the many networks shown on the map. During the past 6 months, the RON map has been used in presentations and publicity materials by The Ohio Supercomputer Center, EDUCAUSE and Internet2 and other institutions.

Regional Research and Education networks in the United States

During the period, ANML also collaborated with the Global Research Network Operations Center (NOC) in Indianapolis, helping them develop their next-generation network atlas (announced in January, 2008 at the "Joint Techs" conference in Wakkiki, Hawaii).



Intellectual and Artistic Accomplishments

Below are brief summaries of the intellectual and artistic accomplishments of the ANML during the reporting period.

Please note: detailed lists and descriptions of all invention disclosures, software releases, online services, hardware applications, grant funding, and lists of publications and presentations described in this report can be found in the Appendices section. Numbers and counts included in this report have been adjusted based on the most current information available and may be inconsistent with counts given in prior reports.

- **New Technology Disclosures to IURTC**
  - To date, the lab has disclosed seven (7) inventions to IURTC.

- **New Software Distributed**
  - To date, the lab has distributed eleven (11) open source software packages.

- **Online Services Created**
  - The lab now delivers four (4) online services.

- **Publications and Presentations**
  - To date, the lab has now published a total of fourteen (14) peer-reviewed scientific papers, and students in the lab have completed a total of three (3) Masters' Theses.
  - The lab gave a total of two (2) presentations during the reporting period.

Creating the 21st Century Workforce

- The ANML currently employs four (4) full-time lab staff members.
- During the reporting period the following changes in lab personnel occurred:
  - Research Associate, Danko Antolovic left the labs in December to pursue a job with IBM in a partnership with Indiana University.

Educating the Residents of Indiana and Beyond

ANML continues its program of regular public service information articles, internally called "Security Sam" in which ANML researchers present topics of general interest such as home wireless security, password protection, and other issues important to Hoosiers in an increasingly wired and interconnected world. "Security Sam" features are published in conjunction with IU's Living Well publication, which is distributed to Indiana and national media outlets. ANML "Security Sam" tips have run both in local Indiana newspapers and in national publications.

For the Indiana State Fair, held in Indianapolis in August of 2007, ANML built a custom boardwalk-style "passphrase checker." IU now uses longer passphrases rather than traditional passwords because they are much more difficult for cyber-criminals to guess. During the event, fairgoers could enter the ANML booth and by typing on a keyboard, test the security strength of various chosen passphrases. The system provided direct and

Visitors to IU Boulevard at the Indiana State Fair tested the security of their online passphrase with help from ANML researchers and PTL outreach staff.

immediate feedback as to the quality of the chosen passphrase, lighting a pole and ringing a bell when users entered a very secure passphrase. The passphrase checker was a very popular display, drawing many people to the booth. Even IU president Michael McRobbie stopped to use the passphrase checker and, after some coaching, was able to generate a secure passphrase for himself, which ANML researchers hope he continues to use in all of his secure online transactions.

Accelerating Economic Growth

ANML continues to be involved in technology transfer and technology consulting with Indiana corporations. During the period, ANML deepened its relationship the Cha Cha Search, Inc. an Indiana company founded by entrepreneur Scott Jones.

ANML spinoff company, SGC Technologies, LLC continues to pursue new opportunities with two recent releases of its flagship "Fileshare" technology. SCG has entered into a preliminary exploratory partnership with a local medical consortium to explore the feasibility of adapting Fileshare to the industry, specifically for the purpose of securely sharing radiological image data.

Bringing Distinction to Indiana University and the State of Indiana

ANML staff continue to travel to industry and academic conferences, reporting on the lab's progress and research and helping IU maintain its status as a leader in advanced network management. Several members of the lab were invited to give conference presentations at various venues, including the Honeynet Alliance retreat held in Costa Rica, an invited presentation on network user behavior at the University of California at Los Angeles, and an NFS workshop on data mining, held in Baltimore, MD.

External Funding

- **Grants Awarded**

o One (1) grant award was made to the lab, totaling $211,726 during the reporting period.
o Total funding from lab grants to date is $2,447,820 all of which flows into lab's budgets.

- **Grants Submitted During Reporting Period**

o The 2007/2008 operations of the ANML are supported by a total of $211,726 in new external funding. To date, the lab has secured $211,726 in funding for operations for FY 2007/2008.

Lab Outlook Jan - June 2008

During the next six months the ANML has specific goals in the following areas:

- Continued development with the University of Michigan on botnet detection, leading to a Phase II proposal to the Department of Homeland Security for a next-generation botnet detection system.

- Continued research and development of advanced network anomaly detection, in particular the use of graph theory as a replacement for traditional signature and rate detection of cyber-attacks.

- Continued collaboration with outside entities for both research and development and economic development purposes.

- Continued and expanded public outreach.

II.3 Community Grids Lab

Geoffrey Fox, *Director*

Lab Mission

The mission of the Community Grids Lab (CGL) is to create the technology that will enable grid computing to help solve important scientific problems. In creating new global communities, grid computing will open the way to new possibilities for e-Business and e-Science. The CGL focuses on creating new technology infrastructure and applications that will enable distributed business enterprises and cyberinfrastructure for distributed science and engineering. Computers and networks are getting faster; the distinction between computers and the network is blurring. This points to a future where individuals and corporations interact with grid-based applications without needing to explicitly manage the underlying technology details. CGL's focus on applications has spawned much cross-disciplinary collaboration in research and development of scientific and business applications. A current major emphasis is in earth science and particle physics, with other projects in education, biocomplexity, chemistry, apparel design, digital film production, and sports informatics.

Summary of Key Lab Activities

The Community Grids Laboratory (CGL) was established in July 2001 as one of Indiana University's Pervasive Technology Laboratories. It is funded by the Lilly Endowment, which provides about one third of the funding with the remainder coming from federal and industry funding. CGL is located in the Indiana University Research Park (Showers) in Bloomington. Its staff includes Director Geoffrey Fox, Associate Director Marlon Pierce, four senior (post-doctorate) research associates, three software engineers, and 14 PhD candidates.

The lab has an international visitors program which hosted three Chinese, one Japanese, and one Korean scholar in 2006-2007. The visiting scholars were supported by their home governments for periods of three months to one year. The students participate in Indiana University's academic program while performing research in the laboratory. Seventeen CGL students have received their PhD since the start of the lab and four more are expected to graduate in 2008.

The CGL is devoted to the combination of excellent technology and its application to important scientific problems. This has been Fox's primary focus since he established the Caltech Concurrent Computation Program (C3P) nearly 25 years ago. Technologies used have changed over time with the expanding field. Starting with parallel computing from 1983 until 1995, Fox and his team later moved to Web-based computing and education with collaborative technologies. Around 2000, Fox and the new CGL began to focus on Grids, broadly defined to include communities and collaboration. Most recently, the CGL

focus has shifted to include multi-core programming and applications, while the Grid work continues with a Web 2.0 flavor.

Research and Development Activity

Grid Architecture
CGL continues core research in Grid and Web services architecture, which acts as a backdrop to all the lab's projects. The lab finished a general analysis of services with PTL Science Director Dennis Gannon. to identify areas where further work is needed by the global community. Data and metadata federation was identified as a critical area for which some approaches exist, but for which there is no consensus on even the appropriate architecture. CGL research on Grid management was received well in international conferences during the reporting period. The CGL research team now believes that practical systems will inevitably mix Web 2.0 with Grid/Web services. This has been a recent CGL focus with the implications of Cloud computing playing a very important role. The lab is also exploring the integration of coarse grain parallel computing with Grid workflow, hoping to identify a possible unified approach, which CGL calls Parallel Programming 2.0. This work benefits greatly from the lab's strong involvement with the Open Grid Forum, for which they lead an eScience group as well as several study groups.

Parallelism and Multi-core Chips
The computer industry will be revolutionized by new chip architectures with multiple cores (processing units) on the same chip. This is illustrated by the Cell processor, which IBM has developed for gaming, and is highlighted in their new Indianapolis Advanced Chip Technology Center. Even commodity Intel chips now have 4 and will have over 100 cores in the next five years. These designs require lower power and potentially offer huge performance increases. However, they require that parallel computing expertise, now largely confined to the science and engineering domain, be applied to the broad range of applications that run on commodity clients and servers. CGL researchers are just beginning a major effort in this area funded by Microsoft in collaboration with Rice University, University of Tennessee, and Barcelona Supercomputing Center. Initial work is focused on studying a range of Advanced Micro Devices (AMD) and Intel multi-core architectures and their performance. CGL researchers are looking into a possible universal runtime for the different forms of parallelism and also at parallel data mining algorithms for multicore chips. Initial parallel algorithms for Cheminformatics and Geographical Information Systems (GIS) have been developed with a complete performance analysis. The first papers have been prepared and were well received at International conferences. The GIS work is collaborative with Polis center at IUPUI.

Semantic Scholar Grid
Semantic Scholar Grid is a new project, started in 2006, that is exploring futuristic models for scientific publishing by developing Web 2.0 social networks to support the sharing, annotating and semantic analysis of scientific data and papers. CGL researchers are building Web service tools that allow integration of capabilities of key systems such as del.icio.us, Connotea, CiteULike, Windows Academic Live and Google Scholar. The initial system is complete and extensive testing will begin early in 2008. Two PhD theses

will be based on this work over next year and will address difficult consistency questions for metadata prepared on different web sites, as well as overall architecture. These papers will also consider improved security models.

Chemical Informatics and Cyberinfrastructure Collaboratory (CICC)
The National Institutes of Health (NIH) - funded CICC project is building the Web Services, Web portals, databases, and workflow tools that can be used to investigate the abundance of publicly available data on drug-like molecules contained in the NIH PubChem and DTP databases. As part of this effort, CGL researchers have developed numerous services, including online services for accessing statistical packages, data services and user interfaces that allow users to search for full three-dimensional chemical structures for the ten million molecules (including one million drug-like molecules) currently in PubChem. These data can be used as inputs to many other calculations. A prominent example includes an online docking results service developed by CGL, which calculates the ability of the drug-like molecules to attach themselves to much larger proteins. The initial versions of these calculations were used in the inaugural run of Indiana University's Big Red supercomputer. This database and the related Pub3D (which contains 3D structures for drug-like molecules) are currently online and are based on the entire PubChem catalog of more than 10 million molecules. CGL has also developed Web Services in collaboratio0n with Cambridge University for performing chemistry-specific document mining. This text mining tool (OSCAR) can be used to extract chemical information and other metadata from abstracts and journal articles available from the NIH Entrez PubMed system. The CGL team has used this information to drive simulations such as structural calculations on Big Red described above, and they also anticipate many other applications.

Minority-Serving Institutions Cyberinfrastructure Outreach Projects
This initiative will help ensure that a diverse group of scientists, engineers, and educators from historically underrepresented minority institutions are actively engaged in the development of new Cyberinfrastructure (CI) tools, strategies, and processes. The CGL approach was not to identify specific universities as partners, but rather to interact with the Alliance for Equity in Higher Education. This consortium is formed by the American Indian Higher Education Consortium (AIHEC), the Hispanic Association of Colleges and Universities (HACU) and by the National Association for Equal Opportunity in Higher Education(NAFEO). Involvement in the consortium ensures that CGL efforts will have systemic impact on at least 335 Minority Serving Institutions.

CGL's current flagship activity is the Minority-Serving Institution Cyberinfrastructure Empowerment Coalition (MSI-CIEC), which builds on success of their initial Minority-Serving Institutions Cyberinfrastructure Institute (MSI CI2) project. Activities include workshops, campus visits and pro-active linkage of faculty at Minority Serving Institutions (MSI's) with Cyberinfrastructure researchers. As part of this project, CGL hosts the MSI-CIEC project wiki:
(http://www.msi-ciec.org/eduwiki/index.php/Main_Page) and has developed the MSI-CIEC Portal (http://gf14.ucs.indiana.edu). This portal is designed to combine the Web 2.0 concepts of social networks and online bookmarking and tagging. By using the portal and

services, researchers can bookmark URLs (such as journal articles) and describe them with simple keyword tags. Tagging in turn builds up tag clouds and helps users identify others with similar interests. User profiles provide contact information, areas of research interest, tag cloud profiles, and RSS feeds of the user's publications. The value of social networking sites depends directly on the amount of data and users, so to populate the portal's database, CGL researchers imported National Science Foundation database information on previously awarded projects (available from http://www.nsf.gov/awardsearch/) and from the TeraGrid allocations database. This information was converted into tags and user profiles, allowing users to use tags to search through awards by NSF directorate, find the top researchers in various fields, and find networks of collaborators.

Earthquake Crisis Management in a Grid of Grids Architecture
This DoD phase II SBIR is led by Anabas with CGL and Ball Aerospace as subcontractors and is creating an environment to build and manage Net-Centric Sensor Grids from services and component Grids. CGL technologies including their GIS and NaradaBrokering systems are used, and CGL will also supply non-military applications including earthquake crisis management. The project currently focuses on integrating wireless sensors (RFID, GPS, Lego Robot and video sensors) that are integrated and managed using lightweight Linux computers (Nokia N800 tablets and Gumstix miniature computers) will be supported in initial system that will allow initial deployment and dynamic real-time management of Collaborative sensor Grids.

Particle Physics Analysis Grid
This project is funded by a US Department of Energy (DoE) phase II Small Business Technology Transfer (STTR) award. It aims to create an interactive Grid using streaming data optimized for the physics analysis stage of Large Hadron Collider (LHC) data grids. This differs from the mainstream work of the Open Science Grid and Enabling Grids for eScience (EGEE), which concentrates on initial batch processing of the raw data. The CGL has come up with a novel concept called "Rootlets", that provides a distributed collaborative implementation of the important European Organization for Nuclear Research (CERN) root analysis package. Lab researchers have built a prototype based on CGL's NaradaBrokering and the Clarens software from Caltech. The prototype allows collaborative data analysis from multiple distributed repositories and can be applied to any of a so-called class of "composable" data analysis approaches. Notably, this includes information retrieval applications, and in future CGL will support Google MapReduce and the statistics package R.

Polar Grid
Polar Grid is a new activity funded by the National Science Foundation, stemming from CGL collaboration with Elizabeth City State (ECSU), a Historically Black University in North Carolina. CGL researchers are working with the Center for Remote Sensing of Ice Sheets (CReSIS) NSF Science and Technology center led by Kansas University to define and implement Cyberinfrastructure to support modeling and remote sensing of ice-sheets. The recent dramatic evidence of the impact of Climate Change on the Polar Regions makes this an urgent project of great societal importance. CGL Assistant Director Marlon

Pierce spent a week at ECSU in July instructing students and research staff on Grid computing, deploying a Condor high throughput computing testbed, and establishing requirements for their science gateway to Polar Grid. The CGL and its partners were awarded an Major Research Instrumentation (MRI) grant from the National Science Foundation for this work, which will deploy field and base sensor grids linked to dedicated analysis systems of Linux clusters at Indiana University and ECSU. The first stage of this work focuses on data analysis with parallel Synthetic Aperture Radar (SAR) algorithms and the second stage on a new generation of simulation models for glaciers and their melting. These will exploit data gathered by CReSIS and analyzed on Polar Grid.

QuakeSim and GIS Grid Project

The QuakeSim project (formerly known as SERVOGrid) was re-funded through NASA's Advanced Information Systems Technology (AIST) and Achieving Competence in Computing, Engineering, and Space Science (ACCESS) programs. The AIST funding continues work led by Dr. A. Donnellan at the NASA Jet Propulsion Laboratory (JPL) to build the distributed computing infrastructure (i.e. Cyberinfrastructure) begun under previous NASA AIST and Computing Technology (CT) program grants. The Community Grids Lab's focus in this project is to convert the QuakeSim portal and services into an NSF TeraGrid Science Gateway. The project team has updated the QuakeSim portal to be compliant with current Java and Gateway standards. They are also developing workflow and planning services based on the University of Wisconsin's Condor-G software that will enable QuakeSim codes such as GeoFEST and Virtual California to run on the best available NSF and NASA supercomputers.

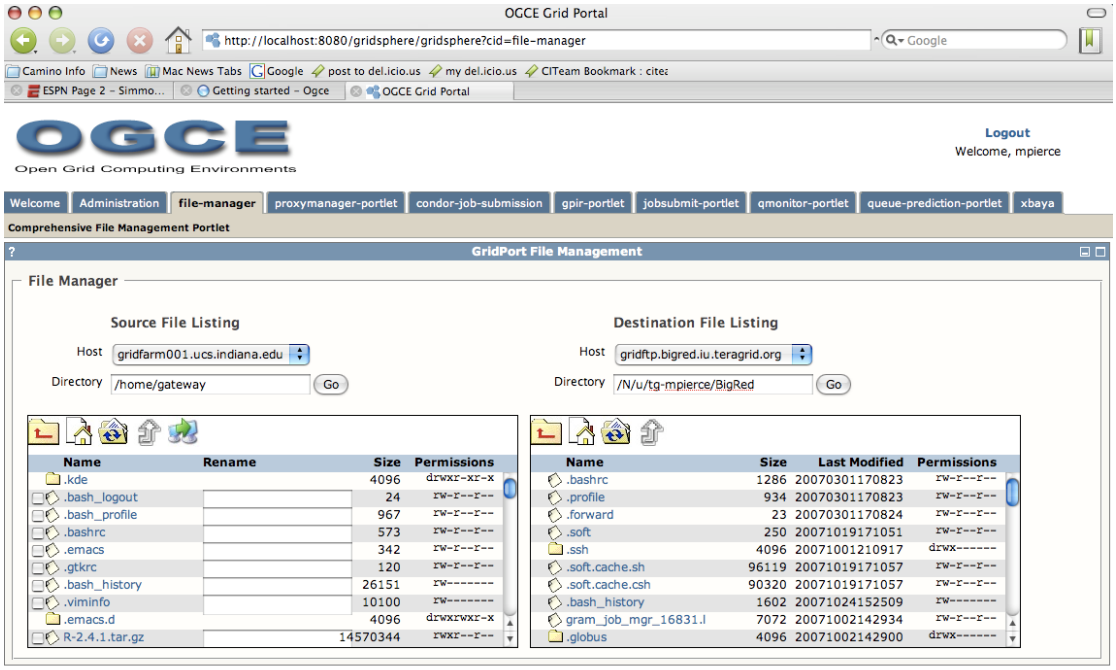
The NASA ACCESS project is a joint project that combines team members from the QuakeSim project with the NASA Research, Education and Applications Solution Network (REASoN) project. CGL researchers work to develop and exchange portal components and Web Services with the REASoN team. Exchanged components include Geophysical Resource Web Services (a GPS data service developed by University of California San Diego/Scripps), Analyze_tseri (portlets and services developed by CGL and adopted by the REASoN team), and RDAHMM (GPS data mining services developed by CGL using JPL codes and adopted by the REASoN team). The RDAHMM portlets and services are currently being expanded to allow historical analysis of network state changes in the Southern California Integrated GPS Network and Bay Area Regional Deformation GPS networks. The CGL team has also developed services and portlets for interacting with real-time GPS data streams from the California Real Time Network (CRTN). This stream management was based on CGL's NaradaBrokering software, and the team demonstrated its scalability to networks 20 times the size of the current CRTN.

The CGL's work during this period was dominated by a complete redevelopment of the QuakeSim portal and several of its Web Services for GPS station analysis and seismic deformation analysis. These included major revisions to the GeoFEST, Disloc, Simplex, Analyze_tseri, and RDAHMM services to make them more self-contained and independent of the portal clients so they can be easily used by other client applications, such as the Taverna workflow composer. The project team built portlet web interfaces

that combine Java Server Faces and Ajax/Google Maps and they have also recently developed a plotting service that produces Google Keyhole Markup Language (KLM) markups of grids and vector points, useful for representing the results of applications such as Disloc and Simplex.

Open Grid Computing Environments (OGCE)

The OGCE project provides downloadable, generic portal software for building scientific Web portals and gateways. This NSF-funded project is a consortium of several universities that is led by CGL. The OGCE project won a major continuation award from the NSF Office of Cyberinfrastructure this year, allowing the project team to continue the work initially begun under the NSF Middleware Initiative program in 2003. The OGCE website (also recently revised) is http://www.collab-ogce.org.



The project team reached a significant milestone with the release of version 2.2 of the core portal software, which completely reorganized and streamlined the build system. This build system has been integrated with non-maskable interrupt (NMI) testbed to provide nightly builds on over 25 operating systems (Mac OS and Linux variants). The OGCE 2.2 release includes several portlets and services designed to work with the NSF's TeraGrid. These include job submission and management portlets (GRAM, Condor, Condor-G), information portlets (Grid Port Information Repository and Queue Bounds Estimation from Time Series), and remote file management (FileManager), which allows users to interact with data files on IU's Data Capacitor and High Performance Storage System. The OGCE Workflow Suite - XBaya, XRegistry, and GFAC components, all adapted from software developed by the NSF funded LEAD project at IU - is a major new addition to the download, allowing users to create composite jobs out of individual Web services. The OGCE's other major release was a beta version of Grid Tag Libraries and Beans (GTLAB), an XML markup language that extends Java Server Faces and

greatly simplifies the development of Grid portlets using reusable tag libraries. In the same spirit, the project team is collaborating with Gregor von Laszewski at Rochester Institute of Technology to develop a JavaScript version of the Commodity Grid (CoG) kit to provide Web 2.0 compatible Grid client development libraries.

The OGCE portlet components can be deployed into Java Specification Request 168 compliant containers such as GridSphere and Sakai. The CGL's modified build system uses the GridSphere container by default, but is extensible to support other containers. The project team is modifying its build process to give developers a choice between Sakai and GridSphere containers in the automated builds.

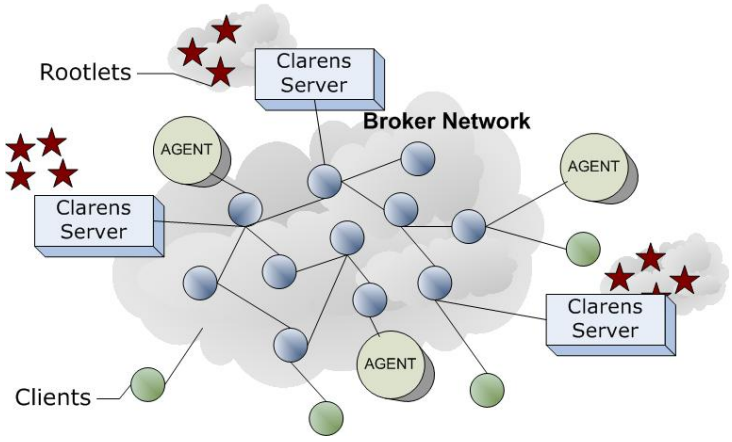
Also under the OGCE banner, CGL continued a collaboration with Dr. Rick McMullen's PTL laboratory on the Common Instrument Middleware Architecture (CIMA) portal. A CGL graduate student is currently completing the development of a set of instrument Atom news feeds. These are web-based content feeds of CIMA instrument metadata that can be integrated with popular news-readers such as iGoogle and Sage.

Finally, the OGCE team led the third Grid Computing Environments workshop (GCE 07) at the annual SuperComputing (SC07) conference held in Reno, Nevada in November. This year's workshop featured over 20 peer-reviewed and invited talks

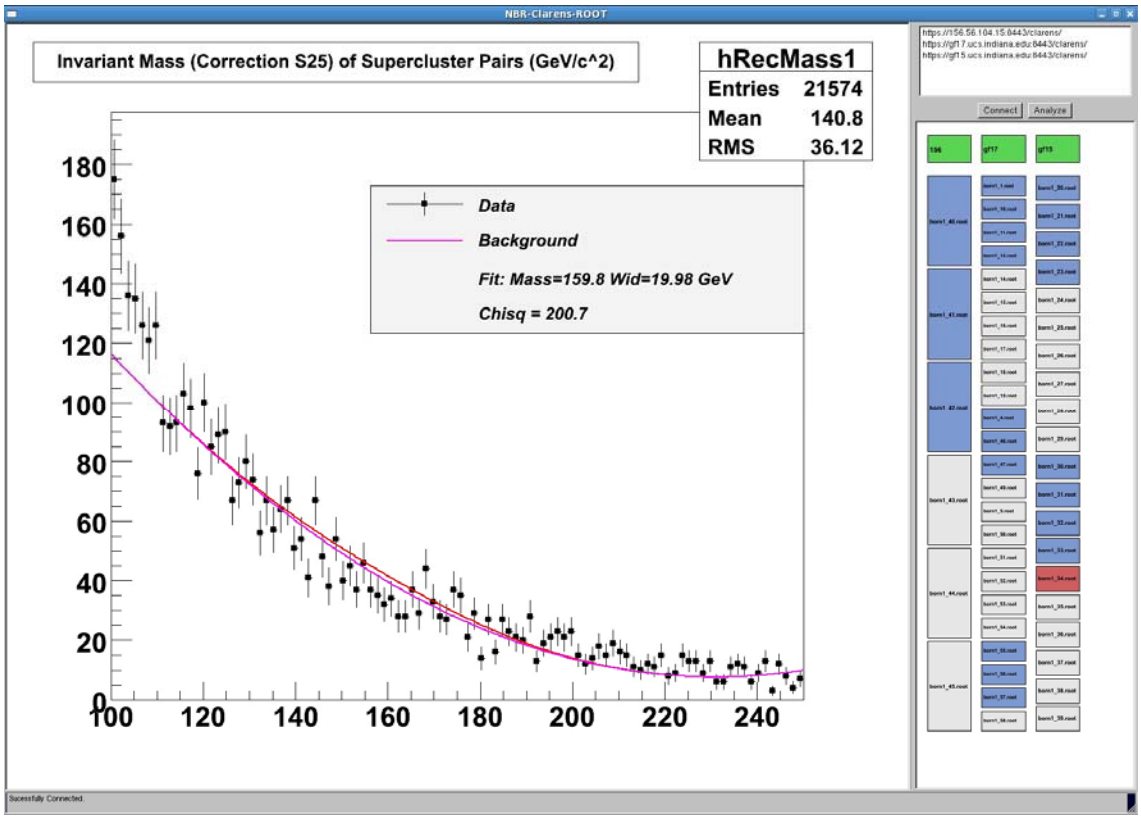
NaradaBrokering Project

The NaradaBrokering project had nine new releases (version 1.3.2, 2.0.1, 2.0.2, 3.0.1, 3.0.2, 3.1.0, 3.1.1, 3.1.2 and 3.1.3) within this reporting period. These releases incorporated support for graphical deployment of distributed broker networks, performance improvements at high publish rates and also resolved compatibility issues with the new Microsoft operating system Vista.

During this timeframe the project team presented their research for securely tracking the availability of entities in distributed systems: a pre-cursor typically to any fault tolerance scheme trying to mask failures in distributed components. This research was presented at the 21st Institute of Electrical and Electronics Engineers (IEEE) International Parallel and Distributed Processing Symposium in Long Beach, California.



Clarens architecture of NaradaBrokering.



Screenshot showing the Clarens architecture application while it is running.

Failures often take place in distributed settings. As part of CGL's research, the project team has developed a framework for incorporating fine-tunable redundancies in their reliable delivery scheme. Their algorithm allows them to guarantee reliable delivery of streams in the presence of multiple failures within the system by incorporating support for fine-tuning the redundancy scheme associated with the repositories responsible for storing streams. This work was presented at the 2007 IEEE Conference on Autonomic Computing in Jacksonville, Florida.

The Clarens effort by the High Energy Physics Group at Cal Tech has developed a framework for wrapping capabilities within ROOT , a powerful particle physics analysis software suite from CERN, as distributed services. As part of a collaborative effort between IU and Caltech, CGL is developing a loosely-coupled framework using NaradaBrokering to discover and load-balance accesses to services that are available to physicists for analyzing and collaborating-over data produced in particle physics experiments. This included a site visit in March, 2007 to lay the groundwork for the algorithms and use cases.

The prototype system that demonstrated collaborative analysis of particle physics data was demonstrated at the SC07 conference in Reno, Nevada where it was very well received.

OMII Software

The CGL received funding from the United Kingdom Open Middleware Infrastructure Institute (OMII) to develop core Web Service (Grid) support for reliable messaging and

notification. Both software packages have been successfully deployed within the latest version of the OMII Container. These projects are now complete.

Collaboration Grids - Global MultiMedia Collaboration System (MMCS)
The MMCS project generated important input for the audio/video transport component of NaradaBrokering, and CGL researchers are focused on improving the core infrastructure and the application to e-Sports for sharing and annotating real time video between trainers and athletes. They are exploring collaborations with China on the 2008 Olympics with a project entitled e-Sports.

e-Sports
This is an effort spun off from GlobalMMCS and working closely with NaradaBrokering development, which were started to enable the following capabilities:

- Manage streams. Play multiple streams while eliminating network-induced effects through the use of services for ordering, buffering and jitter reduction.
- Enable active replays. This is the ability to playback certain sections of a live stream while retaining the ability to revert to the live streams at any time.
- Streams annotation. This refers to the ability to annotate streams, and record these annotated streams at a later time. These annotations can be based on text or graphics. This newly modified stream would then be made available for playbacks or further annotations.

CGL has developed several components of this system, and expect to have a functional prototype of this system in the next few months.

Intellectual and Artistic Accomplishments

Below are brief summaries of the intellectual and artistic accomplishments of the CGL during the reporting period.

Please note: detailed lists and descriptions of all invention disclosures, software releases, online services, hardware applications, grant funding, and lists of publications and presentations described in this report can be found in the Appendices section. Numbers and counts included in this report have been adjusted based on the most current information available and may be inconsistent with counts given in prior reports.

- **New Technology Disclosures to IURTC**
  - There was one (1) new technology disclosures during the reporting period, with three additional disclosures slated for the coming reporting period.
  - To date, the lab has disclosed three (3) inventions to IURTC.

- **New software distributed**
  - Seven (7) new packages of open source software were distributed, as follows:
    - Narada Brokering versions 3.0.2,3.1.0,3.1.1,3.1.2,3.1.3
    - OGCE version 2.2
    - OGCE's GTLAB programming tag libraries (beta)

  - The lab has distributed, to date, twenty-one (21) open source software packages.

- **Online services created**
  - The lab now delivers sixty-one (61) online services.

Publications and Presentations

- The lab had thirty-eight (38) new peer-reviewed publications appear in print during the reporting period.
- The lab had two (2) Ph.D. dissertations completed.
- To date, the lab has now published a total of three-hundred-forty-four (344) peer-reviewed scientific papers, and students in the lab have completed a total of fourteen (14) Ph.D. Dissertations.
- The lab gave a total of fifty-seven (57) presentations during the reporting period.

Creating the 21st century workforce

- The CGL currently employs six (6) full-time lab staff members, and supports an additional thirteen (13) graduate students, affiliated faculty, and two part-time student employees.

- During the reporting period the following changes in lab personnel occurred:
  - Software Engineer, Sima Patel left the labs to pursue other employment.
  - Post Doc, Yilli Gong completed her term and returned to her home country of China.

- During the reporting period, students affiliated with the lab have achieved the following degrees:
  - Mehmet Nacar earned a PhD in Computer Science
  - Kangseok Kim earned a PhD in Computer Science

Educating the Residents of Indiana and Beyond

The CGL has major activities in outreach to Minority Institutions faculty and students. These efforts are motivated by the observation of a Dr. Richard Tapia, Rice University Professor and distinguished Hispanic American scientist who said:

"No first-world nation can maintain the health of its economy or society when such a large part of its population remains outside all scientific and technological endeavors."

A new computer lab established at Elizabeth City State University, IU's partner on the Polar Grid project.

CGL researchers have been successful in four proposals in this area, three from the NSF and one from the Lumina Foundation in Indianapolis. The work hinges on the observation that Cyberinfrastructure and its underlying Grid technology inherently bridges the "digital divide" and can broaden participation in science while providing better education and business opportunities. Currently, CGL activities are focused on the Navajo Nation in providing education and health applications for their Grid and with Historically Black Colleges and Universities (HBCU's) Elizabeth City State and Jackson State. The CGL hosted an undergraduate student from Jackson State University this summer as part of IU's university-wide HBCU initiative. There are clear ways that the CGL work could be extended to K-12 education, but proposals in this area have thus far been unsuccessful.

Professor Fox and CGL staff members frequently lecture on their research and broader topics as part of seminars and courses offered at Indiana University and IUPUI.

The following presentations highlight CGLoutreach seminars and lectures to students and general (non-technical, non-specialist) audiences:

- Geoffrey Fox, "Net-Centric Sensor Grids" Seminar Presentation at Indiana University November 27 2007.
- Geoffrey C. Fox and **M. Pierce**, "Web 2.0 for eScience: SC07 Education Program Tutorial," Education Program Tutorial at SC07 November 12 2007 Reno Nevada.
- Geoffrey Fox Computational Infrastructure for Policy Informatics Workshop on Policy Informatics in an Interdependent World, Washington DC September 13 2007.
- Marlon Pierce, "Web Service Foundations: WSDL and SOAP," I590 Class IUPUI April 5 2007.
- Geoffrey Fox, "Informatics and Particle Physics Experiments" lecture at I573 Class March 27 2007.
- Marlon Pierce, "QuakeSim: Grid Computing, Web Services, and Portals for Earthquake Science," Department of Mechanical Engineering IUPUI January 25 2007.
- Geoffrey Fox, "Global Grids Web 2.0 and Globalization Informatics," Colloquium, Indiana University, January 12 2007.

- Geoffrey Fox, "Cyberinfrastructure across the Globe," Seminar to Indiana University Computer Science Honours Students, January 8 2007.

Accelerating Economic Growth

The Community Grids Lab partners with several small business ventures which were described in greater detail in the previous sections.

- CGL has won a US Department of Defense (DoD) Phase II Small Business Innovation and Research (SBIR) grant to dynamically build and manage Grids. CGL partners with Anabas, a small startup company that leads the project, and with Ball Aerospace.
- CGL has won a DOE Phase II STTR award with Caltech and Deep Web Technologies.
- CGL startup, Anabas and CGL have recently won an additional DoE Phase I STTR for collaborative visualization systems for Plasma Physics.

Anabas, the CGL spinoff company and PTL Seed Fund recipient, remains strong and is continuing to focus locally on its DoD Phase II SBIR developing a Sensor Grid and the tools to deploy and manage it.

Bringing Distinction to Indiana University and the State of Indiana

Geoffrey Fox remains as Vice President responsible for eScience for the Open Grid Forum. He was program chair of two major conferences this year; the annual eScience conference, which is in Bangalore India December 2007, and the Open Grid Forum event in Seattle October 2007. Indiana University will host the 2008 eScience event at IUPUI in December with Fox as general chair in collaboration with PTL Science Director, Dennis Gannon. Fox has reached another notable milestone this period with a total of 57 completed Ph. D. theses supervised by Fox during his career. Fox has also been given courtesy positions at the University of Southampton (UK, renewal), University of Houston Downtown and the Alliance for Equity in Higher Education to recognize importance of collaborative work.

External funding

- **Grants Awarded**

o Four (4) grant awards were made to the lab, totaling $4,229,871 during the reporting period.
o Total funding from lab grants to date is $13,288,074 all of which flows into lab's budgets.

- **Grants Submitted During Reporting Period**

o Five (5) grant proposals were submitted during the reporting period totaling $1,075,084.

- The 2007/2008 operations of the Community Grids Lab is supported by a total of $1,551,356 in new external funding. To date, the lab has secured $1,551,356 in funding for operations for FY 2007/2008.

Lab Outlook Jan-June 2008

Grid Architecture.
The CGL will continue this foundation activity focusing on interaction of Grid, Web 2.0 and digital library technology.

Parallelism and Multi-core Chips
CGL leadership expects this activity to grow in importance with a focus on applications that are likely on future multicore clients. This application work will be conjunction with research in new run time systems.

Semantic Scholar Grid
This flagship Web 2.0 activity will be augmented by a broader range of projects looking at ways of using Web 2.0 approaches in file transfer, document sharing and people networking in science and education.

Chemical Informatics and Cyberinfrastructure Collaboratory (CICC)
The CICC project team will continue their work to populate new data services that add value to NIH PubChem. This work will focus on the calculation, storage, and efficient search of structural conformers for drug-like molecules. In addition to its computational intensity, this work will expand their databases by a factor of 10 or more. It is therefore crucial that they investigate scalable database partitioning techniques. This is naturally done using clustering techniques developed in CGL's Multicore work, so they will strive to implement this.

CICC also provides a significant opportunity for investigations in applying Web 2.0 techniques to e-Science. CGL researchers are evaluating the use of Yahoo Pipes as an example workflow/mashup building tool that can be used to encode scientific use cases that combine several CICC RSS feeds. They are also investigating problems in adapting Start Pages such as Netvibes and iGoogle to support ecosystems of user interface widgets to CICC gadgets. Finally, the important new area of *microformatting* for metadata expression and management will be investigated.

Open Grid Computing Environments (OGCE)
The OGCE project has recently been awarded its second NSF grant from the Office of Cyberinfrastructure. Their next major release will be available for the TeraGrid Conference in June 2008 and will be accompanied by a hands-on tutorial. The release will include an enhanced version of CGL's workflow suite tools and components for interacting with the TeraGrid information services.

Minority-Serving Institutions Cyberinfrastructure Outreach Projects
CGL's recent awards will keep the team busy with a Web 2.0 portal for MSI faculty and students as a major focus. A difficult problem is identifying those scientists at MSI's who are good candidates for collaborating on eScience projects. The project team's idea is to promote self-identification (bottom-up) using Web 2.0 rather than traditional top-down approaches that tend to always locate the same small group of outreach candidates.

CGL has completed the initial phase of the MSI-CIEC portal that combines various Web 2.0 approaches (AJAX, shared bookmarking, profile building, researcher matchmaking, and community building). This portal will be available starting January 15, 2008. The project team will also investigate integrating the MSI-CIEC portal with Facebook and the Google-led Open Social networking sites.

Earthquake Crisis Management in a Grid of Grids Architecture
This work will continue with a focus on sensor Grids integrated with lightweight computing devices.

Polar Grid
CGL will work with Elizabeth City State University to bring up a prototype Polar Grid and Science Gateway. This will include workshops on data analysis, Grid and Portal architecture. Support data gathering expeditions from May 1, 2008 to June 15, 2008 in Greenland and December 2008 to January 2009 in Antarctica will be one challenge faced by the Polar Grid project team during the coming period.

NaradaBrokering and Particle Physics Analysis Grid
During this period the NaradaBrokering team is planning to release software that incorporates production implementations of their scheme for the scalable tracking of distributed entities. An additional capability would be to support the voluminous replay/recording of multimedia streams produced within the eSports project.

They also plan to release a prototype version of the framework, using NaradaBrokering, which will be used within Clarens to discover, and load-balance accesses to services that are available to physicists for analyzing and collaborating-over data produced in particle physics experiments.

QuakeSim and GIS Work
CGL researchers also plan several enhancements to existing portlets and services for better integration with GPS analysis applications. One goals is to extend the current portal into a TeraGrid Science Gateway for selected codes, particularly GeoFEST. This will allow the project team to use much larger high performance computing resources provided by the TeraGrid. CGL researchers will be using their GTLAB project to provide these new capabilities.

e-Sports: The CGL has developed several components of the eSports system. The project team expects to have functional prototype of this system in the next few months. This software will harness the distributed repository capability available within NaradaBrokering to facilitate the recording and replay of multimedia streams.

II.4 Visualization and Interactive Spaces Lab

M. Pauline Baker, *Director*

Lab Mission

The mission of the Visualization and Interactive Spaces Lab (VIS Lab) is to create new capabilities for access to information, and to embed these capabilities into environments for exploration and learning. This goal is accomplished through advanced computer generated graphics and novel sensor-based user interfaces to create innovative environments for data exploration, learning, and visualization of data. The lab's research agenda includes work on user interfaces, display innovations, graphics software, and providing visualization functionality over the Web. The VIS Lab is especially interested in taking a collaborative approach, where technology solutions can contribute to applications that affect people's lives now.

Summary of Key Lab Activities

During this reporting period, the VIS Lab continued to develop the program Discovering the Science of the Environment (DSE). This program, conducted in collaboration with the IUPUI Center for Earth and Environmental Science (CEES), provides activity-based opportunities for middle-school students to learn about environmental science, as well as professional development opportunities for educators to learn about technology for science education. In this reporting period, the VIS Lab prototyped a number of applications related to measuring water quality. In October, VIS Lab researchers field-tested one of these tools during the Eagle Creek Watershed Alliance Water Quality Awareness Day, with 190 students participating. The DSE project delivered additional environmental science learning programs at six Central Indiana schools, making good use of the DSE mobile science education trailer.

Lab researchers also continued to research the relationship of ubiquitous computing, personal health, and quality of life. Under a grant provided by the National Institutes of Health (NIH), Dr. Kay Connelly has been studying how mobile devices, such as Personal Digital Asssitants (PDA), can support patients with kidney disease by providing ubiquitous access to information about food contents. This work is conducted in conjunction with researchers from the School of Nursing. A new award of $821,000 from the National Science Foundation, will allow Dr. Connelly to study the role of ubiquitous computing and technology in supporting independent living among aging individuals.

VIS Lab researchers also continued their efforts at outreach and supporting broad participation in computing. At IUPUI, Baker again hosted participants in the summer LSAMP program (Louis Stokes Alliance for Minority Participation, funded by National Science Foundation) for a half-day visit and discussion about visualization and informatics research. At IUB, Connelly organized Bring IT On! This is a weekend

workshop for undergraduate students in computing. The workshop, partially supported by the National Science Foundation, aims to build a community of students engaged in studying computing, and teach those students how they might organize and implements outreach efforts at their home institutions.

Research and Development Activity

Discovering the Science of the Environment. This program consists of a number of components, including information delivery over the Web, in-the-field experiences focused on data collection and analysis, a mobile environmental science trailer, an equipment loan program, and a professional development program. Project goals are to encourage authentic activity-based opportunities for learning about science. Recognizing that today's learners are growing up in a completely digital and media-rich world, the program makes significant use of technology to entice, engage, and empower.
During this reporting period, the project team developed Down By the Reservoir, an application to allow users to make data observations about water quality and record them on a handheld computing device. The application offers advantages over other approaches in that it supports in-place analysis of the numbers to arrive at an overall water quality score. Using 20 Nokia Internet Tablets, Down by the Reservoir was successfully field-tested with almost 200 middle-school students in October, as part of the Eagle Creek Watershed Alliance Water Quality Awareness Day.

Discovering the Science of the Environment allows Indiana school children to use technology in hands-on environemental science education activities.

Ubiquitous Computing and Quality of Life. For the past three years, Dr. Connelly has been investigating ways in which mobile computing devices can support health care and contribute to an individual's quality of life. A new $821,000 award from the National Science Foundation will allow Dr. Connelly to study the role of

ubiquitous computing and technology in supporting independent living among aging individuals. For example, sensors placed in the residence could be used to detect the opening of doors or the use of various devices, such as the TV remote. An alternative scenario, in which the resident chooses deliberately which activities they want recorded, might call for the placement of activity recorders that require user-activation, such as a fingerprint scanner. A key research question for this project will be the relationship between technology, quality of life, and user privacy and choice. Research will be carried out in a "living-lab" setting. A group of volunteers from Meadowood Apartments, a Bloomington retirement community, will participate.

Intellectual and Artistic Accomplishments

Below are brief summaries of the intellectual and artistic accomplishments of the VISL during the reporting period

Please note: detailed lists and descriptions of all invention disclosures, software releases, online services, hardware applications, grant funding, and lists of publications and presentations described in this report can be found in the Appendices section. Numbers and counts included in this report have been adjusted based on the most current information available and may be inconsistent with counts given in prior reports.

- **New Technology Disclosures to IURTC**
  - There were no new technology disclosures during the reporting period
  - To date, the lab has disclosed six (6) inventions to IURTC.

- **Online Services Created**
  - The lab now delivers ten (10) online services.

- **Hardware Applications**
  - To date, the lab has created three (3) hardware applications, installed and in use in educational settings in the central Indiana region.

- **Publications and Presentations**
  - The lab had two (2) new peer-reviewed publications appear in print during the reporting period.
  - To date, the lab has now published a total of sixteen (16) peer-reviewed scientific papers, and students in the lab have completed a total of one (1) Masters' Thesis.

Creating the 21st Century Workforce

- The VIS Lab currently employs four (4) full-time lab staff members, and supports one part-time student employee.

- During the reporting period the following changes in lab personnel occurred:
  - No changes in personnel during the reporting period.

Educating the Residents of Indiana and Beyond

Dr. Connelly served as a Faculty Organizer for Bring IT On! This weekend workshop encourages computer science students from Indiana colleges to develop outreach programs for their home institutions, as well as K-12 schools. Ginger White, an undergraduate student working in the Lab, participated in the workshop.

Dr. Baker also organized School of Informatics New Media faculty, along with members of the Urban Center for Advancement of Science Technology Engineering and Math (STEM) Learning (IUPUI UCASE) in proposing the Center for Learning in Media-Rich Environments as an IUPUI Signature Center. The IUPUI Signature Center's competition is intended to foster inter-disciplinary collaboration, and to establish and incubate units that will highlight the character of work being conducted on campus. The proposed Center would combine the talents of the New Media faculty and the expertise of the teacher preparation program in the School of Education, and would provide a catalyst that focuses participants on advancing the use of interactive digital media to support learning among K-12 students, with a focus on STEM subjects.

Bring IT On! encourages computer science students from Indiana Colleges to develop outreach programs at their home institutions and at K-12 schools

Bringing Distinction to Indiana University and the State of Indiana

Dr. Connelly was recipient of an award of $821,000 for research on the role of ubiquitous computing in independent living for an aging population. Dr. Baker was named Mentor of the Year Award for her participation in the IUPUI Louis Stokes Alliance for Minority Participation (LSAMP) program.

Ginger White, an undergraduate student working in the Lab, was named LSAMP Student of the Year. Ms. White also won an award for her poster presentation at the statewide gathering of LSAMP participants. She has been nominated as a Top-100 student at IUPUI. Finally, Ginger was selected to represent IUPUI on a student panel discussing the undergraduate experience for this year's Celebrate IU festivities, held in October.

External funding

- **Grants Awarded**

o Total funding from lab grants to date is $1,054,863 all of which flows into lab's budgets.

Lab Outlook Jan-June 2008

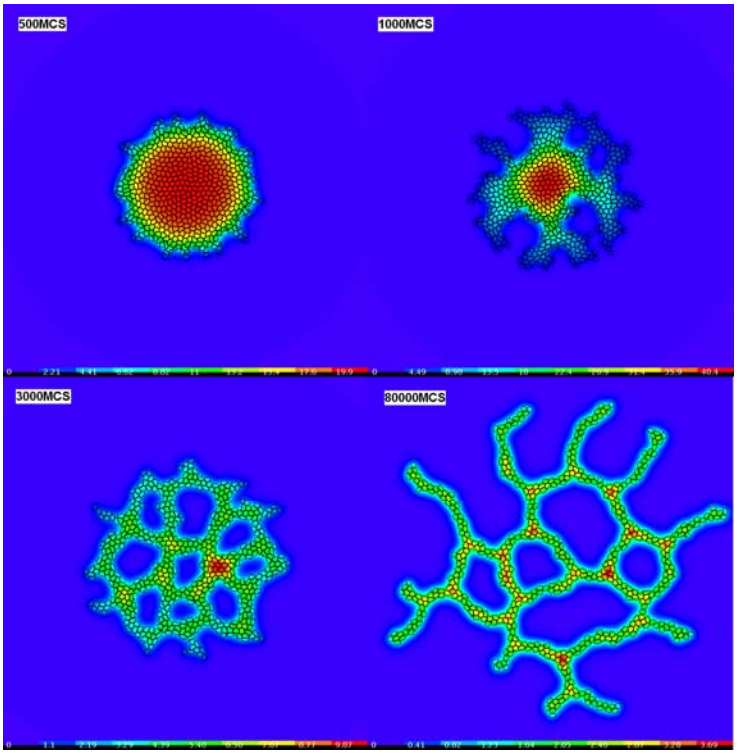
Over the next six months, the VIS Lab will concentrate on researching the use of multimedia and mobile computing for applications in health and environmental science education. VIS Lab researchers will also continue their efforts towards encouraging Indiana youth, including IU students, to consider careers in science and technology. Plans are underway for the second DSE institute, a week-long professional development opportunity for Indiana teachers. This event is scheduled for June and will again be hosted at Eagle Creek Park Earth Discovery Center.

II.5 Scientific Data Analysis Lab

Randy Heiland, ***Associate Director***

Lab Mission

The mission of the Scientific Data Analysis Lab (SDA Lab) is to develop and deploy software tools and applications that contribute to improved science understanding and education. The lab actively seeks academic researchers and educators who have challenging problems in scientific data management, analysis, and visualization. While the lab is interested in tackling problems in many scientific domains, the staff is currently focused on challenges in the life sciences – an area of rapid growth in the State of Indiana. The lab is also committed to science and mathematics education in its K-12 outreach efforts.



Frames from a simulation showing vascularization using CompuCell3D

Summary of Key Lab Activities

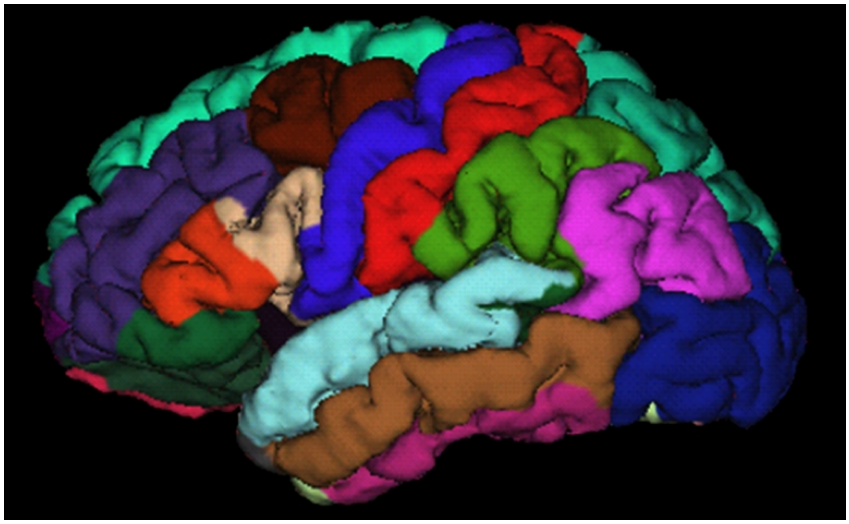
Associate Director Randy Heiland continues his interim role as Acting Manager for the High Performance Applications (HPA) group within the Research Technologies (RT) Division of University Information Technology Services (UITS).

During this reporting period, a grant from the National Institutes of Health (NIH) was awarded to the Biocomplexity Institute at Indiana University. Mr. Heiland is the Co-PI and Project Manager on this grant.

Research and Development Activity

The transition of Mr. Heiland to the HPA group in RT has made it possible to dovetail some of the activities of PTL with those of RT/UITS. Some examples include: supporting and promoting OpenMPI on IU's high performance computers, developing and supporting online services, and enhancing science education through outreach efforts in computational science and high performance computing in support of IU's grant for the NSF TeraGrid project.

The primary mission of the HPA group is to provide support for IU faculty and staff who need high performance computing for their research. This covers a broad spectrum of scholarly research from the sciences to the humanities. Fortunately, a common thread for analytic research is raw data, which leads to the need for data analysis and data visualization - skills the SDAL already possessed. Moreover, the SDAL developed considerable experience using many open source (as well as commercial) software tools aimed at analysis and visualization. This experience is proving to be valuable for the HPA mission. Just one of several examples during this reporting period involves the IU Center for Neuroimaging, directed by Dr. Andrew Saykin. The mission of this Center is to address challenging problems related to mapping the relationship between gene pathways and structural, functional and molecular brain imaging. With plans to analyze large scale data sets from national imaging and genomic consortia in the coming year and beyond, Dr. Saykin's group turned to HPA for assistance. The group was able to install their primary analysis application and the myriad libraries on which it depended, including some with which the SDAL was intimately familiar, on IU's two newest high performance computers.



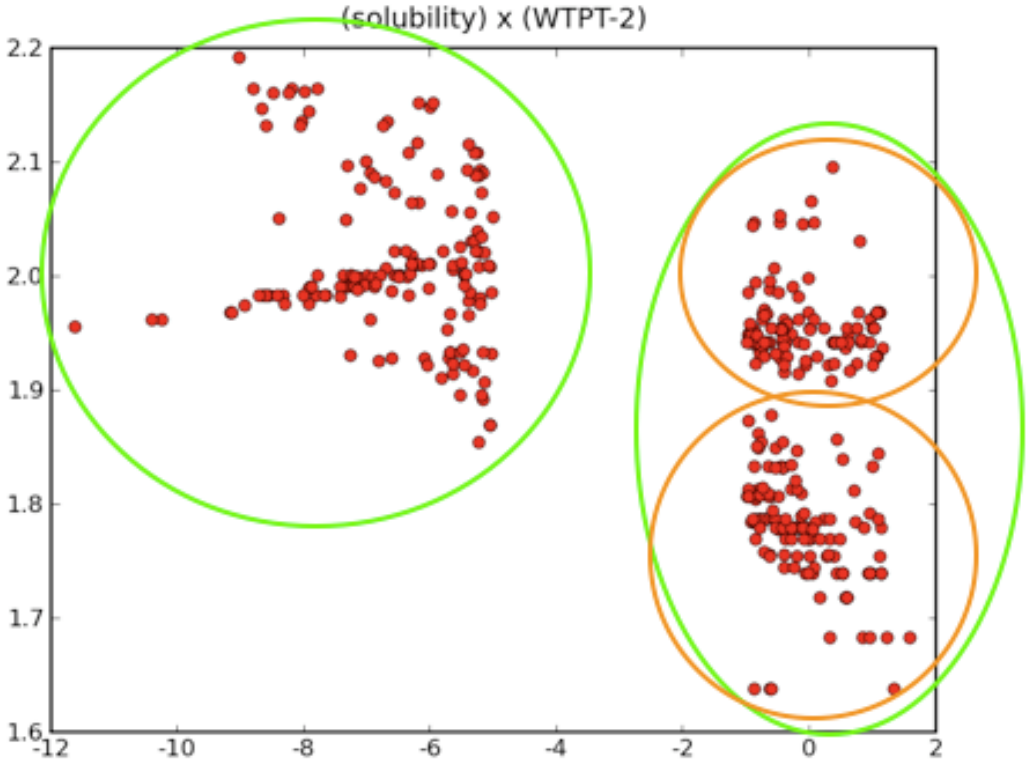
Automatic parcellation of the left hemisphere generated using Freesurfer software on IU's HPC machines. Processing time is approximately 35 hrs to complete the model per subject and the Center has over 700 scans to process. Future work may include up to 10,000 scans

In another project that combines past SDAL activities with the HPA mission, team members have begun the transition of some of the services offered by Life Science Web (lifescienceweb.org), the collaborative project with Dr. Sean Mooney's Lab in the Center for Computational Biology and Bioinformatics in the IU School of Medicine.

Similarly, the SDAL has also dovetailed the collaboration with the IU Biocomplexity Institute from SDAL to HPA. As part of this transition, Mr. Heiland will be partly funded through the NIH grant and will work closely with the Biocomplexity researchers in the IU Physics Department. During this reporting period the research team has ported the CompuCell3D software (a.k.a. Tissue Simulation Toolkit) associated with the grant to IU's high performance computers. This has enabled researchers to run lengthy time-series simulations, an example of which is depicted in the figure above.

In another funded NSF project with Dr. Garth Simpson in the Chemistry Department at Purdue University, Mr. Heiland has continued the SDAL collaboration supporting the NLOPredict software package.

Finally, continuing SDAL's affiliation with IU's Chemical Informatics and Cyberinfrastructure Collaboratory (CICC) and incorporating recent research in the Community Grids Lab, SDAL has begun looking at methods for visualizing results from high-dimensional data clustering analysis. Clustering is, in lay terms, simply the partitioning of data into subsets, thereby (hopefully) providing insight into the data. The data of interest to the CICC are molecules with a variety of properties.



Results of clustering a set of molecules

Intellectual and Artistic Accomplishments

Below are brief summaries of the intellectual and artistic accomplishments of the SDA Lab during the reporting period.

Please note: detailed lists and descriptions of all invention disclosures, software releases, online services, hardware applications, grant funding, and lists of publications and presentations described in this report can be found in the Appendices section. Numbers and counts included in this report have been adjusted based on the most current information available and may be inconsistent with counts given in prior reports.

- **New Technology Disclosures to IURTC**
  - To date, the lab has disclosed one (1) invention to IURTC.

- **New software distributed**
  - The lab has distributed, to date five (5) open source software packages.

- **Online services created**
  - The lab now delivers eleven (11) online services.

- **Publications and Presentations**
  - The lab had three (3) new peer-reviewed publications appear in print during the reporting period.
  - To date, the lab has now published a total of twelve (12) peer-reviewed scientific papers, and students in the lab have completed a total of two (2) Masters' Theses.
  - The lab gave one (1) presentation during the reporting period.

Creating the 21st Century Workforce

- The SDAL currently employs one (1) full-time lab staff member.

- During the reporting period the following changes in lab personnel occurred:
  - No changes in personnel during the reporting period.

Educating the Residents of Indiana and Beyond

We are happy to report that the program begun as a SDAL outreach project with the Girl Scout Math & Science Center in Indianapolis has continued to operate independently of the SDAL. The Director of the Center, Katie Wahlstrom, now conducts the evening workshops, teaching a hands-on computer class on programming and modeling. (Ms. Wahlstrom knows that she can contact Mr. Heiland for support when needed).

Accelerating Economic Growth

During the reporting period, SDAL and UITS have continued to foster a relationship with engineers at Cummins, Inc., in Columbus, IN, as part of the mission of the Indiana Economic Development Corporation (IEDC).

Bringing Distinction to Indiana University and the State of Indiana

In November, Mr. Heiland delivered a presentation in the Grid Computing Environments workshop at the SuperComputing Conference in Reno, NV.

External funding

- **Grants Awarded**

o Two (2) new grant awards totaling $296,482 were made to the lab during the reporting period.
o To date, the lab has obtained $296,482 in external funding.

- **Grants Submitted During Reporting Period**

o The 2007/2008 operations of the SDA Lab are supported by a total of $89,516 in new external funding. To date, the lab has secured $89,516 in funding for operations for FY 2007/2008.

Lab Outlook Jan-June 2007

Mr. Heiland will continue to work on the NIH and NSF funded grants offered through the Biocomplexity Institute at Indiana University and the Chemistry Department at Purdue, and will continue to pursue other grant-funded activities.

II.6 Knowledge Acquisition and Projection Lab

Donald F. "Rick" McMullen, *Director*

Lab Mission

The mission of the Knowledge Acquisition and Projection Lab (KAP Lab) is to develop new insights about how knowledge is created, managed, and used within organizations, and then use this knowledge to develop advanced information technology systems that will create new possibilities for management, delivery, and use of institutional knowledge. Some application areas for the technology developed by the KAP Lab include:

Managing the data and information produced by arrays of sensors, such as ocean buoys;
Creating tools to enhance problem solving in distributed and virtual organizations;
Knowledge management for innovation in virtual organizations; and
Just-in-time information delivery systems for distributed organizations, such as delivery of information needed to repair the highly technical infrastructure and equipment on board Navy ships.

The Knowledge Acquisition and Projection Lab is currently unique among Pervasive Technology Labs in that it is almost entirely self-funded.

Summary of Key Lab Activities

During the reporting period, the KAP Lab participated in several key activities:

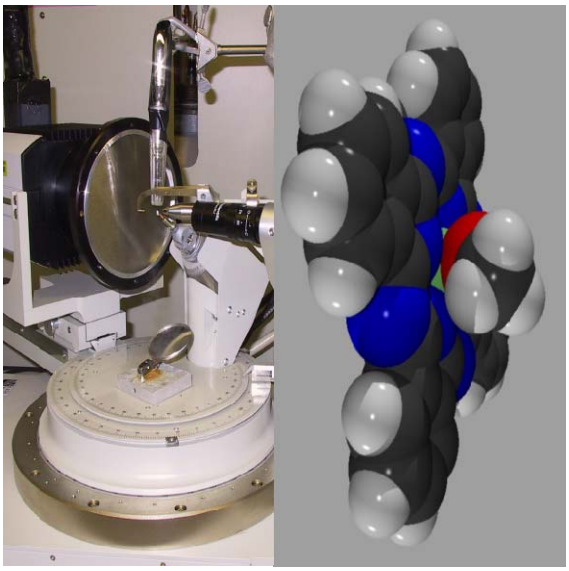
- Continued support for the CrystalGrid Framework (CGF) project. CGF is funded by the NSF to develop an integrated approach to e-Science for crystallography. This project aims to develop an end-to-end approach to experiment design and execution, data acquisition, analysis, publication and dissemanation of results. Further research collaborations were started with Case Western Reserve University and Rochester Institute of Technology to expand this project.
- Continued participation in the NSF funded Polar Grid project with the Community Grids Lab and UITS. Field data from assessments of ice sheet thickness in Greenland by SAR radar will be acquired and analyzed in the field, with input from scientists in the US. The polar exploration Grid will provide a deeper understanding of the impact of global climate change on polar ice sheets and will allow real-time interaction of scientists with new data rather than waiting weeks to see and analyze data from a campaign.
- Continued work with School of Informatics researchers in socio-technical systems for disaster management, and developing next generation performance support systems. The KAP Lab continues to work with the Indiana Department of Homeland Defense

to further develop a proposal for statewide implementation of the Bloomington Emergency Communication Information System concept and plans for integration with state disaster management systems.

- The KAP Lab continues to work on developing and applying a Web 2.0 approach to remote access and use of instruments and sensors. Presentations about the current state of this work were made at the Open Grid Forum, and the lab is a participant in the OGF remote instrument working group.
- Continued development of a project with the director and operations manager of the IU Imaging Center, an advanced capability microscopy service center supported by the NSF and IU Office of the Vice President for Research. The objective is to apply Common Instrument Middleware Archtecture (CIMA) technology for remote access to instruments and data management to improve throughput and utility of the facility.
- Continued work with the Environmental Sensor Network Autoscaling project. This is a collaboration between IU, UCSD and the University of Wisconsin to develop next generation sensor networks for understanding how freshwater lake ecosystems work.

Conference, workshop and symposia committees:

- Technical Program committee for the Third IEEE International Conference on Intelligent Sensors and Information Processing (ISSNIP07) to be held in Melbourne, Australia, December 2007.
- Program committee for CCGrid 2007, the IEEE International Symposium on Cluster Computing and the Grid.
- Program Committee for AusGrid08, the Australian Sympsium on Grid Computing and e-Research
- Program Committee for INGRID 2008, International Workshop on Distributed Cooperative Laboratories Instrumenting the Grid.



Crystallography is the premier technique for determining the detailed 3-D structure of molecules, and is used extensively in biology, life sciences, chemistry and materials science. KAP Lab is collaborating with a worldwide group of crystallographers and computer scientists to develop a software architecture and set of reusable components to make the discovery of new compounds, from catalysts to proteins, easier and more productive.

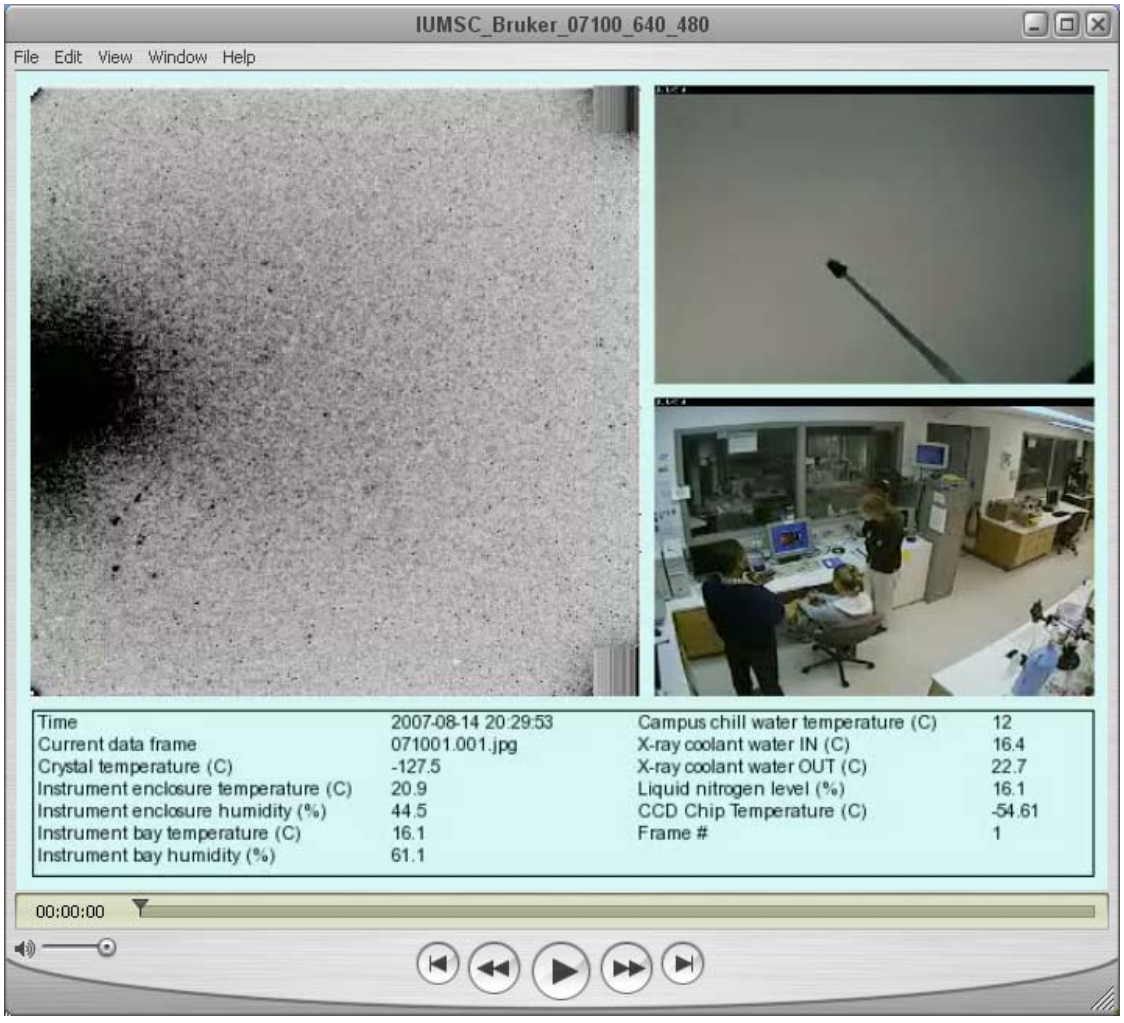
Research and Development Activity

The KAP lab began a collaboration with the Department of Geosciences and the Department of Anthropology and Archaeology at IU to develop a new approach to theory construction and evaluation in Archaeology using advanced computing infrastructure and social computing services. The implementation, Logistes, will provide a focal point for community collaboration and infrastructure development.

During the reporting period KAP Lab

researchers continued collaboration with astronomers at Purdue University Calumet to develop a remote access capability to a 20” robotic telescope. This telescope will be used for teaching astronomy to undergraduates and junior high school students, for research, and as a community resource for informal science education. The control software will combine informal observing directed by an instructor with a queue of observations requested by researchers and will be accessible through a portal that supports the various communities (students, researchers and general public) intended to use the instrument.

Work continued on the CIMA NSF Middleware project. The network of research facilities using this software continues to grow has added two new members during the reporting period. CIMA provides the mechanism for acquiring data from instruments and sensors in these labs and sending these data streams to remote data management systems. A key component of the services that support this network of labs is the IU Data Capacitor (DC), a very large network-attached disk cache for streaming data. The CIMA group participated in demonstrations of the DC at the SC07 SuperComputing expo, at



The KAPLab is working on making complex experiments involving many real-time data streams easier for scientists to understand. One approach shown here is to combine streams of data from instruments and sensors used in an experiment into a digital movie that can be shared on the web and shown with everyday media tools.

which the IU entry won the SC07 bandwidth Challenge illustrating advanced capability to support high data volume network-based research applications.

The KAP Lab collaboration with the Open Grid Computing Environments group also continues. Through this collaboration new approaches to real-time instrument access that bring together Web 2.0 technologies and social computing services.

This photo shows the meteorological and oceanographic tower at Davies Reef in the Great Barrier Reef in Australia, about 70Km off Townsville, AU. Sensors and instruments on this tower measure conditions in the air and water, and is a part of a network of such platforms along the Reef. The KAPLab is working with environmental scientists and educators in Australia to develop a science education program to bring real-time data from the Great Barrier Reef into classrooms and science education programs.

The KAP Lab continued collaboration with IU School of Informatics researchers on context-aware systems and the use of context to improve human performance in problem solving environments. This work brings together several important concepts in AI and performance support. Context in work or learning situations is a powerful determiner of what actions are necessary and appropriate for achieving individual and group goals. Technologies from this work will be used in the Logistes archaeological reasoning project.

Work continued on the SAG3E sensor agent software system. This system is used an NSF-sponsored research collaboration on auto-scaling of sensor networks for environmental research. SAG3E is a distributed, agent-based signal processing and condition monitoring system that can be used to produce, capture, process and monitor real-time data streams, and to create value-added real-time signal products from existing streams in an open, easily accessible way. The system now provides highly reliable monitoring and event detection for a network of meteorological stations and monitoring buoys in freshwater lakes.

During the reporting period work began to build a consortium of technologists within the state to look at continuous monitoring of bridge safety. This work has great potential impact for decision support in road and bridge maintenance.

Intellectual and Artistic Accomplishments

Below are brief summaries of the intellectual and artistic accomplishments of the KAPL during the reporting period.

Please note: detailed lists and descriptions of all invention disclosures, software releases, online services, hardware applications, grant funding, and lists of publications and presentations described in this report can be found in the Appendices section. Numbers and counts included in this report have been adjusted based on the most current information available and may be inconsistent with counts given in prior reports.

- **New Technology Disclosures to IURTC**
  - To date, the lab has disclosed four (4) inventions to IURTC.

- **New Software Distributed**
  - The lab has distributed, to date, three (3) open-source software packages.

- **Online Services Created**
  - The lab now delivers three (3) online services.

- **Publications and Presentations**
  - To date, the lab has now published a total of fifty-six (56) peer-reviewed scientific papers, and students in the lab have completed a total of five (5) Ph.D. Dissertations and two (2) Masters' Theses.
  - The lab gave a total of four (4) presentations during the reporting period.

Creating the 21st Century Workforce

- The KAP Lab currently employs four (4) full-time lab staff members, and supports one (1) graduate students, research associates, affiliated faculty, and part-time student employees.

- During the reporting period the following changes in lab personnel occurred:
  - No changes in full-time staff occurred during the reporting period.

- During the reporting period, students affiliated with the lab have achieved the following degrees:
  - No degrees earned during the reporting period.

Educating the Residents of Indiana and Beyond

This reporting period the KAP Lab continues to develop its relationship with the P-16 Center in the School of Education through exploration of a joint project. The goal of the IU P-16 Center is to foster collaborations and partnerships that lead to educational improvement from pre-kindergarten through postsecondary education. The aim of this

project is to allow teachers in Indiana school districts to locate expertise within the P-16 Center, the School of Education, or across the IU Bloomington Campus to consult with to solve their educational problems or to develop outreach partnerships with IU to strengthen Indiana's schools.

Work continued on two research projects: "ReefScope: An International Research and Education Partnership in Curriculum and Cyber-infrastructure Development for Teaching Secondary and Higher Education Students about Coral Reef Ecology, Sensor Networks and the Impact of Global Climate Change" and "International System Development and Education Center (ISDEC): Developing information and instructional systems for a global high-tech workforce." At this stage the KAP Lab continue to seek Non-governmental Organization (NGO) and foreign government support for these international projects.

Accelerating Economic Growth

During the reporting period, the KAP Lab participated in the submission of a Small Business Innovative Research proposal with an Indiana-based defense contractor entitled: "Expedited Transition of Propulsion Modeling & Simulation Capability."

Bringing Distinction to Indiana University and the State of Indiana

As mentioned in more detail elsewhere in the report, the KAP Lab participated in the organization and execution of several international e-Science meetings.

External funding

- **Grants Awarded**
  - Total funding from lab grants to date is $3,241,009 all of which flows into lab's budgets.

Lab Outlook Jan-June 2007

Work will continue on all of the projects described above during the upcoming reporting period. In addition to these ongoing activities the KAP Lab expects expand its relationship with the IU School of Education in Science, Technology, Engineering and Mathematics education (STEM). KAP Lab interactions started with joint development of STEM teaching and workforce development projects, and are expected to branch out into other areas including effectively leveraging expertise in the School of Education to support the development of school and district enhancement projects. The KAP Lab will also continue to participate in the Open Grid Forum as a developer of software systems for remote access to instruments and sensors and a member of the OGF remote instrumentation working group.

III. Collaborative and Leveraged Activities

The evolution and continued strengthening of collaboration between Pervasive Technology Labs, the School of Informatics, and University Information Technology Services rose to new pinnacles of achievement during the fall of 2007. Key highlights include the following:

PTL COO, Craig Stewart

PTL Science Director, Dennis Gannon

- Indiana University, led by PTL, received tremendous national and international attention at the annual SuperComputinc conference, held each year during November. Key highlights include:
    - A team led by Indiana University (including University Information Technology Services, Pervasive Technology Labs, and the IU School of Informatics) won a prestigious Bandwidth Challenge award at the SuperComputing '07 conference.
    - A team of students led by Open Systems Lab Director Andrew Lumsdaine competed strongly in the SuperComputing Cluster Challenge.
    - The PTL-led PolarGrid project received significant attention at the SC07 conference; CGL Director Geoffrey C. Fox hosted a kickoff dinner of IU and Elizabeth city State University.
- Science Director Dennis Gannon, PTL generally, and COO Stewart continue to lead IU toward an increasingly prominent role in the NSF-funded TeraGrid. UITS and the Community Grids Lab collaborated to add new services to the TeraGrid, deploying intuitive advanced tools for scientific discovery for the national research community
- PTL-affiliated Faculty Beth Plale led IU's effort to prepare and submit a $9,000,000 proposal to the NSF under the new NSF DataNet solicitation, in collaboration with the University of Michigan.
- COO Stewart and UITS colleague D. Scott McCaulay aided Arthur F. Bentley Professor of Political Science, Elinor Ostrom in preparation of a $1.5 million Cyber-Enabled Discovery and Innovation (CDI) proposal. Ostrom's proposal will explore sustainability of Social-Ecological systems.
- COO Stewart and UITS colleagues Stephen Simms and Matthew Link aided IU astronomy professor Katherine Rhode in the submission of a $1.9 million CDI proposa. Rhode's proposal will support image analysis, data mining, and information flow for astrophysics.

In addition, overall success in obtaining grants continues to grow. To date, the total impact of Pervasive Technology Labs on grant successes by Indiana University totals $109,681,208. This reflects grants won by PTL, and grants won by PTL in collaboration with other parts of IU, or grants won by other subunits of IU leveraging and drawing upon the expertise of Pervasive Technology Labs.

Further information on collaborative and leveraged accomplishments of PTL working with UITS, the IU School of Informatics, and other parts of Indiana University is presented below.

SuperComputing '07

Bandwidth Challenge

The international SuperComputing (SC) conference is the largest and most important conference in advanced computing and networking in the world. It is held in the US each November - this year in Reno, Nevada. Each year for the past decade, the core of IU's presence at SC has been a large display booth. And for more than five years IU has partnered with other state Universities, including Purdue each year, and also the University of Notre Dame.

PTL's Daphne Siefert-Herron (Left) and Therese Miller at the reception desk of the IU exhibit for the SC07 SuperComputing conference.

Each year, there are a series of challenge events held at the SuperComputing conference. These challenges represent various areas of advanced information technology and networking. In prior years, Indiana University has won three High Performance Computing Challenges (won in 1995, 1997, and 2003 by teams led by PTL Science Director Gannon, PTL faculty affiliate Randall Bramley, and PTL COO Stewart, respectively). Despite earlier attempts, IU had never won the Bandwidth Challenge – considered by many to be the most prestigious. The Bandwidth Challenge is judged on multiple factors, but primarily on the extent to which commodity high speed networks are used to their fullest theoretical limits in support of distributed computer applications, as well as on scientific merit. This year, a team led by Indiana University won the SC07 BandWidth challenge, beating out some of the most elite supercomputing centers in the world in head-to head competition – including the San Diego Supercomuting Center.

The theme of this year's Bandwith Challege competition was "serving as a model." Competitors were challenged to create methods for fully utilizing a high-speed network path to support end-to-end network applications. Network applications were supposed to run across a grid that included the conference exhibit floor and the participant's home institutions using production networks.

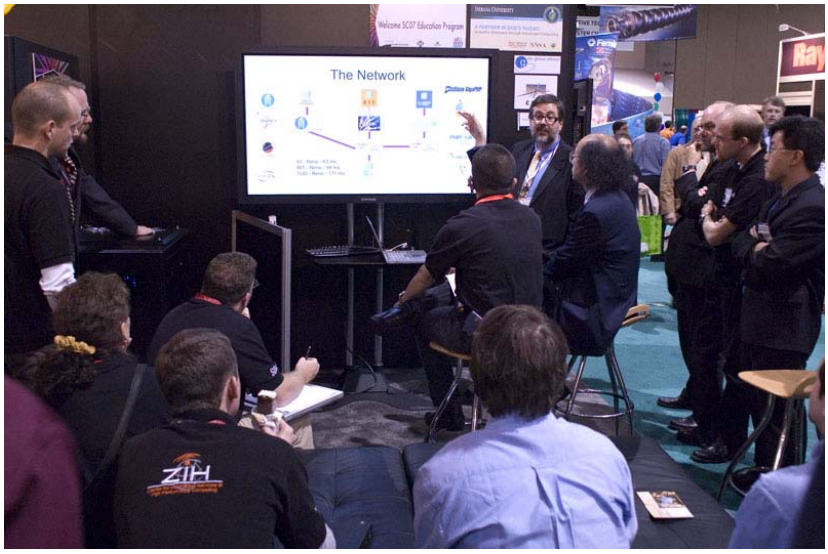
Using the IU Data Capacitor, a system designed to store and manipulate massive data sets, the IU team achieved a peak transfer rate of 18.21 Gigabits/second out of a possible maximum of 20 Gigabits/second. This performance was nearly twice the peak rate of the nearest competitor. The IU team achieved an overall sustained rate of 16.2 Gigabits/second (roughly equivalent to sending 170 CDs of data per minute) using a

transatlantic network path that included the Internet2, GÉANT, and DFN research networks.

During the competition, the IU-led team ran several cutting edge computer applications, all of which depend upon the Data Capacitor's ability to read and write data at extreme speeds. A key aspect of the demonstration was the ability to simultaneously support a mix of several different applications from the sciences and humanities, including:

- Modeling and analysis of the amyloid peptide, which is thought to be the cause of Alzheimer's disease, using IU's Big Red Supercomputer, led by Mookie Baik of the IU School of Informatics and IU Bloomington Department of Chemistry.
- Live acquisition of x-ray crystallography data, led by D.F. "Rick" McMullen, of Pervasive Technology Labs at Indiana University.
- Digital preservation of ancient Sanskrit manuscripts, led by P.R. Mukund of the Rochester Institute of Technology.
- Performance analysis of a computational fluid dynamics application by the Technische Universitaet Dresden using its Vampir/VampirTrace software package, led by Matthias Mueller of the Center for Information Services and High Performance Computing.
- Simulations of a high energy physics reaction between the basic particles of matter, led by Scott Teige of Indiana University Information Technology Services.

Often, today's demonstrations are tomorrow's production systems. In the case of Lustre-WAN, the Data Capacitor, and IU's Big Red Supercomputer, today's demonstrations are *today's* production systems. The Bandwidth Challenge award garnered tremendous publicity for IU and pervasive technology labs – and highlighted PTL's role in creating new tools to advance scientific research. There were more than 50 items in the technical and lay press about IU's Bandwidth Challenge award; it was the single biggest IT press event for IU this year.



Data Capacitor project lead, Stephen Simms presents IU's outstanding results to the judges during the SC07 Bandwidth Challenge. IU earned first-place in the prestigious supercomputing competition.

Cluster Challenge

Among the SC07 Challenge Competitions was the student Cluster Challenge – a competition among teams of undergraduate students to build the best performance cluster possible in one 19" wide computing rack, using a maximum of 30 amps of power. Teams were judged by the amount of processing they were able to accomplish in the course of 48 hours on a suite of advanced scientific applications. The team of IU undergraduates entered this competition worked under the leadership of OSL Director Andrew Lumsdaine. The educational aspects of this activity were described in detail in the OSL lab report. The team worked all summer and fall at IU, building an Apple cluster called "Red Delicious." This cluster was built with the support of UITS and corporate partners Apple, Intel, Myricom and Fujitsu. The cluster was shipped to Reno, Nevada, and the team went to work on Monday, November 12. Working in shifts, team members worked round the clock. At one point, the team was interrupted by a complete power outage at the SC conference. It was at this point that the IU team really showed their mettle. Many teams ran to the judges asking for extra time, only to be told "no, this is real life, get to work." But the determined IU team remained unphased and concentrated on getting their cluster up and running again. In the end, the IU team did not win the competition. However, the event was a great learning experience, generated tremendous interest in scientific computing among many IU undergrads… and prepped IU for next year, when Lumsdaine will again lead a team - hopefully on to victory. But excitement and education are the real goals here, and by those most meaningful metrics, IU is already a winner.

PolarGrid

PTL and IU caught lightning in a jar with the PolarGrid project. This project demonstrates new pervasive computing technologies and also addresses the gravely important problem of global warming, just as national attention on the topic reaches new heights. The IU-led PolarGrid project, already discussed in the Community Grid Lab report, was featured in the IU display at SC07. It is traditional for conference booths to have a small giveaway item for those who visit the booth. This year IU's giveaway was a small polar bear wearing a PolarGrid t-shirt. This was the most popular giveaway at the entire conference, and the effect of this was that the PolarGrid project, IU, and the general issue of global warming were all received great attention at the SC07 conference. CGL Lab Director Geoffrey Fox hosted a PolarGrid kickoff dinner at SC07, and this exciting project is now underway. IU, under the leadership of Pervasive Technology

Polar Grid polar bears delighted visitors to the IU booth during the SC07 SuperComputing conference in November.

Labs, aims for nothing less than to revolutionize the world's understanding of polar ice sheet structure and thickness. In so doing, the Polar Grid team will enable scientists to much better measure and understand the impact and rate of global warming.

PTL Operations Manager, Therese Miller (Left) and Professor Linda Hayden from Elizabeth City State University (ECSU). ECSU is IU's partner in the Polar Grid project.

TeraGrid.

2007 was a turning point in IU's involvement in the TeraGrid (the National Science Foundation's flagship effort to create a national cyberinfrastructure for 21st century innovation). IU's Big Red continues to be the main computational engine behind the science gateway for tornado prediction being created by PTL Science Director Dennis Gannon. More importantly, IU has established a unique niche for itself within the TeraGrid. Leveraging the expertise of CGL Director Geoffrey C. Fox, CGL Associate Director Marlon Pierce, and PTL Science Director Dennis Gannon, IU is specializing in support for science gateways – tools that provide intuitive web interfaces to advanced supercomputing systems. By focusing on these tools – which provide end-to-end solutions in support of scientific innovation – IU is changing the way US scientists interact with advanced computing systems.

This effort also gives IU an approach to funding in ways that serve the best interests of the University and the state. IU submitted two applications to the NSF for delivery of supercomputing cycles to the nation. Unfortuntately, neither was funded. Looking at the winning bids however, one sees that the winning proposals were heavily aided by subsidies in the tens of millions of dollars. Winning grants –even large ones for $40 or $60 million dollars – by giving away subsidies in the tens of millions of dollars or more is simply not in IU's best interest. So the strategy IU has adopted in competing for national cyberinfrastructure funding concentrates on IU's intellectual leadership – primarily via PTL – to focus on grants that can be won in ways that serve the best interests of the State and Nation.

The Indiana Economic Development Corporation and "Even Bigger" Red

As mentioned in the last report, IU's Big Red Supercomputer was upgraded from 20 to 30 TFLOPS during the spring of 2007. While not yet publicly announced, IU now has an industrial outreach expert – Dr. Danko Antolovic – who is working with IBM to help private concerns located in the State of Indiana use the added capacity of Big Red to help boost the economy of Indiana. Dr. Antolovic's move from the ANML to this new role will take advantage of his tremendously diverse professional experience from his advance network research with ANML while leveraging his prior scientific background and past experience with computing in industrial settings. An announcement from the Governor's office is forthcoming. IU is nearing completion of an agreement with a major heavy manufacturing concern located in southern Indiana to do engineering calculations and

simulations on Big Red. IU has high hopes for this collaboration, and believes it will become an exemplar of IU and PTL scientists delivering services of direct benefit to the economy of the State of Indiana.

New Grants

PTL participated through the fall in the creation of three major new grants. All are complex and important. These grants were submitted between the end of the formal reporting period and the completion of the actual report. Since the majority of the preparatory work was done during the reporting period, it seemed appropriate to describe these grant proposals here.

NSF DataNet Solicitation

10 years after creating the Internet, the National Science Foundation issued a call for proposals called "'DataNEt." The entire national scientific community is attuned to seomthing IU has understood for years: the future of advanced computing is based on the need to analyze and understand the data being born digital at a rate that increases every month. PTL faculty affiliate Beth Plale led the writing of a grant pre-proposal entitled "DataCuRe: A National Center for Social, Human, and Environmental Science Data Integration, Curation and ReUse." This grant, if funded, will create a national network of data and data analysis tools designed to help scholars better understand human behavior and the impact of humans on the global environment. The grant is for a total of $20 million dollars; if funded, a total of $9 million would come to IU.

NSF Cyber-Enabled Discovery and Innovation (CDI) Solicitation

Beginning in 2008, the National Science Foundation (NSF) will begin a new five year program, the Cyber-enabled Discovery and Innovation (CDI) initiative for the development of novel approaches to the application of new information technology capabilities toward scientific inquiry. COO Stewart and UITS colleague D. Scott McCaulay aided Arthur F. Bentley Professor of Political Science, Elinor Ostrom in preparation of a $1.5 million Cyber-Enabled Discovery and Innovation (CDI) proposal to explore sustainability of Social-Ecological systems. This grant, if funded, will create an ontological cyber-enabled methodology that will enable integration of data and results from existing studies and also adapt to new sources and types of information.

NSF CDI-Type II Solicitation: Gigapixel Astrophysics in the New Millennium - Image Analysis, Data Mining, and Information Flow in the Data Capacitor Era

Astrophysics, like much of science, is approaching an era in which research with large data sets -- e.g., surveys that detect millions of objects and produce petabytes of data -- will become the norm. The WIYN One Degree Imager (ODI) will be completed in 2010 and will provide high-resolution imaging over a very large field of view. ODI images will have a billion pixels and be 4 GB in size - too large for current astronomical software and desktop computers to easily handle. A typical observing run will yield ~2-6 TB of data,

and ODI will generate 1-2 PB in its first 10 years. To tackle these issues, IU has assembled a team with expertise in astronomical and statistical data analysis, networking, high-performance computing, data archiving, metadata handling, and visualization. The system will be built around the Data Capacitor, a unique 1 petabyte storage system that accesses data over wide areas at unprecedented rates and that is already changing how research is done in a number of disciplines. The proposal was submitted by IU astronomy professor Katherine Rhode and totals $1.9 million over four years.

IV. Economic Development

As noted earlier, it has been eight years since the initial funding of the Indiana Pervasive Computing Research Initiative. Enough time has transpired to begin to see patterns in the outcomes of investments made by the PTL Capital Investment Fund. Investments in two companies – the Haelan Group and Chartlogix, Inc. (formerly Dynomed) – were absolutely critical to the success of these Indiana-based businesses. Those investments have paid off in terms of high quality jobs in the State of Indiana for some time. Both companies are doing well. The Haelan Group was acquired by CareGuide during the first half of 2007, and IU expects to received continued return on investment per the terms of sale (which call for additional payments to IU as the new business achieves revenue generation milestones). Among the companies started via transfer of technology from PTL Labs, or started by PTL personnel, Anabas Inc. has done particularly well, and is growing at a deliberate pace through SBIR and STTR grants.

The following sections of this report summarize the status of companies in which the Pervasive Technologies Labs have played some role.

Companies in which the PTL Capital Investment Fund has made investments, not affiliated with PTL:

The Haelan Group –IU has received investments valued at $480,000 as a result of the sale of the Haelan Group to CareGuide. There are anticipated additional earnings described in sales contract that are realizable when the Haelan Group achieves business milestones over the next three years.

Chartlogix, Inc. (was Dynomed, Inc.) – Following the successful sale of Dynomed, Inc. to Chartlogix in 2006, the investment remains at the given value of $300,000 for 346,711 shares.

Companies in which the PTL Capital Investment Fund has made investments, affiliated with PTL:

Anabas, Inc. (affiliated with the Community Grids Lab) – Anabas is now hard at work executing the work-plan of a grant funded during the first half of 2007 by a US Department of Defense Phase II Small Business Innovation and Research (SBIR) grant. This grant focuses on development of a Sensor Grid that has applications in defense, homeland security, and civil security. Anabas is including their collaborative environment to support shared applications with embedded video, important as a business tool and possibly related to future business opportunities to enable decreased bandwidth for videoconferencing without sacrificing quality.

SGC Technologies, LLC (affiliated with the Advanced Network Management Lab) - SGC Technologies, LLC (www.sgctech.com) remains active and continues to develop and market its enterprise file and data-sharing tool, FileShare.

EnVizable LLC (affiliated with the Visualization and Interactive Spaces Lab) – En Vizable ceased operations during the reporting period.

Veterisoft, Inc. (created by and affiliated with the Open Systems Lab) – Veterisoft's position remains essentially unchanged from the previous report. The company has had insufficient sales to continue operations at full strength and is operating in virtual mode.

Companies affiliated with PTL, but operating without investment from the PTL Capital Investment Fund:

White River Labs, LLC - (affiliated with the Open Systems Lab) - Founded earlier in 2007 by Christopher Mueller, a recent IU graduate, and Andrew Lumsdaine, director of OSL, the goal of PTL's newest spin-off company is to commercialize technology based on synthetic programming techniques. Lumsdaine and Mueller held a series of meetings with potential investors during the reporting period, and remain optimistic regarding chances for obtaining venture capital investment.

Acquired Science, LLC (affiliated with the Scientific Data Analysis Lab)- Acquired Science, LLC continues operations as a consulting business but no new contracts were added during the reporting period.

V. School of Informatics Progress Report

Indiana University's School of Informatics is in a transition period, moving from its formative period under the leadership of founding Dean Mike Dunn to the beginning of a more mature stage under the leadership of new dean, Bobby Schnabel. Since Schnabel's arrival in Bloomington it's been full-speed ahead with impressive accomplishments by faculty and staff. Most notable is the recently completed Strategic Plan (http://www.informatics.indiana.edu), the culmination of detailed findings by several internal task forces identifying strengths, weaknesses and opportunities for the School in the areas of undergraduate education, graduate education, faculty development, and research.

The School currently has about 1,600 students enrolled in undergraduate and graduate degree programs at IU campuses in Bloomington, Indianapolis, South Bend, New Albany and Kokomo. More than 1,000 students have earned diplomas from the School of Informatics.

Economic Development
The School is re-committing to its role as an important partner in Indiana's economic development initiatives. With the assistance of the Dean's Advisory Council, a council of regional and national advisors, a strategy is being developed to ensure that informatics students and graduates are properly prepared for and sufficiently connected to Indiana's emerging technology and life sciences sectors.

Research Highlights
Faculty at the School of Informatics in Bloomington and IUPUI continue their impressive string of research funding awards, and publication of research findings in leading national and international journals. Highlights include:

- **Informatics designs tools to promote privacy in health care and independent living**. An Indiana University School of Informatics-led team, which includes PTL scientist Kay Connelly, is creating tools that enable elders to maintain their privacy while utilizing home-based computing for their health and personal safety. The project, which is funded by an $821,000 grant from the National Science Foundation, will construct a "living lab" with a select group of volunteers at a Bloomington retirement community.

- **Toolkit for scientific provenance data collection and reuse.** Faculty from the School of Informatics' Center for Data and Search Informatics (DSI), which includes DSI Director Beth Plale and PTL lead scientist Dennis Gannon, recently received a National Science Foundation (NSF) grant for $432,954 to develop a digital toolkit to help researchers more easily capture information about their scientific work and data products. The new tools will create a kind of "digital tagging," keeping research intact as it passes from one scientist to another. The grant also funds the creation of a public catalog for provenance information collected from scientific workflows.

- **Prestigious award received for research into Chile's use of technology during its historic political shift.** Eden Medina, assistant professor, Indiana University School of Informatics, was awarded the Institute of Electrical and Electronics Engineers (IEEE) Life Members Prize in Electrical History for 2007, for her research paper entitled, *Designing Freedom Regulating a Nation: Socialist Cybernetics in Allende's Chile*. The IEEE is the world's largest professional society for the advancement of technology. It supports work in the areas of electrical engineering, communications, computer engineering, computer science and related disciplines.

- **Research measures neurological, physiological response to interactive social media.** Two IU School of Informatics faculty researchers have received a multi-year funding grant from One-to-One, a Boston-based digital marketing company that will bring to Indiana University's Bloomington campus a one-of-a-kind research laboratory to measure media and user engagement. Jeffrey Bardzell, assistant professor, IU School of Informatics in Bloomington; and Shaowen Bardzell, assistant professor, IU School of Informatics at IUPUI – both professors with the School's Human-Computer Interaction Design program – have been awarded the use of a neurological/physiological user engagement research lab (valued at $65,000), with additional funding at more than $50,000 per year to support research.

- **Outreach DVD for the American Legion.** A team of IUPUI students, including two undergrads from the IU School of Informatics Media Arts & Science Program, has produced a four-minute DVD project designed to change the public face of the American Legion, as it relates to teens. The challenge – issued by the Legion, and Legion Women's Auxiliary – was to increase awareness of events hosted by its Boys and Girls State Programs, offered to high school juniors via American Legion posts across the country.

VI. PTL Outreach Activities

Pervasive Technology Labs participated in many outreach activities during the reporting period thorough the Community Outreach Program and various activities done by individual labs. The Community Outreach Program is currently exploring ways to reach greater numbers of Indiana school children through a planned partnership with the Wonderlab Science and Technology Museum in Bloomington. The groups have agreed to move forward with offering technology-themed classes held at Wonderlab during the spring and summer, with PTL employees serving as volunteer instructors. Meetings are scheduled for early in 2008 to fully develop the plan and content for these classes.

PTL also plans to hold another summer technology workshop for teens in June, and plans to participate for the second year in the School of Informatics Summer Camp for teens. The Community Outreach Program has found these larger, concentrated events to be more effective at reaching a larger number of students than the smaller monthly events.

In addition to numerous other outreach events mentioned in the individual lab reports, outreach event highlights for the current reporting period include PTL's exhibit at the Indiana State Fair in July. PTL researchers and outreach staff braved the blistering summer temperatures to educate Indiana residents on online security and choosing a safe passphrase for their online accounts. The Advanced Network Management Lab provided both staff and equipment for a display entitled "Test Your Passphrase Strength" in which fairgoers could see how weak or strong their chosen password or passphrase is on a

Professor Linda Hayden from Elizabeth City State University talks to K-12 teachers about polar science education methods and resources. Hayden was an invited speaker at IU's exhibit at the SC07 conference.

lighted display pole. Once an individual entered a password that was determined to be highly secure, the pole would light up and a bell would ring. This was a very popular display with many "contestants" returning to try their luck several times throughout the day.

Another outreach highlight was a talk given by Professor Linda Hayden of partner organization Elizabeth City State University to k-12 teachers involved in the TeraGrid

education program at the annual SC07 SuperComputing conference. The talk, entitled “Ice, Ice, Baby: Remote Sensing of Ice Sheets Educational Activities” introduced teachers to methods and resources for teaching polar and ice sheet science in a k-12 environment. This outreach event was an extension of the Community Grids Lab’s Polar Grid project.

VII. Operational Activities

PTL Operations Manager, Therese Miller (right) and Information Manager, Daphne Siefert-Herron

Increased partnership and collaboration between PTL and the Research Technologies division of UITS have enhanced the effectiveness of both – and the effectiveness of the IU School of Informatics in the processs. Therese Miller continues to manage all central supporting staff within PTL, and that centralization has resulted in excellent operational support for the labs overall. Daphne Siefert-Herron has been tremendously successful as PTL Information Manager. Ms. Siefert-Herron has been particularly effective in achieving excellent press coverage of PTL activities such as the Bandwith Challenge award win.

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Deana Forest serves as the PTL Office Services Assistant and supports the Bloomington Labs. Jennifer Browning serves as Services Coordinator in Indianapolis, aiding the activities of the VIS and SDA Labs.

Office Services Assistant, Deana Forrest

The streamlining of PTL operational activities achieved during the past two years has allowed COO Craig Stewart to focus more on strategic planning for PTL. IU Vice President and CIO Bradley Wheeler, Science Director Dennis Cannon, and Stewart communicate regularly to set and coordinate achievement of PTL strategic goals.

VIII. Appendices

Appendix 1: Technology Disclosures by Pervasive Technology Labs July-December 2007

Tech No.	Tech Name	PTL Director	Description	Status	Comments
08053	MPI.NET: Message Passing Interface in C#	Lumsdaine	A software library that provides access to the Message Passing Interface (MPI) for high performance parallel computing on clusters	Open Source	
	Fault Tolerant High Performance Information Services	Fox	Fault tolerant high performance information services for dynamic collections of grid and web services	New	

Appendix 2: Open Source Software Distributed by Pervasive Technology Labs July-December 2007

Name	Description	Lab	URL	Comments
Open MPI v1.2.4	Open Source MPI implementation	Open Systems Lab	http://open-mpi.org	
Open MPI v1.2.5	Open Source MPI implementation	Open Systems Lab	http://open-mpi.org	
LibNBC v0.8.2	Non-blocking interface for MPI collective operations	Open Systems Lab	http://www.unixer.de/research/nbcoll.libnbc	
LibNBC v0.9.1	Non-blocking interface for MPI collective operations	Open Systems Lab	http://www.unixer.de/research/nbcoll.libnbc	
NetGuage v2.Orc2	High-precision network parameter measurement tool	Open Systems Lab	http://www.unixer.de/research/netguage	
MPI.NET v0.5.0	Implementation of the MPI for Microsoft's .NET environment	Open Systems Lab	http://www.osl.iu.edu/research/mpi.net	
Boost v1.34.1	Collection of free, peer reviewed C++ libraries	Open System Lab	http://www.boost.org	
OSCAR v5.1	Software that allows users to set up and maintain a high performance computing cluster	Open Systems Lab	http://oscar.openclustergroup.org	
Narada Brokering v3.0.2	Infrastructure for building distributed applications	Community Grids Lab	www.naradabrokering.org	
Narada Brokering v3.1.0	Infrastructure for building distributed applications	Community Grids Lab	www.naradabrokering.org	
Narada Brokering v3.1.1	Infrastructure for building distributed applications	Community Grids Lab	www.naradabrokering.org	
Narada Brokering v3.1.2	Infrastructure for building distributed applications	Community Grids Lab	www.naradabrokering.org	
Narada Brokering v3.1.3	Infrastructure for building distributed applications	Community Grids Lab	www.naradabrokering.org	
OGCE v2.2	Open grid computing environments software	Community Grids Lab	www.colab-ogce.org/ogce2/	
OGCE GTLAB	Programming tag libraries	Community Grids Lab	www.collab-ogce.org	

Appendix 3: Online Services Deployed by Pervasive Technology Labs July-December 2007

Name	Description	Lab	URL	Comments
MPI.NET Web Site	Hope of the MPI.NET software library providing software, documentation and tutorials	Open Systems Lab	http://www.osl.iu.edu/research/mpi.net	
QuakeSim2 Portal and Web Services	Earthquake monitoring tools and services	Community Grids Lab	http://gf7.ucs.indiana.edu:8080/gridsphere	
CICC Web Services	Numerous services for the Chemical Informatics Cyberinfrastructure Collaboratory	Community Grids Lab	http://www.chembiogrid.org/wiki/index.php/CICC_Web_Resources	
MSI-CIEC Portal	Portal for scientists at Minority Serving Institutions	Community Grids Lab	http://gf14.ucs.indiana.edu	
MSI-CIEC Wiki	Wiki for scientists at Minority Serving Institutions	Community Grids Lab	http://www.msi-ciec.org/eduwiki/index.php/Main_Page	
SALSA Wiki	Wiki for SALSA Project	Community Grids Lab	http://www.infomall.org/multicore.index.pho/Main_Page	
Polar Grid Wiki	Wiki for Polar Grid Project	Community Grids Lab	http://www.polargrid.org/polargrid/index.php/Main_Page	

Appendix 4: Pervasive Technology Labs Papers and Publications

July-December 2007

Open Systems Lab Publications

B. Barrett, G. Shipman, **A. Lumsdaine,** "Analysis of Implementation Options for MPI-2 One-Sided. in proceedings, Euro PVM/MPI, Paris, France, October 2007.

J. Cottam, A. Lumsdaine, "ThisStar: Declarative Visualization Prototype" in IEEE Symposium on Information Visualization, 2007.

J. Cottam, B. Martin, C. Mueller, **A. Lumsdaine**, "Reading the Envelope: Understanding Visual Similarity Matrices" in IEEE Symposium on Visualization, 2007.

P. Gottschling, D. Wise, M. Adams, "Representation-transparent Matrix Algorithms with Scalable Performance" in ICS '07: Proceedings of the 21st annual International Conference on SuperComputing, New York, NY, ACM Press, pp 116--125, 2007.

R.Graham, **B. Barrett**, G. Shipman, T. Woodall, G. Bosilca, "Open MPI: A High Performance, Flexible Implementation of MPI Point-to-Point Communications" in Parallel Processing Letters, Volume 17, Issue 1, pp79-88, 2007.

R. Graham, R. Brightwell, **B. Barrett**, G. Bosilca, Pjesivac-Grbovic, "An Evaluation of Open MPI's Matching Transport Layer on the Cray XT" October 2007.

D. Gregor, "A Tour of the Concepts Wording" technical report N2399=07-0259, ISO/IEC JTC 1, Information Technology, Subcommittee SC 22, Programming Language C++, September 2007.

D. Gregor, **A. Lumsdaine**, "Concepts for the C++0x Standard Library: Utilities (Revision 2)" technical report N2322=07-0182, ISO/IEC JTC 1, Information Technology, Subcommittee SC 22, Programming Language C++, July 2007.

D. Gregor, E. Niebler, "Extending Variadic Template Template Parameters" technical report N2488=07-0358, ISO/IEC JTC 1, Information Technology, Subcommittee SC 22, Programming Language C++, December 2007.

D. Gregor, **J. Siek**, **A. Lumsdaine**, "Concepts for the C++0x Standard Library: Iterators (Revision 2)" technical report N2323=07-0183, ISO/IEC JTC 1, Information Technology, Subcommittee SC 22, Programming Language C++, July 2007.

D. Gregor, B. Stroustrup, "Proposed Wording for Concepts (Revision 1)" technical report N2307=07-0167, ISO/IEC JTC 1, Information Technology, Subcommittee SC 22, Programming Language C++, July 2007.

D. Gregor, B. Stroustrup, “Proposed Wording for Concepts (Revision 2)” technical report N2398=07-0258, ISO/IEC JTC 1, Information Technology, Subcommittee SC 22, Programming Language C++, September 2007.

D.Gregor, B. Stroustrup, “Proposed Wording for Concepts (Revision 3)” technical report N2421=07-0281, ISO/IEC JTC 1, Information Technology, Subcommittee SC 22, Programming Language C++, October 2007.

G. Shipman, R. Brightwell, **B. Barrett**, J. Squyres, and G. Bloch, “Investigations on InfiniBand: Efficient Network Buffer Utilization at Scale” in proceedings, Euro PVM/MPI, Paris, France, October 2007.

Community Grids Lab Publications

M. Aktas, **G. Fox**, **M. Pierce**, “Distributed High Performance Grid Information Service” technical report, December 2007.

M. Aktas, **G. Fox**, **M. Pierce**, “Information Federation in Grid Information Services” technical report, December 2007.

J. Choi, Y. Yang, S. Kim, D. Gannon, “V-Lab-Protein: Virtual Collaborative Lab for Protein Sequence Analysis” in proceedings Workshop on High-Throughput Data Analysis for Proteomics and Genomics as part of BIBM Silicon Valley Fremont CA, November 2-4, 2007.

A. Donnellan, J. Parker, R. Granat, **G. Fox**, **M. Pierce**, J. Rundle, D. McLeod, R. Al-Ghanmi, L. Grant, W. Brooks, “QuakeSim: Efficient Modeling of Sensor Web Data in a Web Services Environment” November 30, 2007, to be published in 2008 IEEE Aerospace Conference Big Sky, Montana, March 1-8, 2008.

A. Donnellan, , J. Rundle, L. Grant, D. McLeod, **G. Fox**, **M. Pierce**, T. Tullis, W. Brooks, J. Parker, R. Granat, “Abstract” for 2007 SCEC Annual Meeting, Palm Springs, California, September 9-12.

J. Ekanayake, **S. Pallickara** and **G. Fox**, “A Scalable Framework for the Collaborative Analysis of Scientific Data” technical report submitted to CCGrid Doctoral Symposium, December 12, 2007.

G. Fox, **S. Bae**, R. Guha, **M. Pierce**, **X. Qiu**, D. Wild , H. Yuan, “High Performance Robust Datamining for Cheminformatics” Paper ID: 1168842 at Division of Chemical Information session on Cheminformatics: From Teaching to Research Tuesday, April 8, 2008 at Spring 2008 American Chemical Society National Meeting & Exposition, April 6-10, 2008.

G. Fox, **S. Bae**, R. Guha, **M. Pierce**, **X. Qiu**, D. Wild , H. Yuan, N. Devadasan, G. Chrysanthakopoulos, H. Nielsen, "Parallel Clustering in a Cheminformatics Grid" at the 2007 Microsoft eScience Workshop, Chapel Hill, North Carolina, October 21-23, 2007.

G. Fox, R.Guha, D. McMullen, **A. Mustacoglu**, **M. Pierce**, **A. Topcu**, and D. Wild, "Web 2.0 for Grids and e-Science" in proceedings, INGRID 2007 - Instrumenting the Grid 2nd International Workshop on Distributed Cooperative Laboratories, S.Margherita Ligure Portofino, Italy, April 18, 2007.

G. Fox, **A. Mustacoglu**, **A. Topcu** Web 2.0 technology and Semantic Research Grid(SRG), Web 2.0 Workshop at The 21st Open Grid Forum - OGF21 Grand Hyatt Seattle Seattle, Washington October 15-19, 2007.

G. Fox , **M. Pierce**, "Grids Challenged by a Web 2.0 and Multicore Sandwich" technical report, December 26, 2007.

G. Fox , **M. Pierce**, "Grids Meet Too Much Computing, Too much Data and Never Too much Simplicity" white paper, December 27, 2007.

G. Fox, **M. Pierce**, **A. Mustacoglu**, **A. Topcu,** "Web 2.0 for E-Science Environments" Keynote Presentation at 3rd International Conference on Semantics, Knowledge and Grid (SKG2007), Xian, China, October 28-30, 2007.

G. Fox, M. Pierce, **S. Pallickara**, "Summary of CGL Lab Activities January-December 2007" technical report, December 31, 2007.

H. Gadgil, **G. Fox**, **S. Pallickara**, **M. Pierce,** "Scalable, Fault-tolerant Management of Grid Services" technical report , to appear in Proceedings of IEEE Cluster 2007 May 19, 2007.

Y. Gong, M. Pierce, **G. Fox,** "Matchmaking Scientific Workflows in Grid Environments" (updated from original), in proceedings of IASTED International Conference on Parallel and Distributed Computing and Systems (PDCS 2007), Cambridge, Massachusetts, November 19 - 21, 2007.

R. Guha, **G. Fox**, K. Gilbert, **M. Pierce**, D. Wild, "I Don't Care Where My Data and Methods Are: A Web-service Approach for Distributed Access to Methods, Data and Models" paper ID: 1170920 at Division of Chemical Information session on Cheminformatics: From Teaching to Research Tuesday, April 8, 2008 at Spring 2008 American Chemical Society National Meeting & Exposition, April 6-10, 2008.

M. Jovovic, **G. Fox,** "Multi-dimensional Data Scaling – Dynamical Cascade Approach, Technical Report, September 26, 2007.

A. Kaplan, **G. Fox**, G. Laszewski, "GridTorrent Framework: A High-performance Data Transfer and Data Sharing Framework for Scientific Computing" paper at GCE07 Workshop at SC07, Reno, Nevada, November 11-12, 2007.

K. Kim, "A Framework for Synchronous and Ubiquitous Collaboration" thesis, Indiana University Ph.D., September 26, 2007.

B. Lee, **S. Lim, J. Kim** , **G. Fox**, "Lease Based Consistency Scheme in the Web Environment" technical report, December 27, 2007.

D. McMullen, **M. Pierce**, **C. Deng**, **K. Huffman,** "Real-time Web 2.0: Evolution of Middleware for Grid-based Instruments and Sensors" at the Web 2.0 Workshop, 21st Open Grid Forum - OGF21 Grand Hyatt Seattle Seattle, Washington October 15-19, 2007.

A. Mustacoglu, **G. Fox**, "Hybrid Consistency Framework for Distributed Annotation Records" technical report, October 30, 2007.

M. Nacar, "A Component Framework for Building Web Science Gateways and Portals" thesis, Indiana University, Ph.D. November 27, 2007.

M. Nacar, **M. Pierce**, A. Donnellan, **G. Fox**, "Building QuakeSim Portlets with GTLAB" paper at GCE07 Workshop at SC07, Reno, Nevada, November 11-12, 2007.

M. Nacar, **M. Pierce**, **G. Fox,** "GTLAB: Grid Tag Libraries Supporting Workflows within Science Gateways" at the 3rd International Conference on Semantics, Knowledge and Grid (SKG2007), Xian, China, October 28-30, 2007.

S. Pallickara, **H. Bulut** , **G. Fox**, "Fault-Tolerant Reliable Delivery of Messages in Distributed Publish/Subscribe Systems" to appear in International Journal of Autonomic Computing 2008.

M. Pierce, "Web 2.0: Social Networking for MSI Researchers" Web 2.0 Workshop at the 21st Open Grid Forum - OGF21 Grand Hyatt Seattle Seattle, Washington, October 15-19, 2007.

M. Pierce et al, "Open Grid Computing Environments (OGCE) Annual Report: September 1, 2003-August 31, 2007" prepared December 2007.

M. Pierce, **G. Fox**, G. Aydin, Z. Qi, A. Donnellan, J. Parker and R. Granat, "QuakeSim: Web Services, Portals, and Infrastructure for Geophysics" December 19, 2007 to be published in 2008 IEEE Aerospace Conference, Big Sky, Montana, March 1-8, 2008.

M. Pierce, **G. Fox**, L. Dirks, "eChemistry" at the Web 2.0 Workshop, 21st Open Grid Forum - OGF21 Grand Hyatt Seattle Seattle, Washington October 15-19, 2007.

X. Qiu, **G. Fox**, H. Yuan, **S. Bae**, G. Chrysanthakopoulos, H. Nielsen, "Performance of a Multi-Paradigm Messaging Runtime on Multicore Systems" Abstract of Poster at Grid 2007 Conference, Austin, Texas, September 19, 2007.

M. Pierce, **G. Fox**, **H. Yuan**, **Y. Deng,** "Cyberinfrastructure and Web 2.0" in proceedings HPC2007, Cetraro, Italy, July 4, 2007.

X. Qiu, **G. Fox**, H. Yuan, **S. Bae**, G. Chrysanthakopoulos, H. Nielsen, "Web 2.0 Grids and Cyberinfrastructure" at the Web 2.0 Workshop, 21st Open Grid Forum – (OGF21), Seattle, Washington, October 15-19, 2007.

X. Qiu, **G. Fox**, H.Yuan, **S. Bae**, G. Chrysanthakopoulos, H. Nielsen, "Performance of Multicore Systems on Parallel Datamining Services" technical report Noveber 19, 2007.

X. Qiu, **G. Fox**, H. Yuan, **S. Bae**, G. Chrysanthakopoulos, H. Nielsen, "High Performance Multi-Paradigm Messaging Runtime Integrating Grids and Multicore Systems" (updated from original), September 23, 2007, in proceedings eScience 2007 Conference Bangalore India December 10-13, 2007.

A. Sayar, **G. Fox**, **M. Pierce** Supporting Event-based Unified Data Access/query over Integrated Data-views for Decision Making in Geographic Information Systems Technical Report, December 1, 2007.

A. Topcu , **A. Mustacoglu**, **G. Fox** , **A. Cami,** "Integration of Collaborative Information Systems in Web 2.0" at the 3rd International Conference on Semantics, Knowledge and Grid (SKG2007), Xian, China, October 28-30, 2007.

Visualization and Interactive Spaces Lab Publications

A. Khalil, **K. Connelly**, "Do I Do What I Say?: Observed Versus Stated Privacy Preferences" in Proceedings of 11th IFIP TC13 International Conference on Human-Computer Interaction (INTERACT), September 2007.

K. Rogers, **K. Connelly**, L. Tedesco, W. Hazelwood, A. Kurtz, R. Hall, J. Hursey, T. Toscos "Why It's Worth the Hassle: The Value of In-Situ Studies When Designing Ubicomp Y" in Proceedings of UbiComp 2007, September 2007.

Scientific Data Analysis Lab Publications

X. Dong, K. Gilbert, R. Guha, **R. Heiland**, **J. Kim**, **M. Pierce**, **G. Fox**, D. Wild, "Web Service Infrastructure for Chemoinformatics" J. Chem. Inf. Model. Issue 47, Volume 4, pp. 1303-1307, 2007.

R. Heiland, Sean. Mooney, J. Boverhof, K. Jackson, M. Christie, M. Swat, A. Balter, J. Insley, "Python for Scientific Gateways Development" in proceedings Grid Computing Environments (GCE) workshop, SuperComputing 2007, Reno, Nevada, November 2007.

A. Singh, **A. Olowoyeye**, P. Baenziger, J. Dantzer, M. Kann, P. Radivojac, **R. Heiland**, Sean D. Mooney, "MutDB: Update on Development of Tools for the Biochemical Analysis of Genetic Variation, Nucleic Acids Research, 2007.

Knowledge Acquisition and Projection Lab Publications

D. McMullen, "Enabling Remote Access to Instruments for AU-US Collaboration" in proceedings Workshop on Driving eResearch Collaboration Across the Pacific, Perth, Western Australia, September 11-12, 2007.

D. McMullen "Evolution of Middleware for Grid-based Instruments and Sensors or Why Facebook, MySpace and Social Computing Really Matter," Invited talk at Monash University, Melbourne, Australia, August 14, 2007.

D. McMullen "Overcome by Events? The Red Queen Effect, Web 2.0 and the Future of the Grid" in proceedings APAC07, Perth, Western Australia, October 8-12, 2007.

D. McMullen, C. Deng, **M. Pierce**, **K. Huffman**, "Real-time Web 2.0: Evolution of Middleware for Grid-based Instruments and Sensors" in proceedings Open Grid Forum 21, Seattle, Washington, October 15, 2007.

Appendix 5: Pervasive Technology Labs Presentations

(July – December, 2007)

Pervasive Technology Labs staff indicated in boldface.

Open Systems Lab Presentations

D. Gregor, "Generic Programming in the Parallel Boost Graph Library" presentation to Microsoft Live Labs, Bellevue, Washington, November 2007.

D. Gregor, "Large-Scale Network Analysis with the Parallel Boost Graph Library" Center for Data and Search Informatics Seminar, Bloomington, Indiana, September 2007.

D. Gregor, "MPI.NET: High-Performance Message Passing in C# and .NET" presentation to Microsoft High-Performance Computing Group, Redmond, Washington, November 2007.

T. Mattox, "MPI Is Dead? Long Live MPI! Evolving MPI for the Next Generation of Supercomputing" presentation in the Cisco booth at the ACM/IEEE SC07 Conference, Reno, Nevada, November 2007.

Advanced Network Management Lab Presentations

M. Meiss, "Mathematics of Knowledge and Search Engines" Dynamic Searches and Knowledge Building, UCLA, Los Angeles, California, October 1, 2007.

M. Meiss, F. Menczer, and A. Vespignani "A framework for Analysis of Anonymized Network Flow Data" National Science Foundation Symposium on Next Generation of Data Mining and Cyber-Enabled Discovery for Innovation (NGDM 07), Baltimore, Maryland, October 2007.

Community Grids Lab Presentations

R. Alo, K. Barnes, D. Baxter, **G. Fox**, A. Kuslikis, A. Ramirez, " Minority Serving Institutions Cyberinfrastructure Empowerment Coalition (MSI-CIEC), poster at Cyberinfrastructure - Training, Education, and Mentoring (CI-TEAM) Community Workshop, Washington, DC, July 9-11, 2007.

C. Dabrowski, G.**Fox,** "Research Group Meeting on Reliability and Robustness" in Grid Computing Systems Open Grid Forum (OGF21), Seattle, Washington, October 17, 2007.

J. Ekanayake, Qualifying Exam practice presentation, Indiana University Bloomington, July 17, 2007.

J. Ekanayake, Qualifying Exam PhD proposal presentation, Indiana University Bloomington, July 19, 2007.

G. Fox, "Computational Infrastructure for Policy Informatics" Workshop on Policy Informatics in an Interdependent World, Washington, DC, September 13, 2007.

G. Fox, "Cyberinfrastructure and Scientific Collaboration Science and Technology" Pacific Century (STIP) East Asian Colloquium, East Asian Studies Center Indiana University, November 30, 2007.

G. Fox, "Cyberinfrastructure Technologies and Applications" keynote presentation at Summit Cyberinfrastructure: Innovation At Work, Banff, Canada, October 11, 2007.

G. Fox, "Grids and Web 2.0 supporting eScience" STEM Scholars Seminar, Indiana University Memorial Union, Bloomington, Indiana, August 1, 2007.

G. Fox, "Net-Centric Sensor Grids" presentation Indiana University, November 27, 2007.
G. Fox, "OGF eScience Function" Open Grid Forum Board Presentation (OGF21), Seattle, Washington, October 17, 2007.

G. Fox, "Panel Questions for Web 2.0 and Grids" panel at Open Grid Forum Web 2.0 Workshop (OGF21), Seattle, Washington, October 16, 2007.

G. Fox, "PolarGrid" Open Grid Forum Presentation (OGF21), Seattle, Washington, October 16, 2007.

G. Fox, "Research Strategies" presentation at Chinese Academy of Sciences, Beijing, China, November 2, 2007.

G. Fox, "The Two Faces of Cyberinfrastructure: Grids (or Web 2.0) and Supercomputing: What is their Future, Which is Brighter and How Can Both Communities Benefit from Each Other?" moderator of panel at Grid 2007 Conference, Austin, Texas, September 19, 2007.

G. Fox, "Web 2.0, Grids and Parallel Computing" Tsiunghua University at Tsinghua National Laboratory for Information Science and Technology, Beijing, China, November 1, 2007.

G. Fox, "Web 2.0, Grids and Parallel Computing" Oxford e-Science Centre, December 7, 2007.

G. Fox, R. Alo, K. Barnes, D. Baxter, J. Foertsch, A. Kuslikis, A. Ramirez, "Minority Serving Institutions Cyberinfrastructure Institute" (MSI-CII) poster at Cyberinfrastructure - Training, Education, and Mentoring (CI-TEAM) Community Workshop, Washington, DC, July 9-11, 2007.

G. Fox, **S. Bae**, R. Guha, **M. Pierce**, **X. Qiu**, D. Wild , **H. Yuan**, N. Devadasan, G. Chrysanthakopoulos, H. Nielsen, "Multicore SALSA: Parallel Computing and Web 2.0 for Cheminformatics and GIS Analysis" the 2007 Microsoft eScience Workshop, Chapel Hill, North Carolina, October 21-23, 2007.

G. Fox, **A. Cami**, **A. Mustacoglu**, **A. Topcu,** "Semantic Research Grid" Open Grid Forum, Web 2.0 Workshop (OGF21), Seattle, Washington, October 15, 2007.

G. Fox, **M. Pierce,** "Web 2.0 for E-Science Environments" keynote presentation at 3rd International Conference on Semantics, Knowledge and Grid (SKG2007), Xian, China, October 29, 2007.

G. Fox, **M. Pierce,** "Web 2.0 for E-Science Environments" presentation at Chinese Academy of Sciences, Beijing, China, November 2, 2007.

G. Fox, **M. Pierce,** "Web 2.0 for eScience" SC07 Education Program Tutorial Education Program Tutorial at SC07, Reno, Nevada, November 12, 2007.

G. Fox, **M. Pierce**, R. Wang, A. Ho, "Collaboration Grid work at Anabas and Community Grids Laboratory" SAIC Project Review at Indiana University Bloomington, July 30, 2007.

G. Fox, **H. Yuan**, **S. Bae**, **X. Qiu** , G. Chrysanthakopoulos, H. Nielsen, "High Performance Multi-Paradigm Messaging Runtime Integrating Grids and Multicore Systems" eScience 2007, the 3rd IEEE International Conference on e-Science and Grid Computing, Bangalore, India, December 13, 2007.

G. Fox, **H.Yuan**, **S. Bae**, **X. Qiu** , G. Chrysanthakopoulos, H. Nielsen, "Multicore Salsa: Parallel Computing and Web 2.0" Open Grid Forum Web 2.0 Workshop (OGF21), Seattle, Washington, October 15, 2007.

G. Fox, **H.Yuan**, **S. Bae**, **X. Qiu** , G. Chrysanthakopoulos, H. Nielsen, "Multicore Salsa: Parallel Programming 2.0" Peking University Computer Science Department, Beijing, China, November 1, 2007.

G. Fox, H. Yuan, **S. Bae**, **X. Qiu** , G. Chrysanthakopoulos, H. Nielsen, "Multicore Salsa: Parallel Programming 2.0" Booth Presentation at SC07 2007, Reno, Nevada, November 14, 2007.

H. Gadgil, **G. Fox**, **S. Pallickara**, **M. Pierce,** "Scalable, Fault-tolerant Management of Grid Services" Cluster 2007 Conference, Austin Texas, September 18, 2007.

Y. Gong, **M. Pierce**, **G. Fox,** "Matchmaking Scientific Workflows in Grid Environments" presentation at IASTED International Conference on Parallel and Distributed Computing and Systems (PDCS 2007), Cambridge, Massachusetts, November 19 - 21, 2007.

A. Kaplan, "Performance Oriented Data Transfer and Sharing Framework for Scientific Computing" PhD proposal presentation, Indiana University Bloomington, July 26, 2007.

A. Kaplan, **G. Fox**, G. Laszewski, "GridTorrent Framework: A High-performance Data Transfer and Data Sharing Framework for Scientific Computing" Presentation at GCE07 Portal Workshop at SC07, Reno, Nevada, November 11, 2007.

K. Kim, "A Framework for Synchronous and Ubiquitous Collaboration" Indiana University presentation, August 30, 2007.

K. Kim, "A Framework for Synchronous and Ubiquitous Collaboration" Indiana University presentation, September 25, 2007.

K. Kim, "A Framework for Synchronous and Ubiquitous Collaboration" Indiana University PhD presentation, September 26, 2007.

S. Maini, "MSI-CIEC Portal" ScreenShots, December 19, 2007.

M. Nacar, "A Component Framework for Building Web Science Gateways and Portals" Indiana University presentation, September 28, 2007.

M. Nacar, "A Component Framework for Building Web Science Gateways and Portals" Indiana University presentation, October 12, 2007.

M. Nacar, "A Component Framework for Building Web Science Gateways and Portals" Indiana University Ph.D Defense Presentation, November 27, 2007.

M. Nacar, **M. Pierce**, A. Donnellan, **G. Fox,** "Building QuakeSim Portlets with GTLAB" presentation at GCE07 Portal Workshop, SC07, Reno, Nevada, November 11, 2007.

M. Nacar, **M. Pierce**, **G. Fox**, "GTLAB: Grid Tag Libraries Supporting Workflows within Science Gateways" presentation at 3rd International Conference on Semantics, Knowledge and Grid (SKG2007), Xian, China, October 30, 2007.

S. Pallickara, J. Ekanayake, **G. Fox,** "Collaborative Analysis of Distributed Data Applied to Particle Physics Experiments" Booth Presentation at SC07, Reno, Nevada, November 13, 2007.

M. Pierce, "E-Chemistry and Web 2.0" Open Grid Forum Web 2.0 Workshop, OGF21 Seattle, Washington, October 15, 2007.

M. Pierce, "GCE07 Workshop Introduction" welcome presentation for GCE07 Portal Workshop, SC07, Reno, Nevada, November 11, 2007.

M. Pierce, "Open Grid Computing Environment Summary" September 27, 2007.

M. Pierce, "The Open Grid Computing Environments Project" presentation at Fermilab, Batavia, Illinois, October 25, 2007.

M. Pierce, "Social Networking to Support Researchers at Minority Serving Institutions" Open Grid Forum Web 2.0 Workshop (OGF21), Seattle, Washington, October 15, 2007.

M. Pierce, **G. Aydin**, **Z. Qi,** "Using Topic-Based Publish/Subscribe for Managing Real Time GPS Streams" project review with Ball Aerospace at Indiana University Bloomington, July 25, 2007.

M. Pierce, **G. Aydin**, **Z. Qi**, "Using Topic-Based Publish/Subscribe for Managing Real Time GPS Streams" SAIC project review at Indiana University Bloomington, July 30, 2007.

M. Pierce, S. Marru, G. Laszewski, "Open Grid Computing Environments" Booth Presentation at SC07, Reno, Nevada, November 13, 2007.

X. Qiu, **G. Fox**, H. Yuan, **S. Bae**, G. Chrysanthakopoulos, H. Nielsen, "Performance of a Multi-Paradigm Messaging Runtime on Multicore Systems" poster at Grid 2007 Conference, Austin, Texas, September 19, 2007.

X. Qiu, **G. Fox**, **H. Yuan**, **S. Bae**, G. Chrysanthakopoulos, H. Nielsen, "Performance Measurements of CCR and MPI on Multicore Systems Summary" September 23, 2007.

A. Sayar, "High Performance Federated Service-Oriented Geographic Information Systems" research presentation at Indiana University, Bloomington, October 26, 2007.

C. Smith, with modifications by **G. Fox,** "Building Blocks for the Grid" OGF Workshop at eScience 2007, the 3rd IEEE International Conference on e-Science and Grid Computing, Bangalore, India, December 10, 2007.

A. Topcu, "Integrated Collaborative Information Systems" presentation, Indiana University Bloomington, July 26, 2007.

A. Topcu, "Integrated Collaborative Information Systems" PhD proposal presentation, Indiana University Bloomington, July 27, 2007.

A. Topcu A. Mustacoglu, G. Fox, **A. Cami,** "SRG: A Digital Document-Enhanced Service Oriented Research Grid" IEEE International Conference on Information Reuse and Integration (IEEE IRI-2007), Las Vegas, Nevada, August 13 - 15, 2007.

R. Wang, "Grid Builder Status" project review with Ball Aerospace at Indiana University Bloomington, July 25, 2007.

Visualization and Interactive Spaces Lab Presentations

L. Tedesco, **M. Baker**, K. Salazar and **K. Connelly**, "Integrating Technology and the Environment to Inspire Future Scientists" 36th Annual Conference, North American Association for Environmental Education, Virginia Beach, VA, November 14-17, 2007.

Scientific Data Analysis Lab Presentations

R. Heiland, Presentation for the Grid Computing Environments Workshop, SC07 Conference, Reno Nevada, November 13, 2007.

Presentations by the Chief Operating Officer

C. Stewart, "Big Red, HPSS, Data Capacitor: Performance and Usage of IU's TeraGrid Accessible Resources" Indiana University Display, SuperComputing (SC07) Held Reno, Nevada, November 14, 2007.

C. Stewart, "Implementation and Experience with Big Red (a 30.7 TFLOPS IBM BladeCenter cluster), the Data Capacitor, and HPSS" Indiana University Display, SuperComputing (SC07), Reno, Nevada, November 13, 2007.

C. Stewart, "Implementing Big Red" Research Technologies Brownbag Lecture Series, Bloomington, Indiana, November 1, 2007.

C. Stewart, "Using IU's Big Red PowerPC Cluster via the TeraGrid" invited tutorial presented at BIBE (Bioinformatics and Biomedical Engineering) '07. Boston, Massachusetts, October 14-17, 2007.

Appendix 6: Active, Completed, and Pending Grants

PERVASIVE TECHNOLOGY LABS
CURRENT FUNDING
SOURCES OTHER THAN LILLY ENDOWMENT, INC.
NEW GRANTS SHOWN IN ITALICS

Title	PI	Co-PIs	PTL-related SIs	Start/End Date	*New Grants this Reporting Period 7/1/07-12/31/07*	Cumulative/Total Active Grants	Agency	Proposal #
Open Systems Lab (Lumsdaine)								
Scalable Fault Tolerance for MPI	**Lumsdaine**			8/15/03-7/31/08		$650,000	NSF	
Collaborative Research: Lifting Compiler Optimizations via Generic Programming	**Lumsdaine**	-	-	1/1/06- 1/31/09		$279,233	NSF	01-78456
Coordinated Fault Tolerance for High Performance Computing	**Lumsdaine**			9/15/06-9/14/11		$1,000,000	DOE	
Exploring Multi-Path Routing for Collective Communication in MPI	**Lumsdaine**			1/1/07-12/31/08		$80,506	Cisco, Inc.	
Collaborative Research: Modular Metaprogramming	**Lumsdaine**			2/1/07-1/31/10		$230,000	NSF	
Gift: Unrestricted - Managed Wrappers for MPI Functions	**Lumsdaine**			6/15/07		$93,000	Microsoft Corp.	
Subtotal Open Systems Lab					***$0***	**$2,332,739**		
Advanced Network Management Lab (Wallace)								
Unrestricted Gift	**Wallace**			10/18/06		$50,000	Scott Jones Foundation	
Detecting and Dismantling Botnet Command and Control Infrastructure using Behavioral Profilers	**Travis**			6/1/07-5/29/08		$88,391	University of Michigan	
Internet2	***Wallace***			*1/1/08-12/31/08*	*$211,726*	*$211,726*	*Universtiy Corp. for Advanced Internet Development*	
Subtotal Advanced Network Mgmt Lab					***$211,726***	**$350,117**		
Community Grids Lab (Fox)								
Middleware for the Development of Grid Computing User Environments	**Fox**	**Gannon Pierce Plale**		9/1/03-8/31/08		$1,056,452	NSF	01-73127
Virtual Laboratory for Earth & Planetary Materials Studies	**Fox**	**Pierce**		10/1/04-9/30/08		$166,227	NSF	01-73127
Development of Middleware/Software to Allow Visualization of 4-D Geoscience Data Sets	**Fox**	-	**Pallickara Pierce**	6/1/05-5/31/08		$199,020	NSF	01-74740
Collaborative Research:The MSI Cyberinfrastructure Institute:Bringing Minority Serving Faculty into e-Science	**Fox**	**Pierce**	-	9/1/05-9/30/07		$60,000	NSF	01-78158
Sub-contract: Modeling and On-the-fly Solutions in Solid Earth Science	**Pierce**	-	-	9/1/05-8/31/08		$299,378	UCSD/Scripps Institution of Oceanography	01-78059

Chemical Informatics Cyberinfrastructure	**Fox**	**Pierce**		9/23/05-1/31/08		$155,224	NIH	01-77366
Collaborative Research: High-Performance Techniques,Designs and Implementaion of Software Infrastructure for Change Detection and Mining	**Fox**	**Pallickara Pierce**	-	9/1/05-8/31/08		$371,850	NSF	01-78080
Unrestriced Gift	**Fox**			01/19/06		$30,000	Microsoft, Inc.	
Center for Research on Multicore Computing (CRMC)	**Fox Gannon**		**Pierce, Pallickara**	7/1/06-6/30/09		$1,499,996	Microsoft, Inc.	
Digital Document Enhanced Researech Grid Service Oriented Tool Box	**Fox**			6/1/06-5/31/08		$423,746	Microsoft, Inc.	
QuakeSim: Enabling Model Interactions in Solid EarthScience Sensor Webs	**Fox**		**Pierce**	10/1/06-9/30/09		$224,764	JPL/NASA	
Earthquake Crisis Management	**Fox**		**Pierce, Pallickara**	6/23/06-6/30/08			Anabas SBIR	
Dynamic Collaborative Visualization for Plasma Physics	**Fox**		**Pallickara**	8/1/07-1/31/08		$32,000	Anabas, Inc.	
MRI Acquisition of: PolarGrid: Cyberinfrastructure for Polar Science	***Fox***	***Stewart, Pierce***	***Gannon, McMullen***	*8/1/07-7/31/10*	*$570,541*	*$1,964,049*	*NSF*	
Chemical Informatics Cyberinfrastructure	***Fox***	***Pierce***		*8/1/07-7/31/08*	*$342,753*	*$342,753*	*NIH*	
Interactive Physics Data Analysis Using Distributed Streaming Grid Technology (SBIR Phase II)	***Fox***	***Pallickara***		*1/1/08-12/31/09*	*$112,500*	*$224,722*	*Deep Web Technologies*	
SDCI NMI Improvement: Open Brid Computing Environments Software for Science Gateways	***Fox***	***Pierce***		*9/1/07-8/31/10*	*$525,562*	*$1,698,347*	*NSF*	
Subtotal Community Grids Lab					***$1,551,356***	***$8,748,528***		

PERVASIVE TECHNOLOGY LABS
CURRENT FUNDING
SOURCES OTHER THAN LILLY ENDOWMENT, INC.

NEW GRANTS SHOWN IN ITALICS

Title	PI	Co-PIs	PTL-related SIs	Start/End Date	*New Grants this Reporting Period 1/1/07-6/30/07*	Cumulative/Total Active Grants	Agency	Proposal #
Visualization and Active Spaces Lab (Baker)								
Modular Ocean Data Assimilation	**Baker**		**Bachta Stein**	7/19/03-12/31/07		$491,863	NSF	01-78794
Shedding New Light on Exploding Starts:Visualization for TeraScale Simulations of Neutrino-Driven Supernovae and their Nucleosynthesis	**Baker**		**Bachta**	10/1/03-8/14/07		$250,000	DOE	01-74550
Discovering the Science of the Environment	**Tedesco**	**Baker**		5/8/06-5/7/09		$200,000	Veolia Water Indianapolis	
Subtotal Visualization and Active Spaces Lab					***$0***	**$941,863**		
Scientific Data Analysis Lab (Heiland)								

Polarization Dependent Nonlinear Optical Properties of Biomoleculestitle (subaward w/Purdue)	***Baker***	***Heiland***		*1/1/07-12/31/09*	*$21,628*	*$67,359*	*NSF*	
Development and Improvement of Tissue Simulation Environment		***Heiland***		*10/1/07-9/30/10*	*$67,888*	*$229,123*		
Subtotal Scientific Data Analysis Lab					***$89,516***	**$296,482**		
Knowledge Acquisition and Projection Lab (McMullen)								
Instruments & Sensor Network Services	**McMullen**	-	**Bramley Huffman**	8/15/03-8/31/08		$1,587,302	NSF	01-78362
Automating Scaling & Extending of Data Flow in a Network of Sensors: Towards a Global Network of Lakes	**McMullen**	-	**Bramley Huffman**	3/1/05-2/28/08		$299,168	NSF	01-74717
Subtotal Knowledge Acquisition and Projection Lab					***$0***	**$1,886,470**		
Science Director (Gannon)								
none active						$0		
Subtotal Science Director					***$0***	**$0**		
Chief Operating Officer (Stewart)								
none active						$0		
Subtotal Chief Operating Officer					***$0***	**$0**		
GRAND TOTAL CURRENT FUNDING FROM SOURCES OTHER THAN LILLY ENDOWMENT					***$1,852,598***	**$14,556,199**		

PERVASIVE TECHNOLOGY LABS
EXTERNAL GRANTS SUBMITTED OR UNDER CONTINUING REVIEW

Title	PI	Co-PIs	PTL-related SIs	Start/End Date	FY 2007/2008 Budget	Total Budget	Agency	Proposal #
Open Systems Lab (Lumsdaine)								
Rapid Application Performance Tuning and Optimization	**Lumsdaine**		**Mueller**	1/1/08-12/31/08		$319,977	US Government	
Minimizing System noise Effects for Extreme-Scale Scientific Simulation through Function Delegation	**Lumsdaine**		**Mattox**	1/1/07-9/30/10		$144,137	DOE	
Productivity Enhancement of Emerging Multicore Architectures	***Lumsdaine***		***Gregor, Mueller***	*1/1/08-12/31/08*	*$467,540*	*$467,540*	*US Government*	
Development of Parallel Boost Graph Library into Titan	***Lumsdaine***		***Gregor***	*1/1/08-9/30/08*	*$50,000*	*$50,000*	*Sandia National Lab*	
Subtotal Open Systems Lab					***$517,540***	***$981,654***		
Advanced Network Management Lab (Wallace)								
Subtotal Advanced Network Management Lab					***$0***	***$0***		
Community Grids Lab (Fox)								
III-CXT-Small: Scalable Cheminformatics: 3D Structure Database Searches and Predictive Model Discovery	***Fox***			*7/1/0/8-6/30/11*	*$142,290*	*$438,856*	*NSF*	
Collaborative Research: PetaScale Computing Enabled Simulations of Contagion on Very large Social Networks (PetaApps)	***Fox***			*2/1/08-1/31/11*	*$74,999*	*$224,999*	*NSF*	
Accelarating Discovery in Science and Engineering through Petascale Simulations and Analysis (PetaApps)	***Pierce***			*1/1/08-12/31/09*	*$19,747*	*$170,325*	*NSF*	
Microsoft eChemistry	***Fox***	***Pierce***		*1/1/08-12/31/09*	*$91,500*	*$200,948*	*Microsoft, Inc.*	
Developing a Service Oriented Architecture for the National Hydrography Dataset Plus Navigation Tools and Consumption of Framework Web Feature Services for Geospatial Analysis of the Connecticut River Watershed Atlas and Framework Datasets	***Pierce***			*7/1/08-6/30/09*	*$39,956*	*$39,956*	*USGS*	
Subtotal Community Grids Lab					***$368,492***	***$1,075,084***		

PERVASIVE TECHNOLOGY LABS
EXTERNAL GRANTS SUBMITTED OR UNDER CONTINUING REVIEW

Title	PI	Co-PIs	PTL-related SIs	Start/End Date	FY 2005/2006 Budget	Total Budget	Agency	Proposal #
Visualization and Interactive Spaces Lab (Baker)								
Pilot: Creativity in Computing: A Media-Rich, Problem-Basaed Approach for Design and Development Skills	***Baker***			*6/1/08-5/30/10*	*$83,475*	*$162,058*	*NSF*	
Center for Learning in Media-Rich Environments	***Baker***			*9/1/08-8/31/11*		*$300,000*	*IUPUI*	
Subtotal Visualization and Interactive Spaces Lab					***$83,475***	***$462,058***		
Scientific Data Analysis Lab (Heiland)								
Subtotal Scientific Data Analysis Lab					***$0***	***$0***		

PERVASIVE TECHNOLOGY LABS
EXTERNAL GRANTS SUBMITTED OR UNDER CONTINUING REVIEW

Title	PI	Co-PIs	PTL-related SIs	Start/End Date	FY 2005/2006 Budget	Total Budget	Agency	Proposal #
Chief Operating Officer (Stewart)								
CDI-Type II: Gigapixel Astrophysics in the New Millennium - Image Analysis, Data Mining, and Information Flow in the Data Capacitor Era		***Stewart***	***Ma***	*1/1/09-6/30/11*		*$1,900,000*	*NSF*	
CDI: Cyber-enabled Discovery and Innovation		***Stewart***		*1/1/09-6/30/11*		*$1,499,329*	*NSF*	
DataNets - Collaborative with University of Michigan	***Plale***	***Gannon***		*1/1/09-12/31/14*		*$9,000,000*	*NSF*	
Subtotal Chief Operating Officer					***$0***	***$12,399,329***		
GRAND TOTAL GRANTS SUBMITTED OR UNDER CONTINUING REVIEW					**$3,827,480**	**$17,776,098**		

PERVASIVE TECHNOLOGY LABS
COMPLETED GRANTS

Title	PI/Project Director	Co-PIs	PTL-related SIs	Start/End Date	Total Budget	Agency	Proposal #	Account #
Open Systems Lab (Lumsdaine)								
Parallel Graph Toolkit	**Lumsdaine**	-	**Gregor**	9/30/03-3/31/06	$400,000	US Government	01-77144	4312405
Parallel Graph Toolkit	**Lumsdaine**	-	**Gregor**	3/30/05-3/31/06	$198,485	US Government	01-77144	4312405
Enhancing Performance of MATLAB	**Lumsdaine**	**Chauhan**	-	9/1/04-3/31/06	$96,684	Ohio Supercomputing Center	01-75802	4012421
Open MPI Optimizations: Shared Memory Collectives, Component Architecture Design, and Red Storm Implications	**Lumsdaine**	-	**Squyres**	2/11/05-2/17/06	$165,980	Los Alamos National Laboratory	01-76640	4112406
High Performance Software Components for Scientific Computing	**Lumsdaine**			9/15/01-8/31/05	$288,497	NSF		4829770
High Performance Software Components for Scientifice Computing	**Lumsdaine**			4/1/02-3/31/03	$111,833	NSF		4829770
Open Compilation for Self Optimizing Generic Components	**Lumsdaine**			9/1/02-8/31/05	$450,000	NSF		4829771
Checkpoint Restart Support for LAM/MPI	**Lumsdaine**			4/1/03-12/31/03	$28,280	Lawrence Berkley National Labs		4129704
Subtotal Open Systems Lab					***$1,739,759***			
Advanced Network Management Lab (Wallace)								
Network Management Tools for End-to-End Performance Management	**Wallace**		**McMullen Meiss Travis**	2/15/02-1/31/05	$699,394	NSF	-	4812410
USAF Advanced Network Security Proj	**Wallace**	-	**Balas Ripley Travis**	9/16/02-9/15/04	$965,000	USAF	01-66338	4312402
Sub-contract: Detecting Distributed Intrusion Using Real Time Data Mining Feasibility Study	Grossman	**Wallace**	-	3/28/03-3/27/04	$58,000	University of Illinois at Chicago	68469	4012414

The Honeynet Project	**Wallace**	**Balas**	1/2/05 - 7/1/05	$35,000	The Honeynet Project	76426	4112405
Internet2 Transition to NewNet	**Wallace**		5/15/06-12/31/06	$130,393	Internet2		4112414
Internet2	**Wallace**		1/1/07-12/31/07	$209,916	Universtiy Corp. for Advanced Internet Development		4112414
Subtotal Advanced Network Management Lab				***$2,097,703***			

PERVASIVE TECHNOLOGY LABS
COMPLETED GRANTS

Title	PI/Project Director	Co-PIs	PTL-related SIs	Start Date	Total Budget	Agency	Proposal #	Account #
Community Grids Lab (Fox)								
ASC CY5 (Computer Science Corp.)	**Fox**	-	-	7/1/01-9/30/01	$48,215	Florida State University	01-64186	4012405
ERDC PET Support (Computer Science Corp.)	**Fox**	-	-	7/1/01-9/30/01	$41,574	Florida State University	01-64187	4012406
High Performance JAVA to Fortran	**Fox**	-	-	7/5/01-11/30/02	$168,002	National Science Foundation	01-64876	4812409
High Performance Computing Modernization Program	**Fox**	-	-	10/1/01-5/31/04	$63,421	High Performance Technology, Inc.	01-65022	4512402
Sub-contract: PACI - Education, Outreach & Traning	**Fox**	-	-	10/1/00-9/30/03	$290,714	U. Illinois - Champaign-Urbana	01-72488	4012404
Sub-contract: High Performance Computing Modernization Program - Enabling Technologies	**Fox**	-	**Pierce**	6/1/01-5/31/04	$32,293	Mississippi State University	01-65119	4012402
Sub-contract: Online Knowledge Center OKC-Rapid Deployment	**Fox**	-	**Pierce**	11/2/01-9/30/02	$249,611	Mississippi State University		4012407
Sub-contract: OKC-Advanced Technolgy	**Fox**	-	**Wu**	11/2/01-9/30/02	$181,898	Mississippi State University		4012407
Sub-contract: High Performance Computing Modernization Program - Online Knowledge Center	**Fox**		**Pierce Wu**	12/1/01-1/31/02	$24,214	Mississippi State University		4012402
Sub-contract: High Performance Computing Modernization Program - Building Interoperable DoD Portals with Web Service	**Fox**	-	**Pierce**	10/1/02-9/30/03	$56,965	Mississippi State University	01-68532	4012411
Sub-contract: DOD-PET Task 12 Core Management and Training - Online Knowledge Center	**Fox**	-	**Ko Pallickara Pierce**	6/1/03-5/31/04	$583,410	Mississippi State University	01-70315	4012413
PET Training Course - Java HPC Course	**Fox**	-	**Carpenter**	9/14/03-9/19/03	$14,996	Mississippi State University	01-71681	4012416
Sub-contract: High Performance Computing Modernization Program - Programming Environment and Training	**Fox**	-	-	6/1/01-11/30/01	$72,643	Mississippi State University	01-63860	4012402
Sub-contract: Numerical Simulations for Active Tectonic Processes: Increasing Interoperability	**Fox**	-	**Pierce**	3/25/03-11/30/04	$383,796	JPL/California Institute of Technology	01-66904	4012409
Sub-contract: PACI - Expedition Project: Scientific Portals	**Fox**	-	-	10/1/02-3/31/05	$270,000	U. Illinois - Champaign-Urbana	01-72486	4012412
Sub-contract: PACI - ET: Develoment of Collaboration Technolgy Education	**Fox**	-	-	10/1/00-9/30/03	$307,867	U. Illinois - Champaign-Urbana	01-64711	4012403
Research Experiences for Undergarduates (REU)	**Fox**			9/1/03-8/31/04	$6,000	U. Illinois - Champaign-Urbana	01-71211	4012418
Sub-contract: Computational e-Science: Topics in Higher Performance and Globally Distributed Computing	**Fox**	-	**Pierce**	6/1/04-5/31/05	$60,684	Mississippi State University	01-72538	4012419
Sub-contract: Performance Evaluation of Naradabrokering Messaging System	**Fox**	-	**Pallickara**	8/31/04-2/27/05	$46,568	Cardiff University	01-76008	4012422

Adavanced Decision Environment Technology	**Fox**	-	**Wu**	12/1/04-7/30/05	$51,100	Ball Aerospace	01-73776	4512410
NASA/JPL Data Assimilation SERVO Grid	**Fox**	-	**Pierce**	9/12/03-3/31/06	$407,000	Jet Propulsion Lab	01-77844	4012415
Portal Web Services	**Fox**	**Gannon**	-	9/1/02-8/31/06	$630,510	University of Texas at Austin	01-75690	4012408
Sub-contract: FIRMS: Federation and Implementation of Reliable Messaging Specification and Web Services	**Fox**	**Pallickara**	**Yemme**	9/1/04-12/31/06	$158,570	University of Southampton		4012423
Sub-contract: FINS: Federation and Implementation of Notification Specifications for Web Services	**Fox**	**Pallickara**	**Patel**	9/1/04-12/31/06	$307,247	University of Southampton		4012424
Sub-contract: FIRMS: Federation and Implementatino of Reliable Messaging Specification and Web Services	**Fox**	**Pallickara**		1/15/06-12/31/06	$16,778	University of Southampton		4012423
Sub-contract: FINS: Federation and Implementation of Notification Specificatinos for Web Services	**Fox**	**Pallickara**		2/1/06-12/31/06	$21,871	University of Southampton		4012424
Interactive Physics Data Analysis Using Streaming Grid Technology	**Fox**			6/28/06-3/27/07	$43,599	Deep Web Technologies		4512416
Subtotal Community Grids Lab					***$4,539,546***			

Visualization and Interactive Space Lab Lab (Baker)

ArtXPlore	Palakal	**Baker**		01/01/05-4/28/05	$36,000	Indianapolis Museum of Art	01-76238	4198001
Navigating New Spaces	**Baker**		**Stein**	4/29/05-4/28/06	$62,000	INMA	01-77492	4112407
Navigating New Spaces	**Baker**		**Stein**	4/29/05-4/28/06	$15,000	INMA	01-77492	4112407
Subtotal Visualization and Active Spaces Lab					***$113,000***			

PERVASIVE TECHNOLOGY LABS
COMPLETED GRANTS

Title	PI/Project Director	Co-PIs	PTL-related SIs	Start Date	Total Budget	Agency	Proposal #	Account #
Knowledge Acquisition and Projection Lab (McMullen)								
Knowledge Projection for Fleet Maintenance	**McMullen**		Bramley, **Fox, Evans, Leake,** Plale	10/18/02-6/30/04	$556,164	EG&G/Crane	01-69456	4512403
Knowledge Projection for Fleet Maintenance	**McMullen**		Bramley, **Fox, Evans, Leake,** Plale	10/18/02-9/30/04	$444,241	EG&G/Crane	01-71014	4512406, 4512407
EC&G - Fleet Maintenance	**McMullen**		Bramley, **Fox, Evans, Leake,** Plale	9/29/03-4/30/04	$71,900	EG&G/Crane	01-70107	4512408
EC&G - Fleet Maintenance	**McMullen**		Bramley, **Fox, Evans, Leake,** Plale	9/29/03-4/30/04	$71,936	EG&G/Crane	01-70107	4512408
Knowledge Projection for Fleet Management	**McMullen**		**Evans**	9/28/04-9/27/05	$200,000	Crane	01-74999	4312409
Planning Visit for Research on Inter-agency Coordination in International Science and Engineering Research	**McMullen**	**-**	**Evans**	4/1/05-3/31/07	$10,298	NSF	01-75991	4812419
Subtotal Knowledge Acquisition and Projection Lab					***$1,354,539***			
Chief Operating Officer (Stewart)								
Fulbright Senior Scholar Award					$7,043	$7,043		
Subtotal Chief Operating Officer					**$7,043**	**$7,043**		

GRAND TOTAL COMPLETED GRANTS **$9,851,590**

Appendix 7: Interim Financial Report

Lilly Endowment Inc
Indiana University
"Indiana Pervasive Computing Research Initiative"
Michael A. McRobbie
Grant # 1999 2280-000
Project Period: 09/01/99 - 12/31/07
Report Period: 07/01/07 - 12/31/07
INTERIM Financial Report

Category	Budget	Expenditures Current	Cumulative	Balance
IPCRES Laboratories				
Laboratory One	4,182,362.00	$250,218.34	$4,688,698.38	($506,336.38)
Laboratory Two	4,713,688.00	$249,835.50	$4,238,901.28	$474,786.72
Laboratory Three	5,211,469.00	$298,251.62	$4,757,811.01	$453,657.99
Laboratory Four	3,257,579.00	$172,449.36	$2,823,506.90	$434,072.10
Laboratory Five	1,490,000.00	$71,150.13	$1,158,776.39	$331,223.61
Laboratory Six	0.00	$0.00	$0.00	$0.00
Total IPCRES Laboratories	**18,855,098.00**	**$1,041,904.95**	**$17,667,693.96**	**$1,187,404.04**
Science Directors Office				
Salaries	281,250.00	$20,376.40	$21,443.32	$259,806.68
Benefits	98,516.00	$6,791.45	$6,866.11	$91,649.89
Operating Expenses	57,902.00	$26,322.79	$86,357.37	($28,455.37)
Equipment & Software	15,598.00	$0.00	$15,597.96	$0.04
Travel/Training & Workshops	40,900.00	$2,276.32	$44,174.64	($3,274.64)
Total Science Directors Office	**494,166.00**	**$55,766.96**	**$174,439.40**	**$319,726.60**
Economic Development Office				
Salaries	757,700.00	$49,665.44	$933,838.19	($176,138.19)
Benefits	274,990.00	$14,846.60	$276,981.10	($1,991.10)
Operating Expenses	590,000.00	$4,074.82	$608,315.80	($18,315.80)
Equipment & Software	53,000.00	$0.00	$15,310.17	$37,689.83
Travel/Training & Workshops	105,960.00	$0.00	$50,400.91	$55,559.09
Total Economic Development Office	**1,781,650.00**	**$68,586.86**	**$1,884,846.17**	**($103,196.17)**
ARTI IPCRES Component	2,786,072.00	$44,065.61	$2,584,106.02	$201,965.98
Total ARTI IPCRES Component	**2,786,072.00**	**$44,065.61**	**$2,584,106.02**	**$201,965.98**
School of Informatics IPCRES Component				
Curriculum Development	1,382,353.58	$0.00	$1,382,353.44	$0.14
Program Development	477,089.25	$0.00	$477,089.25	$0.00
Undergraduate & Graduate Scholarships	1,140,410.17	$0.00	$1,140,410.17	$0.00
Total School of Informatics IPCRES Component	**2,999,853.00**	**$0.00**	**$2,999,852.86**	**$0.14**
Space	**1,225,000.00**	**$0.00**	**$1,225,000.00**	**$0.00**
Lab Research Fellows	**373,333.00**	**$3,541.34**	**$324,826.36**	**$48,506.64**
Budget Inflation/Indexing Reserve	**0.00**	**$0.00**	**$0.00**	**$0.00**
Investment Loss	**1,451,990.00**	**$0.00**	**$1,451,990.00**	**$0.00**
TOTALS:	**$29,967,162.00**	**$1,213,865.72**	**$28,312,754.77**	**$1,654,407.23**

Grant Funds Received through 12/31/07:	$29,967,162.00
Total Expenditures through 12/31/07:	$28,312,754.77
Cash Balance	$1,654,407.23

Michael McRobbie
Project Director

Appendix 8: Lab Administration and Contact Information

Pervasive Technology Labs is located on the Bloomington and Indianapolis campuses of Indiana University.

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Director and Chief Technologist:
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Community Grids Lab
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Knowledge Acquisition and Projection Lab
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Appendix 9: Press Releases and Print/Online Media Placements

Pervasive Technology Labs leadership, researchers or projects were featured more than 95 times in news releases and items in the technical and popular press during the reporting period. Summaries of the main news items for the reporting period appear below, followed by the full-text versions of most news items.

June 27, 2007 IU's Big Red supercomputer and Data Capacitor shine at International Supercomputer Conference - IU's Supercomputer is again ranked among the world's fastest and IU Data Capacitor attracts attention at International SuperComputing Conference. With related coverage in **HPC Wire, Supercomputing Online, Herald Times.**

July 9, 2007 Passwords are a piece of cake for cybercrooks – The Advanced Network Management Lab's David Ripley tells how to avoid becoming the victim of cyber-crime by choosing a secure password in IU's Living Well. With related coverage in **Science Daily, Newswise, Indiana Daily Student, John Tesh.com, Bedford Times, Dental Plans.com, CCN News.**

August 1, 2007 Data, Data Everywhere – Research @ IU article about the IU Data Capacitor, a collaborative project by University Information Technology Services, IU School of Informatics, and Pervasive Technology Labs.

September 18,2007 IU research labs receive $1.9 million for Polar Grid research – The Community Grids Lab and collaborators receive funding from the National Science Foundation to establish a global grid used in ice sheet research. With related coverage in **Grid Today, HPC Wire, International Science Grid this Week, Primeur, Supercomputing Online, Grid Computing Planet, Herald Times, TCM News, InternetNews.com, ACM Tech News, TeraGrid News, SAP Info, InfoSeek Japan, JDN Solutions, Care2 News Network, College Toolkit, Distance Learning News, Environmental News Network, Global Warming Heatwatch, International Polar Year, Japan Newswire, MagPortal, NCAA News.**

October 10, 2007 IU research labs receive $1.69 million to develop scientific research gateway – The Community Grids Lab receives award from the National Science Foundation to support the Open Grid Computing Environments project. The project develops science gateways, tools that make modern supercomputers more accessible and easier to use. With related coverage in **Inside Indiana Business, Primeur, Grid Today, HPC Wire, Herald Times, GridWatch, Supercomputing Online, TeraGrid, Technology News 24x7.**

November 8, 2007 IU cyberinfrastructure and science gateways showcased at annual SuperComputing **conference –** Pervasive Technology Labs researchers and projects, including the Polar Grid and Open Grid Computing Environments projects, are among those featured at IU's exhibit for the SuperComputing 2007 conference in Reno Nevada. With related coverage in **HPC Wire, Supercomputing Online**.

November 13, 2007 Informatics Students competing in SuperComputing challenge – Andrew Lumsdaine of the Open Systems Lab serves as faculty sponsor for a team of IU undergraduate students competing in the Cluster Challenge competition at the SuperComputing 2007 conference in Reno, Nevada. With related coverage in **the Mac Observer, Ars Technica, HPC Wire, the Register.**

November 13, 2007 Cisco Unveils High Pervofmance InfiniBand Gateway Platform and Fabric Analysis Tools – The Open Systems Lab's Tim Mattox is among the presenters at the Cisco exhibit for the SuperComputing 2007 conference. Article in **CNN Money.**

November 16, 2007 Team Led By IU wins Supercomputing Bandwidth Competition – Pervasive Technology Labs researchers were among those who comprised IU's victorious team in the Bandwidth Challenge competition at the SuperComputing 2007 conference. IU's winning entry was nearly twice as fast as the closest competitor. With related news releases and coverage in **Chronicle of Higher Education, Inside Indiana Business, Ars Technica, Primeur, International Science Grid this Week, Herald Times, HPC Wire, Supercomputing Online, Internet2 In Real Time, Network World, PC Welt, CIO, Australian PC World, VWN News, Computer World, Webpro Wire, World Newswire, Data Direct Networks, Forbes, Yahoo Finance, HPC Wire (2), Supercomputing Online (2), Business Wire, PR Newswire, Ad Hoc News Germany, Alfonsofuggetta, Finanz Nachrichten Germany, TMC Net, Myricom PC Net, SC07 Conference Committee**.

INDIANA UNIVERSITY

IU News Room

IU News from all eight campuses

Tuesday, January 22, 2008

Last modified: Thursday, June 28, 2007

IU's Big Red supercomputer and Data Capacitor shine at International Supercomputer Conference

FOR IMMEDIATE RELEASE

June 27, 2007

BLOOMINGTON, Ind. -- Indiana University's "Big Red" supercomputer is again ranked among the world's fastest, and IU accomplishments in advanced cyberinfrastructure are attracting attention and acclaim at the International Supercomputer Conference being held this week in Dresden, Germany. "Big Red" placed 30th on the June 2007 list of the world's 500 fastest supercomputers unveiled today at the conference. Additionally, Indiana University's Data Capacitor team, with partners from Technische Universitaet Dresden, demonstrated impressive performance on a distributed transatlantic Lustre file system designed to move large amounts of scientific data quickly and easily.

Thanks to an upgrade this spring with the assistance of the Indiana Economic Development Corporation, Big Red moved up in rank, after placing 31st in the previous (fall 2006) list. The higher rankings of the TOP500 list change very rapidly; IU's ranking shows the strides that IU is making to provide researchers with the tools to accelerate innovation and discovery.

"Big Red is one of the most powerful supercomputers in existence and it is the fastest ever in the state of Indiana," said Brad Wheeler, Indiana University chief information officer and dean of information technology at IU Bloomington.

Since 1993, The TOP500 List has been compiled twice a year by a group of highly respected leaders in the supercomputing community and released at the world's two largest supercomputing conferences - the International Supercomputer Conference held each June in Germany, and the US Supercomputing Conference held each November in the U.S.

IU's Data Capacitor - a 535 Terabyte storage system - is also featured in the week's hardware news at the International Supercomputing Conference. Using Wide Area Network access to the Lustre file system and the Data Capacitor over GEANT2 and Internet2 advanced research networks, a team from IU and the Technische Universitaet Dresden achieved nearly 100 Megabytes/sec data transfer over a

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This material is based upon work supported by the National Science Foundation under grant numbers. CNS-0521433. ACI-0338618l, OCI-0451237, OCI-0535258, and OCI-0504075. Collaboration with the Technische Universitaet Dresden has been supported by TU-D, Indiana University, and the Fulbright Senior Scholar's program. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation (NSF), Lilly Endowment, Inc., or any other funding agency.

University Information Technology Services (UITS) at Indiana University, with offices on the Bloomington and Indianapolis campuses, develops and maintains a modern information technology environment throughout the university in support of IU's vision for excellence in research, teaching, outreach and lifelong learning. UITS provides tools and services to support the academic and administrative work of the university, including supercomputers for data analysis and visualization. For more information, see http://uits.iu.edu/.

IU's Big Red supercomputer was funded in part via the Indiana METACyt Initiative, with support from the Lilly Endowment, Inc. and by Shared University Research grants from IBM, Inc. to Indiana University.

About TOP500

The TOP500 project was started in 1993 to provide a reliable basis for tracking and detecting trends in high-performance computing. For more information, see http://www.top500.org/.

The Leading Source for Global News and Information Covering the Ecosystem of High Productivity Computing / June 29, 2007

Hardware:

IU's Big Red supercomputer, Data Capacitor shine at ISC

BLOOMINGTON, Ind., June 27 -- Indiana University's "Big Red" supercomputer is again ranked among the world's fastest, and IU accomplishments in advanced cyberinfrastructure are attracting attention and acclaim at the International Supercomputer Conference being held this week in Dresden, Germany. "Big Red" placed 30th on the June 2007 list of the world's 500 fastest supercomputers unveiled today at the conference. Additionally, Indiana University's Data Capacitor team, with partners from Technische Universitaet Dresden, demonstrated impressive performance on a distributed transatlantic Lustre file system designed to move large amounts of scientific data quickly and easily.

Thanks to an upgrade this spring with the assistance of the Indiana Economic Development Corporation, Big Red moved up in rank, after placing 31st in the previous (fall 2006) list. The higher rankings of the TOP500 list change very rapidly; IU's ranking shows the strides that IU is making to provide researchers with the tools to accelerate innovation and discovery.

"Big Red is one of the most powerful supercomputers in existence and it is the fastest ever in the state of Indiana," said Brad Wheeler, Indiana University chief information officer and dean of information technology at IU Bloomington.

Since 1993, The TOP500 List has been compiled twice a year by a group of highly respected leaders in the supercomputing community and released at the world's two largest supercomputing conferences - the International Supercomputer Conference held each June in Germany, and the US Supercomputing Conference held each November in the U.S.

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Source: Indiana University

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IU's Big Red Supercomputer & Data Capacitor Shine at ISC '07

Saturday, Jun 28 @ 12:38 EDT

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IU's Big Red supercomputer No. 30 fastest in world

By Steve Hinnefeld 331-4374 | shinnefeld@heraldt.com
July 5, 2007

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Indiana University's Big Red supercomputer ranked No. 30 on a list of the world's fastest computers released this summer.

It was no longer the fastest university-owned computer, however, according to the TOP500 list released at the International Supercomputer Conference in Dresden, Germany.

"Big Red is one of the most powerful supercomputers in existence, and it is the faster ever in the state of Indiana," Brad Wheeler, IU chief information officer and IU Bloomington dean of information technology, said in a statement.

Big Red, an IBM e1350 BladeCenter Cluster supercomputer, was installed last year at IU's Wrubel Computing Center and went into operation in August 2006. Together with IU's Data Capacitor, capable of storing 535 trillion bytes of data, it supports academic research analyzing massive quantities of data.

A year ago, Big Red ranked as 23rd-fastest in the world. But in the fast-changing world of supercomputing, it fell to 31st on a TOP500 list released last November.

IU officials said Big Red rose in the latest rankings because of an upgrade this spring in cooperation with the Indiana Economic Development Corp. An IBM-led team provided more capacity for the machine as part of a deal to take over processing of food stamp, Medicaid and welfare claims for the state.

Craig Stewart, associate dean for research technologies and chief operating officer of Pervasive Technology Labs at IU, said IU is focusing on using supercomputing to support economic development.

"The key challenge for us in the months ahead will be to use Big Red to enable new business innovations within the state of Indiana, working with our colleagues from Purdue for the benefit of the economy of the state," he said in a statement.

When Big Red was installed, it was billed as the fastest university-owned supercomputer. On the June 2007 list, it trails new supercomputers at the universities of Texas and North Carolina and Caltech.

The eight fastest supercomputers on the latest TOP500 list are in the United States, most of them at national laboratories and research centers.

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INDIANA UNIVERSITY

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Tuesday, January 22, 2008

Living Well: Back-to-school tips from Indiana University

Broadcast media: To arrange on-camera, studio interviews via Indiana University Bloomington's Enberg Studio, please contact Tracy James, 812-855-0084 or traljame@indiana.edu.

Living Well's back-to-school issue discusses the following topics:

Backpacks and pain

Binge drinking on college campuses -- it's about fear, not freedom

A "tragic" and unnecessary health hazard in schools nationwide -- pesticides

Picking a password that keeps the cybercrooks guessing

Neijfelt (center) weigh student backpacks outside the Wells Library at Indiana University Bloomington.

Print-Quality Photo

When schoolwork becomes a pain. Heavy backpacks and bags have been known to cause pain and fatigue in children and adults. While these conditions should be a concern for parents and students alike, healthcare professionals increasingly are concerned about the role these bags play in the

development of more serious conditions, such as chronic back pain and functional scoliosis, which is caused when the spine becomes twisted because one shoulder muscle is stronger than the other. "A load of books or materials, distributed improperly or unevenly, day after day, is indeed going to cause stress to a growing spinal column and back," said Kevin Slates, an occupational and environmental health expert at Indiana University Bloomington. "The old adage, 'As the twig is bent, so grows the tree,' comes to mind. We are seeing a growing concern about the improper use of backpacks and the relatively scarce amount of preventive information available to young people." The Consumer Products Safety Commission estimates that 4,928 emergency room visits each year result from injuries related to book bags and back carriers. "Students attending primary and secondary schools are more susceptible to these disorders because their bodies are developing faster," Slates said. "Females are even more susceptible because of the physiological demands on their bodies. But body mass and the weight of the back pack plays a role. If she weighs 120 pounds and is carrying a 25-pound backpack, it places a huge burden on her musculoskeletal system."

Slates, a clinical assistant professor in IUB's Department of Applied Health Science, offers these suggestions and considerations:

- **Pain and fatigue are, well, a pain.** In Slates' preliminary study of the relationship between backpacks and health conditions, 55.3 percent of the college-age respondents reported experiencing pain from carrying their bags, with a higher percentage of women (66.9 percent), reporting such pain.
- **Parents, take note.** Parents should be aware of the weight of their children's backpacks and encourage them to store some of their books and belongings in lockers.
- **Find a locker.** University students should look into the use of temporary lockers on campus so they do not have to carry books for all of their classes all day. Universities should consider placing day lockers throughout campus to facilitate this.
- **Lighten the load.** Healthcare professionals suggest keeping backpack weight below 15 percent to 20 percent of the carrier's body weight.
- **Strategic loading.** Waists, Slates says, are designed to carry more weight than shoulders. Waist and chest straps help keep backpack weight as close to the body as possible, minimizing problems by distributing the weight more evenly across the body.
- **Options.** Slates does not recommend one model over another, but he said parents and students should know they have options -- backpacks come in different shapes and sizes, including backpacks with one strap and messenger bags. He encourages people to use both straps on the packs that have two straps, however, because two straps cut the physiological burden in half by distributing weight more evenly. He also suggests moving the weight around to avoid overuse on particular muscles.

Last spring, Slates and members of the American Society of Safety Engineers began collecting data for the study by weighing backpacks and talking with students at bus stops on the IU Bloomington campus. Slates plans to expand his sample through next spring. In his preliminary findings, the students who reported experiencing pain reported having it in multiple areas, including the neck, shoulders and upper and lower back. Graduate students had the heaviest packs, weighing in at 12 pounds, 2 ounces on average. Male students' bags averaged 11 pounds, 10 ounces, with female students' bags averaging 1 pound, 2 ounces less. The heaviest bag recorded weighed 25 pounds, 6 ounces. The study examines the use of traditional double-strap backpacks and the newer one-strap bags and messenger bags. The study should shed some light on whether any of these styles result in less pain.

Slates can be reached at 812-856-3766 and kslates@indiana.edu. Top

Institute at Indiana
University Southeast

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Binge drinking on college campuses: A matter of fear, not freedom. Teaching assistants, typically graduate students hired to help undergrads with their courses, are staples on college campuses. Indiana University shyness expert Bernardo J. Carducci said social assistants, people hired to help new students with their conversation IQ and social skills, should become staples, as well. New students, said Carducci, director of the Shyness Research Institute at IU Southeast, are no different than the estimated 40 percent of the population that is shy. The transition to college, however, can exacerbate this vulnerability, so students turn to an easy conversation-maker -- booze. "Usually universities have organizers, not facilitators," Carducci said. "You bring these people together, but you don't help them connect. You don't have people who go around and say, 'Steve, this is Rachel.' You need to do this at a much more personal level. That's what social facilitators at keggers do. They're walking around handing you drinks." Carducci says binge drinking is the fruit of the fear and anxiety new

students can experience, not the result of them enjoying their new-found independence. "What this really is all about is the process of transition, the process of change," Carducci said. "Change brings uncertainty. Uncertainty brings anxiety. They drink out of fear. They drink out of anxiety. They drink out of loneliness. They don't talk about how afraid they are because they think everyone will think they're a weenie. So, they conform. They talk about drinking -- where did they go, what did they do, where are they going this week. It gives students a topic of conversation. What begins to happen is they drink to get accepted."

Carducci offers the following suggestions:

- **Teach them to make connections.** Carducci, a psychology professor and author of *The Pocket Guide to Making Successful Small Talk: How to Talk to Anyone Anytime Anywhere About Anything*, said new students often have low levels of conversation intelligence. Universities should consider organizing friendship circles, where they bring students together on a regular basis, or including class sections that help students develop conversational skills and other social skills. If the university organizes a freshman picnic, for example, it needs to go the extra mile by having people mingle and make introductions.
- **A rational appeal.** University administrators need to acknowledge the dynamic by letting students know the root of their drinking is in loneliness, fear and anxiety. "Tell them you know they're drinking because they want to be liked and accepted. Don't make it a moral or emotional appeal."
- **Reality check.** Students have a drinking problem if they drink alcohol to feel relaxed at social functions or comfortable dancing or talking with others or if they pre-drink -- drink before they go to social functions so they "feel" more relaxed and comfortable when they arrive.
- **Avoid drinking games.** Drinking games might look fun, but they are designed to get drinkers drunk as quickly as possible. When people are drunk, they are easier to control and become more susceptible to everything from theft to sexual assault to alcohol poisoning, which can be fatal.
- **Lonely? Find people with similar interests.** Student groups focusing on a wide range of interests can be found on university campuses, providing students with a way to indulge their hobbies and interests while meeting similarly minded people.
- **Volunteer.** Students focus less on their own challenges with their transition to school when they focus on the needs of others. Volunteering puts students in a low stress situation because typically it's their time that is desired, not special skills. It lets them meet other people with similar interests.
- **Get a job.** Part-time jobs can help students with school by making them more organized and helping them meet people. Carducci says working up to 20 hours a week should not hurt grades. If the job is on campus, it can provide students with contacts and experience in areas related to their major.

- **Be a host to humanity.** Take the initiative by talking to people in the same boat -- new students. Introduce people. "It all boils down to taking the attention off of yourself and getting involved in the lives of others," Carducci said.
- **Parents, think "inoculation."** Parents shouldn't be afraid of talking to their children about limited alcohol consumption and about the anxiety and fear they could experience when they begin college. Let them know everyone feels that way and that they should not confuse drinking with bravado, Carducci said. "It's like having the drug and the sex talk -- this is what's likely to happen to you."

Carducci can be reached at 812-941-2295 and bcarducc@ius.edu. To learn more about the Shyness Research Institute, visit http://www.ius.edu/shyness. Top

A "tragic" health hazard. Pesticides in schools are a pervasive, unnecessary health hazard, said Marc Lame, an entomologist and professor in Indiana University's School of Public and Environmental Affairs. "Over 80 percent of schools in America are applying pesticides on a regular basis, whether they have a pest problem or not," he said. "This is tragic not only because of the well-documented link between pesticides and health problems in children, such as asthma and neurological disorders, but also because pesticides generally do not work in a preventive manner in the school environment. Applying pesticides does not prevent pests from coming in, so using them when pests are not present does nothing other than expose children and staff to toxic chemicals."

- **Background:** The most widely used insecticides are nerve poisons, which cause nerves to fire in an uncontrolled manner and disrupt endocrine (hormone) systems, Lame said. Prolonged exposure to these chemicals can result in similar effects on the human nervous system, with symptoms ranging from vomiting to severe breathing problems. Although research is limited, these endocrine disrupting pesticides are suspected in problems ranging from ADHD to autism to infertility, Lame said. Exposure during childhood carries the greatest risk. "The thing to remember is that it is not just a question of children being smaller than adults and getting more exposure pound-for-pound. The even more serious issue is that their nervous systems are still developing, so they are especially susceptible to nerve poisons," he said.
- **Solution:** Lame said pest problems are better managed with an integrated approach that involves recognition and remediation of conditions that attract pests or allow pests to enter facilities. "It's common sense pro-action rather than toxic reaction," he said. Lame serves as a

consultant for schools and environmental health agencies around the country, helping them implement such programs through a process known as Integrated Pest Management (IPM). He is also the author of a book on pest management in schools, *A Worm in the Teacher's Apple: Protecting America's School Children from Pests and Pesticides* (Authorhouse, 2005).

More information on IPM is available from the U.S. Environmental Protection Agency at http://www.epa.gov/pesticides/factsheets/ipm.htm.

Lame can be reached at 812-855-5249 or mlame@indiana.edu. Top

Passwords are a piece of cake -- for cybercrooks. Choosing a good password is one of the many choices students make as they head to college, and it's a decision that should not be taken lightly, says David Ripley, researcher at the Pervasive Technology Labs' Advanced Network Management Lab at Indiana University Bloomington. What really makes a password difficult -- or easy -- for someone else to figure out? A computer cracker or identity thief will never know the name of your favorite great-aunt's cousin's dog -- so that's a good password, right? "Sadly, that's not true," said Ripley. "Modern-day bad guys don't bother trying to guess your password themselves; they have computers do it for them." Using special programs and huge lists of words, these cybercrooks try millions of different words -- long words, short words and foreign words. They can try every word in every dictionary, in every language on Earth; every dog's and cat's and goldfish's name imaginable. They try all those words with dIffErenT cApITaLiZation, and all kinds of oth3r vArati0ns! They'll keep guessing for hours, or even days -- the program doing the guessing never gets tired or bored. "A random string of numbers and letters makes the best password," says Ripley, "Unfortunately those are very difficult passwords for most people to remember."

Ripley offers these tips on choosing and protecting a password:

- **Long and complicated isn't so hard.** Think of a phrase that will be easy for you to remember; use the first letter of each word to make a new word, leaving in the punctuation, capitalization and any numbers. Here's an example: "My first cat was named Fluffy. He was orange, with stripes. He only had 3 legs!" Taking the first letter of each word makes "MfcwnF.Hwo,ws.Hoh3l!"...which would be a really good password. Much better than just using

the word "Fluffy."

- **Longer the better.** In general, choose a longer password, rather than a shorter one.
- **Since you might forget ...** Don't write passwords on a sticky note and leave them on your monitor or near your computer. And definitely don't keep your password in a text file on your computer as crackers can potentially access them. However, keeping a list of your passwords in an envelope in a safety deposit box, home safe, or other secure location away from the computer can be a good idea, just in case of an emergency.

To speak with Ripley, contact Daphne Siefert-Herron at 812-856-1242 and dsiefert@indiana.edu. Top

For further assistance with these tips, contact Tracy James at 812-855-0084 or traljame@indiana.edu or Elisabeth Andrews, at 812-856-3717 and ecandrew@indiana.edu.

EDITORS: This monthly tip sheet is based on Indiana University faculty research, teaching and service. "Living Well Through Healthy Lifestyles" is the guiding philosophy of IU Bloomington's School of Health, Physical Education and Recreation. In keeping with that philosophy, this tip sheet offers information related to both physical and mental well-being. Faculty in other IU schools and departments also contribute their expertise in this area.

Source: Indiana University
Date: July 23, 2007

More on: Computer Science, Distributed Computing, Artificial Intelligence, Computer Modeling, Information Technology, Computer Programming

Passwords Are A Piece Of Cake -- For Cybercrooks

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Note: This story has been adapted from a news release issued by Indiana University.

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Source: Indiana University

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Passwords Are a Piece of Cake -- for Cybercrooks

Libraries
Life News (Social and Behavioral Sciences)

Keywords
PASSWORDS, INTERNET SECURITY

Contact Information

Available for logged-in reporters only

Description

Choosing a good password is one of the many choices students make as they head to college, and it's a decision that should not be taken lightly, says David Ripley, researcher at the Pervasive Technology Labs' at Indiana University Bloomington. Making long and complicated passwords is not so difficult, he says.

Newswise — Choosing a good password is one of the many choices students make as they head to college, and it's a decision that should not be taken lightly, says David Ripley, researcher at the Pervasive Technology Labs' Advanced Network Management Lab at Indiana University Bloomington.

What really makes a password difficult -- or easy -- for someone else to figure out? A computer cracker or identity thief will never know the name of your favorite great-aunt's cousin's dog -- so that's a good password, right?

"Sadly, that's not true," said Ripley. "Modern-day bad guys don't bother trying to guess your password themselves; they have computers do it for them."

Using special programs and huge lists of words, these cybercrooks try millions of different words -- long words, short words and foreign words. They can try every word in every dictionary, in every language on Earth; every dog's and cat's and goldfish's name imaginable. They try all those words with dIffErenT cApITaLiZation, and all kinds of oth3r vArati0ns! They'll keep guessing for hours, or even days -- the program doing the guessing never gets tired or bored.

"A random string of numbers and letters makes the best password," says Ripley, "Unfortunately those are very difficult passwords for most people to remember."

Ripley offers these tips on choosing and protecting a password:

* Long and complicated isn't so hard. Think of a phrase that will be easy for you to remember; use the first letter of each word to make a new word, leaving in the punctuation, capitalization and any numbers. Here's an example: "My first cat was named Fluffy. He was orange, with stripes. He only had 3 legs!" Taking the first letter of each word makes "MfcwnF.Hwo,ws.Hoh3l!"…which would be a really good password. Much better than just using the word "Fluffy."

* Longer the better. In general, choose a longer password, rather than a shorter one.

* Since you might forget ... Don't write passwords on a sticky note and leave them on your monitor or near your computer. And definitely don't keep your password in a text file on your computer as crackers can potentially access them. However, keeping a list of your passwords in an envelope in a safety deposit box, home safe, or other secure location away from the computer can be a good idea, just in case of an emergency.

INDIANA DAILY STUDENT
idsnews.com

Experts: A good password requires more than your mom's maiden name

Heather Haemker | IDS | Date: 9/18/2007

Password security is rapidly becoming a concern not only for students but for anyone with a password protected account.

Choosing a good password is a decision that should not be taken lightly, said David Ripley, a researcher at the Pervasive Technology Labs' Advanced Network Management Lab at IU, in a tip sheet for IU faculty research titled "Living Well Through Healthy Lifestyles."

Students may think a computer cracker or identity thief would never be able to guess their dogs' names, however, they do not need to guess thanks to computers that can do the guessing for them, according to the tip sheet.

"Most crackers use automated cracking engines designed to either find directory-based words in the password, or ones that simply try every possible combination, which is the most common," said Scott Wilson from the University Information and Policy and Security Office in an e-mail.

Cybercrooks try millions of different words, either long or short or foreign, to crack into systems, Ripley said in the tip-sheet.

He added that cyber hackers can try every word in every dictionary, in every language imaginable, even common pet names. In the monthly tip sheet, Ripley said the best passwords are when people use a random string of numbers and letters, but the only problem is that these types of passwords can be difficult to remember.

"I pick things that aren't related to me, so that people who know me can't guess," senior Annie Oler said.

Oler also said she steers clear of obvious things that people typically use. She said she likes to spell common words or names backwards and then finish the password with a number.

In an e-mail, Wilson said that the University's Information Security Office and University Information Technology Services have implemented the use of passphrases at IU to protect users. He explained that the concept is to trade shorter passwords that are hard to remember for longer ones that are easy to remember and type.

Both Wilson and Ripley recommended that students not write their passwords down and leave them where anyone can find them. Both agree that it is OK to write them down, but only if you have a secure place in which to store them, such as a safety deposit box.

Senior Kathleen Huff said she uses capital letters, numbers and spaces to make it more difficult for people to figure out.

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(5) Got Gordon?
(4) IU focuses on stud...
(3) Eco swift boats
(3) Marketing all-star...

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"The words I use are fairly common and easy," Huff said.

IU currently requires all new accounts and password changes use passphrases, which are a minimum length of 15 characters, and allow almost any combination of lowercase and uppercase letters, numbers, symbols and spaces, Wilson said in an e-mail.

"The goal of the passphrases is that by adding a few more characters and giving users the ability to choose natural language words, the length offers enough security that it would take automated cracking engines longer than most of our lifetimes to crack," Wilson said in an e-mail.

In an e-mail, Wilson explained that choosing a strong password is only one facet of online safety and security. People learn to take a more proactive approach to protecting their identity and information by changing their passwords often, and by choosing different passwords for different sites.

Oler said that to ensure her information is secure, she changes her passwords about every two months and she never checks her online banking from a school computer.

Computers & Tech

Cyber Crooks are After Your Cash

According to Dr. David Ripley, a technology researcher at Indiana University, new computer programs make it easy for bad guys to crack your passwords - and collect your personal information. The new programs can try every word in every dictionary, in every language on Earth! If you don't build the right protection into your passwords, it's only a matter of time until they're cracked. So, here are some tips for keeping your personal information safe, courtesy of *Science Daily*:

- **Longer is better**. Adding just one character to your password can make it TWICE as difficult for the new computer programs to crack.
- **Random strings of letters, numbers and punctuation are best**, but they're difficult to remember. So, here's how to make long and complicated, short and sweet: Think of a phrase you won't forget. Then, use the first letter of each word as your new password. For example: "My aunt has a yellow cat named Fluffy," becomes—M…A…H…A…Y…C…N…F. It would take about 2 centuries for a password cracking program to guess those 8 characters.
- **Don't keep a list of passwords on your computer**. That's the first place they look. Keep your passwords in a safety deposit box, home safe, or other secure location. It takes a little time and imagination to change your passwords, but it's still easier than dealing with what happens after the bad guys get your personal information.

Cyber smarts

Go to greater lengths than would-be crooks to protect your data

By CARLY NATION cnation@tmnews.com
November 28, 2007

A new semester at school is just around the corner for some college students. Now may be the time to double-check those passwords.

Choosing a good password is a decision that should not be taken lightly, said David Ripley, researcher at the Pervasive Technology Labs' Advanced Network Management Lab at Indiana University Bloomington.

Ripley said, in a press release, that students should move beyond a pet's name, or even a single word. "Modern-day bad guys don't bother trying to guess your password themselves; they have computers do it for them," he explained.

Those programs use huge lists of words — long words, short words and even foreign words.

"They can try every word in every dictionary, in every language on Earth, every dog's and cat's and goldfish's name imaginable," the press release states. "They try all those words with dIffErenT cApITaLiZation, and all kinds of oth3r vArati0ns! They'll keep guessing for hours, or even days — the program doing the guessing never gets tired or bored."

So, Ripley recommends using a random string of numbers and letters for the best password.

"Unfortunately those are very difficult passwords for most people to remember," he added.

So, here are some tips compiled from Ripley, Bedford North Lawrence computer technician Nathan Lowery, www.microsoft.com and www.securitystats.com:

•Think of a phrase that will be easy for you to remember; use the first letter of each word to make a new word leaving in punctuation, capitalization and any numbers. Here's an example: "My first cat was named Fluffy. He was orange, with stripes. He only had 3 legs!" Taking the first letter of each word makes "MfcwnF.Hwo,ws.Hoh3l!" — a much stronger password than "Fluffy." — Ripley

•Pick an obscure reference to something in your life, and then misspell it. — Lowery

•For Web sites that have critically important information to your life — like banks — the more complicated you should make your password. — Lowery

•Make it lengthy. Your passwords should be eight or more characters in length; 14 characters or longer is ideal. — www.microsoft.com

•Use the entire keyboard. Your password will be much stronger if you choose from all the symbols on the keyboard, including punctuation marks not on the upper row of the keyboard, and any symbols unique to your language. — www.microsoft.com

•Use two short words connected by punctuation, ex. T1me#0ff — www.securitystats.com

•Use numbers and letters to create an imaginary vanity license plate password, ex. IH8work! — www.securitystats.com

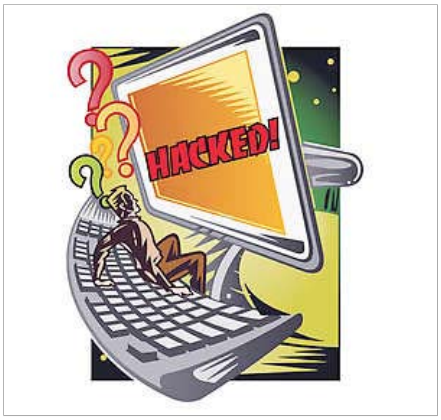
Other tips

When it comes to choosing a password, you may have to get creative several times over.

"Much like everything else in life, don't put all your eggs in one basket," Lowery said. "You shouldn't have one password for everything."

On the Web

Have some ideas for your passwords? Test how safe they are at Microsoft's password checker at www.microsoft.com/protect/yourself/password/default.mspx. Don't believe us? Read one man's blog, describing how he'd get past your passwords at http://onemansblog.com/2007/03/26/how-id-hack-your-weak-passwords/.



Times-Mail / SHANNON PRIDEMORE

Lowery and Ripley also warned against putting your password on a sticky note, and then placing that note on your computer monitor.

“Use your head,” Lowery said. “You wouldn’t hang the key to your front door on your front door.”

Ripley advised going even further: Don’t even keep your passwords in a text file on your computer.

“Keeping a list of your passwords in an envelope in a safety deposit box, home safe or other secure location away from the computer can be a good idea,” he said.

Times-Mail Staff Writer Carly Nation welcomes comments at 277-7262 or by e-mail at cnation@tmnews.com.

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Area business profiles

Passwords Are A Piece Of Cake -- For Cybercrooks

Updated: 7/21/2007 11:03:35 PM

Science Daily — Choosing a good password is one of the many choices students make as they head to college, and it's a decision that should not be taken lightly, says David Ripley, researcher at the Pervasive Technology Labs' Advanced Network Management Lab at Indiana University Bloomington.

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- Longer the better. In general, choose a longer password, rather than a shorter one.
- Since you might forget ... Don't write passwords on a sticky note and leave them on your monitor or near your computer. And definitely don't keep your password in a text file on your computer as crackers can potentially access them. However, keeping a list of your passwords in an envelope in a safety deposit box, home safe, or other secure location away from the computer can be a good idea, just in case of an emergency.

Note: This story has been adapted from a news release issued by Indiana University.

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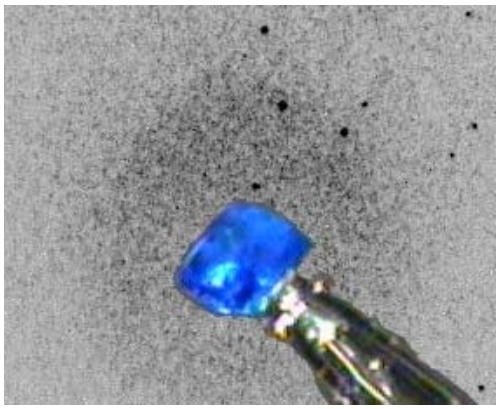
Data, Data, Everywhere



Composite picture of two images captured by the Data Capacitor of a crystalline specimen being observed by X-ray diffraction techniques at the IU Molecular Structure Center.

Modern computational resources provide research scientists with access to unprecedented amounts of data at rates previously thought impossible — data that may help to predict the next big hurricane, or discover a life-saving new drug. But with this incredible opportunity for discovery comes the very real challenge of how to manage and share these massive data sets.

In answer to this challenge, a team from University Information Technology Services, IU School of Informatics, and Pervasive Technology Labs has developed the Data Capacitor — a 535 Terabyte Wide Area Lustre Filesystem designed to help scientists temporarily store and manipulate very large data sets. The system is designed to be easy to use, allowing scientists to share data quickly even across great distances.

The project is supported by a $1.7 million grant from the National Science Foundation under the direction of principal investigator Craig A. Stewart and Data Capacitor project team leader **Stephen Simms**. Project co-PIs include **Randall Bramley, Catherine Pilachowski and Beth Plale**.

The Data Capacitor created a buzz in the research community early this summer when it demonstrated the exceptionally fast single client transfer rate of 977 Megabytes per second across the TeraGrid network.

"Imagine being able to move 12 DVDs worth of data from your desktop machine onto a filesystem two states away in a single minute," said Steven Simms. "This technology has the potential to significantly change how scientists collaborate across distances."

The Data Capacitor team along with partners from the Technische Universitaet Dresden announced recently that they had demonstrated impressive performance on a distributed transatlantic Lustre filesystem, opening the door to greater collaboration between scientists in the U.S. and Europe.

The Data Capacitor has supported several high-profile IU research projects including the Linked Environments for Atmospheric Discovery (LEAD) Project, a weather and storm prediction portal, and the Common Instrument Middleware Architecture (CIMA) project that allows scientists to manipulate instruments at remote labs and manage collected data without leaving their home labs.

In conjunction with the CIMA project, Scientists at IU's Molecular Structure Center use the Data Capacitor to support x-ray crystallography research. A stream of data comes from the lab along with additional metadata about each sample — temperature, humidity, pictures of the crystal sample, etc. — and is written to the Data Capacitor. Through the CIMA project, the Data Capacitor helps to manage similar data for a global consortium of more than a dozen crystallography labs at universities and national facilities with sites in the US, UK and Australia.

"The Data Capacitor has been exceptionally valuable to the CIMA project," said principal investigator, **Donald F. McMullen**. "Its capacity and throughput allowed us to design and implement a system that supports data sharing and maintains workflows involving massive amounts of instrument data."

More info on the Data Capacitor:
http://datacapacitor.researchtechnologies.uits.iu.edu/

More info on the LEAD Project:
https://portal.leadproject.org/gridsphere/gridsphere

More info on the CIMA Project:
http://www.instrument-middleware.org/metadot/index.pl

across six water-cooled racks housed at the Wrubel Computing Center on the IUB Campus.

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Last Updated: 8/27/2007

INDIANA UNIVERSITY

IU News Room

IU News from all eight campuses

Tuesday, September 18, 2007

IU research labs receive $1.9 million for Polar Grid research

Despite the summer heat, researchers from Indiana University are about to get a whole lot cooler. The National Science Foundation (NSF) has awarded an IU-led team $1.96 million to create a cyberinfrastructure that will help scientists better understand the current and future state of polar ice sheets.

Under the leadership of Geoffrey C. Fox, director of Pervasive Technology Labs' Community Grids Lab and IU professor of informatics, the project team includes partners from Elizabeth City State University and the University of Kansas' Center for the Remote Sensing of Ice Sheets.

NSF funding and additional IU support will be used to create a computer grid spanning from the North to the South Pole. This "Polar Grid" will be comprised of ruggedized laptops and clusters deployed in the field in the polar regions, and also two large scale clusters for detailed data analysis in the U.S. -- a 17 Teraflops cluster to be installed at IU, and a 5 TFLOPS cluster at Elizabeth City State University. The clusters will be made highly accessible through a science gateway, using Web 2.0 and portal approaches designed to make high performance computers easier to use.

"The Polar Grid project will transform U.S. capabilities in ice sheet research," said Fox. "With this technology, it will be possible to collect, examine and analyze data -- and then use the results of such analysis to optimize data collection strategies -- all during the course of a single expedition. This will help scientists more quickly gain understanding about the potential impact of rising sea levels and how they relate to global climate change, a problem of urgent importance."

The Polar Grid represents a dramatic change from the current method of study, in which expeditions occur during the summer months, data is brought back to the U.S. for analysis, and a new expedition takes place the following year.

In addition to impacting polar science, the project builds upon Fox's existing efforts to help minority serving institutions enhance their research by gaining greater access to cyberinfrastructure. The Polar Grid project will provide Elizabeth City State University, a historically black university in North Carolina, with a high performance computing cluster and will give its researchers access to IU's cluster, using a high speed network connection.

"Polar Grid will give Elizabeth City some very powerful and highly advanced, high performance computing equipment," said Matt Link, director of Research Technologies-Systems for University Information Technology Services at Indiana University, who serves as equipment coordinator for the project. "ECSU researchers will have access to cyberinfrastructure that's on par with some of the nation's top colleges and universities."

Linda Hayden, co-principal investigator from Elizabeth City State University, says the Polar Grid project will support student learning by expanding ECSU's existing polar science efforts, as well as providing greater access to and understanding of high performance computers.

"This will give ECSU a top-ranked 5 Teraflop high performance computing system, building on existing distance education and undergraduate laboratory infrastructure, that will enable crucial ice-sheet science and educate a diverse workforce in both polar science and cyberinfrastructure," said Hayden.

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August 20, 2007

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Breaking News:

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Faculty and student researchers will participate in field data collection and in Polar Grid implementation of a base camp 64-core cluster, allowing near real-time analysis of radar data by the polar field teams. Students trained and educated on Polar Grid also will participate in internships and enhance the entry of a diverse workforce into important science.

Indiana University is one of fewer than a dozen resource partners that provide hardware resources for the NSF-funded TeraGrid, a national-scale NSF cyberinfrastrtucture facility. IU also will leverage its involvement in the TeraGrid to support the Polar Grid project.

The Polar Grid research team started initial planning earlier this month, and they hope to begin equipment installation in late fall of 2007.

About Pervasive Technology Labs and UITS at Indiana University

Pervasive Technology Labs at Indiana University (pervasive.iu.edu) was established in 1999 by a grant from Lilly Endowment Inc. It performs leading-edge research based on the ubiquity of information technology in today's world, creating new inventions, devices and software that extend the capabilities of information technology in advanced research and everyday life. Fundamental to its mission are efforts to attract, encourage, educate and retain Indiana's workforce of tomorrow, and to accelerate economic growth in the state through the commercialization of new inventions and by forming and supporting new start-up companies. In carrying out its mission, Pervasive Technology Labs is helping Indiana University maintain its position of international leadership in information technology research and as a result is helping to enhance the prosperity of the entire state of Indiana.

University Information Technology Services at IU, with offices on the Bloomington and Indianapolis campuses, develops and maintains a university-wide information technology environment to support excellence in research, teaching, outreach and lifelong learning. Through providing high-performance computing, visualization technologies and network management, UITS contributes toward the advancement of multi-disciplinary research. It also supports research among hundreds of research and education institutions by providing network operations for several advanced networks, such as Internet2.

About Elizabeth City State University

Elizabeth City State University is a historically black university located in the northeastern corner of North Carolina. Through its Center of Excellence in Remote Sensing Education and Research, ECSU continues to develop its remote sensing and cyberinfrastructure capabilities which serve the polar science community and impact the economic development of the region. The impressive commitment of ECSU to this project include both a newly remodeled building and faculty lines.

About the Center for Remote Sensing of Ice Sheets

The Center for Remote Sensing of Ice Sheets (www.cresis.ku.edu) is a science and technology center established by the National Science Foundation (NSF) in 2005, with the mission of developing new technologies and computer models to investigate the present and future contribution of the Greenland and Antarctica ice sheets to sea level change. NSF's Science and Technology Center (STC) program combines the efforts of scientists and engineers to respond to problems of global significance, supporting the intense, sustained, collaborative work that is required to achieve progress

in these areas. CReSIS provides students and faculty with opportunities to pursue exciting research in a variety of disciplines; to collaborate with world-class scientists and engineers in the U.S. and abroad; and to make meaningful contributions to the ongoing, urgent work of addressing the impact of climate change. CReSIS is comprised of six partner universities, with the headquarters located at the lead institution, the University of Kansas.

Source: Pervasive Technology Labs at Indiana University

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The Leading Source for Global News and Information Covering the Ecosystem of High Productivity Computing / August 20, 2007

Breaking News:

Indiana University Receives $1.9M for Polar Grid Project

BLOOMINGTON, Ind., Aug. 20 -- Despite the August heat, researchers from Indiana University are about to get a whole lot cooler. The National Science Foundation (NSF) has awarded an IU-led team $1.96 million to create a cyberinfrastructure that will help scientists better understand the current and future state of polar ice sheets.

Under the leadership of Geoffrey C. Fox, director of Pervasive Technology Labs' Community Grids Lab and IU professor of informatics, the project team includes partners from Elizabeth City State University and the University of Kansas' Center for the Remote Sensing of Ice Sheets.

NSF funding and additional IU support will be used to create a computer grid spanning from the North to the South Pole. This "Polar Grid" will be comprised of ruggedized laptops and clusters deployed in the field in the polar regions, and also two large scale clusters for detailed data analysis in the U.S. -- a 17 Teraflops cluster to be installed at IU, and a 5 TFLOPS cluster at Elizabeth City State University. The clusters will be made highly accessible through a science gateway, using Web 2.0 and portal approaches designed to make high performance computers easier to use.

"The Polar Grid project will transform U.S. capabilities in ice sheet research," said Fox. "With this technology, it will be possible to collect, examine and analyze data -- and then use the results of such analysis to optimize data collection strategies -- all during the course of a single expedition. This will help scientists more quickly gain understanding about the potential impact of rising sea levels and how they relate to global climate change, a problem of urgent importance."

The Polar Grid represents a dramatic change from the current method of study, in which expeditions occur during the summer months, data is brought back to the U.S. for analysis, and a new expedition takes place the following year.

In addition to impacting polar science, the project builds upon Fox's existing efforts to help minority serving institutions enhance their research by gaining greater access to cyberinfrastructure. The Polar Grid project will provide Elizabeth City State University, a historically black university in North Carolina, with a high performance computing cluster and will give its researchers access to IU's cluster, using a high speed network connection.

"Polar Grid will give Elizabeth City some very powerful and highly advanced, high performance computing equipment," said Matt Link, director of Research Technologies-Systems for University Information Technology Services at Indiana University, who serves as equipment coordinator for the project. "ECSU researchers will have access to cyberinfrastructure that's on par with some of the nation's top colleges and universities."

Linda Hayden, co-principal investigator from Elizabeth City State University, says the Polar Grid project will support student learning by expanding ECSU's existing polar science efforts, as well as providing greater access to and understanding of high performance computers.

"This will give ECSU a top-ranked 5 Teraflop high performance computing system, building on existing distance education and undergraduate laboratory infrastructure, that will enable crucial ice-sheet science and educate a diverse workforce in both polar science and cyberinfrastructure," said Hayden.

Faculty and student researchers will participate in field data collection and in Polar Grid implementation of a base camp 64-core cluster, allowing near real-time analysis of radar data by the polar field teams. Students trained and educated on Polar Grid also will participate in internships and enhance the entry of a diverse workforce into important science.

Indiana University is one of fewer than a dozen resource partners that provide hardware resources for the NSF-funded TeraGrid, a national-scale NSF cyberinfrastrtucture facility. IU also will leverage its involvement in the TeraGrid to support the Polar Grid project.

The Polar Grid research team started initial planning earlier this month, and they hope to begin equipment installation in late fall of 2007.

About Pervasive Technology Labs and UITS at Indiana University

Pervasive Technology Labs at Indiana University (pervasive.iu.edu) was established in 1999 by a grant from Lilly Endowment, Inc. It performs leading-edge research based on the ubiquity of information technology in today's world, creating new inventions, devices and software that extend the capabilities of information technology in advanced research and everyday life. Fundamental to its mission are efforts to attract, encourage, educate and retain Indiana 's workforce of tomorrow, and to accelerate economic growth in the state through the commercialization of new inventions and by forming and supporting new start-up companies. In carrying out its mission, Pervasive Technology Labs is helping Indiana University maintain its position of international leadership in information technology research and as a result is helping to enhance the prosperity of the entire state of Indiana.

University Information Technology Services at IU, with offices on the Bloomington and Indianapolis campuses, develops and maintains a university-wide information technology environment to support excellence in research, teaching, outreach and lifelong learning. Through providing high performance computing, visualization technologies and network management, UITS contributes toward the advancement of

multi-disciplinary research. It also supports research among hundreds of research and education institutions by providing network operations for several advanced networks such as Internet2.

About Elizabeth City State University

Elizabeth City State University is a historically black university located in the northeastern corner of North Carolina. Through its Center of Excellence in Remote Sensing Education and Research, ECSU continues to develop its remote sensing and cyberinfrastructure capabilities which serve the polar science community and impact the economic development of the region. The impressive commitment of ECSU to this project include both a newly remodeled building and faculty lines.

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Source: Indiana University

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iSGTW INTERNATIONAL SCIENCE GRID THIS WEEK

Feature - Polar Grid: entering the ice age

"Things that took 100,000 years to change are now changing in ten years," says Geoffrey Fox. "This was a relatively sleepy field. It has come rapidly to the forefront."

Fox is director of the Community Grids Lab at Indiana University's Pervasive Technology Labs. A computer scientist by trade, he's been swept into the fever of ice-sheet science.

"In the last ten years something has happened," he says. "Ten years ago the ice sheets weren't melting. Now they are. And we don't know why."

Polar grid will link the North and South Poles to teraflop facilities in the U.S., providing the massive power required to fill the gap in understanding of ice cap behavior in a changing climate.
Images courtesy of Polar Grid

The need for information is critical. The Intergovernmental Panel on Climate Change report explicitly stated that understanding of ice flow dynamics is limited, that there is no consensus on the magnitude of ice sheet influence, and that there is an urgent need to improve the models being used to predict their effect on ocean levels.

In response to this need, Fox and ice scientist Linda Hayden of Elizabeth City State University, North Carolina, hatched a plan.

Called Polar Grid, the planned project would advance cyberinfrastructure, empower minority and smaller universities, and provide scientists with a gateway to teraflops of power: enough to drive new and improved high-performance simulations and enable measurement and prediction of ice sheet response to climate change and effect on ocean levels.

Most scientific models predict that polar ice sheets will respond slowly to climate change. Yet these models do not account for the sudden changes taking place at our poles. Sometime in the last ten years, the melt-rate heated up.
Images courtesy of Polar Grid

The tip of the cyber-iceberg

Very recently, their planning paid off.

In August 2007 Polar Grid received a US$1.96 million National Science Foundation grant.

Planning is already underway to create a grid that will span the North and South Poles, linking major facilities at Indiana University and Elizabeth City State University with universities and institutions across the United States.

The Polar Grid team will create a computer grid comprising a 64-core cluster of rugged laptops and solar-powered components—deployed in the polar field—and two large-scale clusters on the mainland—17 teraflops at IU and 5 teraflops at ECSU.

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Feature - Polar Grid: entering the ice age

Feature - Grids: a global home for serious science

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September

2-7, CHEP'07, Victoria, British Columbia, Canada

3-7, CoreGRID Summer School 2007, Budapest, Hungary

3-7, PaCT 2007, Pereslavl-Zalessky, Russia

3-7, 6th Joint Meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering, Dubrovnik, Croatia

5-6, 3rd Pan-Galactic BOINC Workshop, Geneva, Switzerland

6-7, 4th International

The clusters will be easily accessible through a science gateway, using Web 2.0 and portal approaches designed to make high-performance computers easier to use.

The result? Real-time analysis of changes in the polar ice sheets; better quality predictions rendered in shorter periods of time.

“It will be possible to collect, examine and analyze data—and then use the results to optimize data collection strategies—all during the course of a single expedition,” says Fox.

The long wait for answers—often until next summer’s expedition—has been side-stepped.

Democratizing science

Another important component of Polar Grid is its role in democratizing science, says Fox. The project will also boost computing power at the historically disadvantaged Elizabeth City State University.

“Cyberinfrastructure helps to level the playing field,” says Fox. “We can link to a variety of universities, allowing people who have not previously been participants in science to join in more easily and with fewer barriers than before. We can tap the unused human potential of smaller and minority institutions.”

The Polar Grid research team hope to start installing equipment in late fall.

- Cristy Burne, iSGTW

Tags: **Americas** **Earth science** **Feature** **Project Profile**

Conference on Life Science Grids, Glasgow, Scotland

10-12, Grid Engine Workshop 2007, Regensburg, Germany

10-13, 6th UK e-Science All Hands Meeting (AHM 2007), Nottingham, UK

10-14, GridKa School 2007, Karlsruhe, Germany

10-14, Tutorial: EGEE/EUMedGrid/EELA, Sevilla, Spain

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Indiana University research labs receive $1.9 million for Polar Grid research

Bloomington 20 August 2007 *Despite the August heat, researchers from Indiana University (IU) are about to get a whole lot cooler. The National Science Foundation (NSF) has awarded an IU-led team $1.96 million to create a cyberinfrastructure that will help scientists better understand the current and future state of polar ice sheets. Under the leadership of Geoffrey C. Fox, director of Pervasive Technology Labs' Community Grids Lab and IU professor of informatics, the project team includes partners from Elizabeth City State University (ECSU) and the University of Kansas' Center for the Remote Sensing of Ice Sheets.*

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Awards

IU Research Labs Receive $1.9 million for Polar Grid Research

Monday, Aug 20 @ 12:18 EDT
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Sponsors

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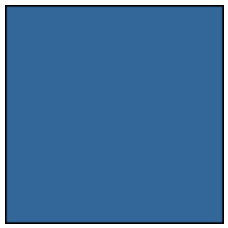

Grid Spans the Globe

August 21, 2007
By Paul Shread

Three universities are banding together to form a "Polar Grid" to study the effects of global warming in real time.

The effort, funded by a $1.96 million grant from the National Science Foundation, will be led by Geoffrey Fox, director of the Community Grids Lab at Indiana University, joined by partners from Elizabeth City State University and the University of Kansas Center for the Remote Sensing of Ice Sheets.

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Around the area

From H-T reports

August 29, 2007

MONROE

IU researchers get polar ice sheet study grant

A team led by Indiana University researchers has been awarded $1.96 million national Science Foundation grant to create cyber infrastructure to help scientists better understand the current and future condition of polar ice sheets.

Informatics professor Geoffrey Fox, director of the Pervasive Technology Lab's Community Grids Lab at IU, leads the team. It includes partners from Elizabeth City State University and the University of Kansas.

The project, called Polar Grid, will include computers deployed in the field in polar regions and linked to powerful computer clusters at IU and Elizabeth City, a historically black university in North Carolina. The technology will make it possible to collect, examine and analyze data, then use the results to optimize additional data collection, Fox said.

IU's ROTC unit ranks high in leader training

The Army ROTC program at Indiana University ranked fourth out of 272 U.S. universities in the ROTC program's 2007 Leader Development and Assessment Course.

The 33-day course, called operation Warrior Forge and conducted at Fort Lewis, Wash., is designed to develop and evaluate leadership ability and is considered the most important training event for Army ROTC cadets and National Guard officer candidates. Twenty-one IU Army cadets took part in the course, and 62 percent received ratings of "E" for excellent.

AREAWIDE

Free workshop on special ed conferences

A free workshop on special education case conferences will be given by attorney Alexandra Curlin at St. Mark's United Methodist Church, 100 N. Ind. 46 from 7 to 9 p.m. on Monday, Sept. 17.

Parents, education professionals, education providers and other interested community members are welcome to attend. Space is limited. Register with Barbara Campbell at 812-277-9766 or barbara.l.campbell@insightbb.com, or with Curlin at 317-202-0301 or amcurlin@curlinlaw.com.

Indiana Resource Center for Families with Special Needs is sponsoring the workshop.

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- An all-out drought
- Hearing tonight on proposed water project
- School bus crashes into cornfield along I-164
- Water boil order
- Campaign aims to curb drunken driving

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TMCnet NEWS

[August 21, 2007]

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Click here to watch a video in which featured Gartner vice president Michael Maoz shares new insights on the innovative technologies and processes shaping the future of customer service.

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Featuring Steven Smigie of Raymond James and Craig Berger of Wedbush Morgan Securities

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Current Issue: Aug. 27, 2007 [Past Issues]

HEADLINES AT A GLANCE:

UICU Prof to Head Team Studying Advanced Multimedia
Campus Technology (08/27/07) McCloskey, Paul

ACM's special interest group on advanced multimedia applications will now be headed by Klara Nahrstedt, a computer science professor at the University of Illinois at Urbana-Champaign (UICU). In her new position, Nahrstedt plans to press for multimedia and networking technology improvements for the humanities, arts, sciences, and medicine. "We are living in exciting times when digital video and audio are becoming available via different platforms, in multiple size and shapes," Nahrstedt says. "I plan to energize the multimedia community to make the multimedia technologies pervasive across many boundaries." Multimedia technologies are still not ubiquitous and pervasive. Nahrstedt also serves as the head of UICU's Multimedia Operating System and Networking Group, a project that involves the development of tele-immersive, 3D multi-camera room environments that are able to facilitate distributed physical activities such as physical therapy and entertainment.
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UM Study: Password Protecting Your Wireless Network Is Not Enough
University of Maryland (08/22/07) Corley, Missy; Copeland, Rebecca

IT Strategy Center (08/23/07) Macavinta, Courtney

Anita Borg Institute for Women and Technology President Telle Whitney says the recent media focus on IT outsourcing has convinced many women, and parents of college-aged students, that IT does not have a solid future, which is partly to blame for women's lack of interest in IT careers compared to men. Perceptions of what an IT career involves also are dampening women's interest in the field. The Information Technology Association of America reports that the number of women in IT declined 20 percent from 1996 to 2004, and the National Science Foundation says women received just 28 percent of computer science bachelor's degrees in the United States in 2003, compared to 38 percent in 1985. "If you ask both genders to identify what an IT professional looks like, the answer is still that it's a man with a pocket protector and glasses," says Whitney. "And there is a belief that you spend all of your time in front of a computer and don't work with people, but the reality is quite different." Experts say a few changes can attract more female workers to the IT industry. First, IT needs an image makeover. People need to know that IT careers involve more than programming and engineering, and that IT careers can be flexible and include working with customers and offer creative contributions. The image makeover is particularly important for exposing "tween" and teenage girls to opportunities in IT, Whitney says. CIOs can support the makeover by encouraging staff to talk to the community about their careers. Companies also need to emphasize the necessity for workers with skills that women are generally stronger in, such as working in teams. CIOs can also send their female employees to conferences like those hosted by the Anita Borg Institute so they can meet mentors and learn more about IT career paths.

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Library School to Lead Team That Will Preserve Virtual Worlds
University of Illinois at Urbana-Champaign (08/21/07) Lynn, Andrea

A team from the University of Illinois Urbana-Champaign's Graduate School of Library and Information Science (GSLIS) will lead a two-year project to preserve virtual worlds such as those found in early video games, electronic literature, and Second Life. The project, called "Preserving Virtual Worlds," will also be worked on by partners at the Rochester Institute of Technology, Stanford University, the University of Maryland, and Linden Lab, the creator of Second Life. GSLIS faculty member and lead investigator of the project Jerome McDonough says interactive media is at a "high risk for loss as technologies rapidly become obsolete." He says the goal is to develop "mechanisms and methods" to preserve digital games and interactive fiction. "In particular, we will be looking at the metadata and knowledge management problems involved in preservation of highly interactive digital works," McDonough says. The Library of Congress is funding the project with a two-year, $590,000 grant through the "Preserving Creative America Initiative," the most recent initiative of the National Digital Information Infrastructure and Preservation Program. The first phase of the project, which is set to begin in January, will attempt to identity information needed to ensure any preservation strategy is successful. In the second phase the team will try to develop XML stands for encoding information so it can be included in digital repositories. The final phase of the project will focus on testing the preservation technologies the team developed in early phases.

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IU Research Labs Receive $1.9 Million for Polar Grid Research
Indiana University (08/20/07) Siefert-Herron, Daphne

Indiana University researchers have received a $1.96 million award from the National Science Foundation to create a cyberinfrastructure to help scientists better understand the current and future state of polar ice sheets. The "Polar Grid" will span both poles using rugged laptops and clusters deployed in the field in the

polar regions, as well as a 17 teraflops cluster at IU and a 5 teraflops cluster at Elizabeth City State University for detailed data analysis. The clusters will use Web 2.0 and portal approaches to be highly accessible and easier to use. "The Polar Grid project will transform U.S. capabilities in ice sheet research," says Geoffrey C. Fox, director of Pervasive Technology Labs' Community Grids Lab and IU professor of informatics. "With this technology, it will be possible to collect, examine, and analyze data--and then use the results of such analysis to optimize data collection strategies--all during the course of a single expedition." In addition to advancing polar grid research, the project advances Fox's existing efforts to provide greater access to cyberinfrastructure to institutions that primarily serve minority students. Elizabeth City State University is a historically black university in North Carolina. The Polar Grid project will provide ECSU with a high-performance computing cluster and access to IU's cluster through a high-speed network connection. Linda Hayden, co-principal investigator from ECSU, says the technology will support student leaning by expanding ECSU's existing polar science efforts and by providing better access to high performance computers.

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Heterogeneous Processing in the Age of Nanocore (Part I)
HPC Wire (08/24/07) Vol. 16, No. 34,

Monolithic and monothreaded scalar processors can no longer deliver steadily expanding computing performance as the age of many-core processing moves forward, writes the High-End Crusader. Reasons for this include the depletion of instruction-level parallelism. "With a thousand cores on a die and a hundred threads per in-order multithreaded core, someone or something had better master thread-level parallelism (TLP)," notes the author. The High-End Crusader explains that parallel computing needs to be reinvented with the participation of both the elite and mainstream parallel computing communities, given the close connection between these approaches' outcomes. "For a nanocore-die's memory-bandwidth walls, we need engineering solutions to increase all of the following: 1) the nanocore-die pin bandwidth, 2) the local (memory) and global (network) interconnect bandwidths, and 3) the aggregate hardware DRAM bandwidth per gigabyte," the author writes. "For a nanocore's memory-bandwidth walls, we need to increase the hierarchical on-chip-network bandwidths." He cites the need for sensible hierarchical caches that lower bandwidth requirements, are not wasteful of bandwidth, and facilitate exploitation of on-chip "spatial" dependence locality. "We need to reinvent heterogeneous processing because, quite apart from useful-scalability imperatives, there are many distinct types of heterogeneity, even many distinct types of processor heterogeneity, and we will need to make intelligent choices about the type (or types) of heterogeneity our applications need," the author concludes.

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Indiana University Receives $1.9 Million Polar Grid Award

08/20/2007 Daphne Siefert-Herron

FOR IMMEDIATE RELEASE
August 20, 2007

BLOOMINGTON, Ind.—Despite the August heat, researchers from Indiana University are about to get a whole lot cooler. The National Science Foundation (NSF) has awarded an IU-led team $1.96 million to create a cyberinfrastructure that will help scientists better understand the current and future state of polar ice sheets.

Under the leadership of Geoffrey C. Fox, director of Pervasive Technology Labs' Community Grids Lab and IU professor of informatics, the project team includes partners from Elizabeth City State University and the University of Kansas' Center for the Remote Sensing of Ice Sheets.

NSF funding and additional IU support will be used to create a computer grid spanning from the North to the South Pole. This "Polar Grid" will be comprised of ruggedized laptops and clusters deployed in the field in the polar regions, and also two large scale clusters for detailed data analysis in the U.S.—a 17 Teraflops cluster to be installed at IU, and a 5 TFLOPS cluster at Elizabeth City State University. The clusters will be made highly accessible through a science gateway, using Web 2.0 and portal approaches designed to make high performance computers easier to use.

"The Polar Grid project will transform U.S. capabilities in ice sheet research," said Fox. "With this technology, it will be possible to collect, examine and analyze data—and then use the results of such analysis to optimize data collection strategies—all during the course of a single expedition. This will help scientists more quickly gain understanding about the potential impact of rising sea levels and how they relate to global climate change, a problem of urgent importance."

The Polar Grid represents a dramatic change from the current method of study, in which expeditions occur during the summer months, data is brought back to the U.S. for analysis, and a new expedition takes place the following year.

In addition to impacting polar science, the project builds upon Fox's existing efforts to help minority serving institutions enhance their research by gaining greater access to cyberinfrastructure. The Polar Grid project will provide Elizabeth City State University, a historically black university in North Carolina, with a high performance computing cluster and will give its researchers access to IU's cluster, using a high speed network connection.

"Polar Grid will give Elizabeth City some very powerful and highly advanced, high performance computing equipment," said Matt Link, director of Research Technologies-Systems for University Information Technology Services at Indiana University, who serves as equipment coordinator for the project. "ECSU researchers will have access to cyberinfrastructure that's on par with some of the nation's top colleges and

universities."

Linda Hayden, co-principal investigator from Elizabeth City State University, says the Polar Grid project will support student learning by expanding ECSU's existing polar science efforts, as well as providing greater access to and understanding of high performance computers.

"This will give ECSU a top-ranked 5 Teraflop high performance computing system, building on existing distance education and undergraduate laboratory infrastructure, that will enable crucial ice-sheet science and educate a diverse workforce in both polar science and cyberinfrastructure," said Hayden.

Faculty and student researchers will participate in field data collection and in Polar Grid implementation of a base camp 64-core cluster, allowing near real-time analysis of radar data by the polar field teams. Students trained and educated on Polar Grid also will participate in internships and enhance the entry of a diverse workforce into important science.

Indiana University is one of fewer than a dozen resource partners that provide hardware resources for the NSF-funded TeraGrid, a national-scale NSF cyberinfrastrtucture facility. IU also will leverage its involvement in the TeraGrid to support the Polar Grid project.

The Polar Grid research team started initial planning earlier this month, and they hope to begin equipment installation in late fall of 2007.

About Pervasive Technology Labs and UITS at Indiana University

Pervasive Technology Labs at Indiana University (pervasive.iu.edu) was established in 1999 by a grant from Lilly Endowment, Inc. It performs leading-edge research based on the ubiquity of information technology in today's world, creating new inventions, devices and software that extend the capabilities of information technology in advanced research and everyday life. Fundamental to its mission are efforts to attract, encourage, educate and retain Indiana 's workforce of tomorrow, and to accelerate economic growth in the state through the commercialization of new inventions and by forming and supporting new start-up companies. In carrying out its mission, Pervasive Technology Labs is helping Indiana University maintain its position of international leadership in information technology research and as a result is helping to enhance the prosperity of the entire state of Indiana.

University Information Technology Services at IU, with offices on the Bloomington and Indianapolis campuses, develops and maintains a university-wide information technology environment to support excellence in research, teaching, outreach and lifelong learning. Through providing high performance computing, visualization technologies and network management, UITS contributes toward the advancement of multi-disciplinary research. It also supports research among hundreds of research and education institutions by providing network operations for several advanced networks such as Internet2.

About Elizabeth City State University

Elizabeth City State University is a historically black university located in the northeastern corner of North Carolina. Through its Center of Excellence in Remote Sensing Education and Research, ECSU continues to develop its remote sensing and cyberinfrastructure capabilities which serve the polar science community and impact the economic development of the region. The impressive commitment of ECSU to this project include both a newly remodeled building and faculty lines.

About the Center for Remote Sensing of Ice Sheets

The Center for Remote Sensing of Ice Sheets (www.cresis.ku.edu) is a science and technology center established by the National Science

Foundation (NSF) in 2005, with the mission of developing new technologies and computer models to investigate the present and future contribution of the Greenland and Antarctica ice sheets to sea level change. NSF's Science and Technology Center (STC) program combines the efforts of scientists and engineers to respond to problems of global significance, supporting the intense, sustained, collaborative work that is required to achieve progress in these areas. CReSIS provides students and faculty with opportunities to pursue exciting research in a variety of disciplines; to collaborate with world-class scientists and engineers in the U.S. and abroad; and to make meaningful contributions to the ongoing, urgent work of addressing the impact of climate change. CReSIS is comprised of six partner universities, with the headquarters located at the lead institution, the University of Kansas.

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Aug 29 2007, 15:46:01 (GMT/UTC)

The TeraGrid project is funded by the National Science Foundation and includes nine partners:
NCAR,NCSA, SDSC, PSC, ORNL, Purdue, Indiana, TACC and UC/ANL.

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August 22, 2007 || Polar Grid:

US Researchers to Study Global Warming in Real-time

Three US universities are banding together to form a "Polar Grid" to study tl global warming in real-time. The team will create a computer grid spanning t to the South poles.

The effort, funded by a $1.96 million grant from the National Science Foundation, Geoffrey Fox, director of the Community Grids Lab at Indiana University(IU), joine from Elizabeth City State University (ECSU) and the University of Kansas Center Sensing of Ice Sheets, Internetnews.com reported.

The computer grid from the North to the South poles is composed of rugged lapto deployed in the field in the polar regions and two large-scale clusters for detailed the US, 17 teraflops at IU and five teraflops at Elizabeth City. The clusters will be accessible through a science gateway, using Web 2.0 and portal approaches desi high-performance computers easier to use.

According to the scientists the result will be instant analysis of changes in the pola "The Polar Grid project will transform US capabilities in ice sheet research," Fox s statement. "With this technology, it will be possible to collect, examine and analyz use the results of such analysis to optimize data collection strategies − all during t single expedition. This will help scientists more quickly gain understanding about t impact of rising sea levels and how they relate to global climate change, a probler importance."

Under current methods, expeditions take place during the summer months, data is the US for analysis, and a new expedition takes place the following year. The proj boost compute power at ECSU, a historically black university in North Carolina.

"This will give ECSU a top-ranked five teraflop high-performance computing syste crucial ice-sheet science and educate a diverse workforce in both polar science a cyberinfrastructure," said Linda Hayden, co-principal investigator from the Univers

Faculty and student researchers will participate in field data collection and implem base camp 64-core cluster, allowing near real-time analysis of radar data by the p Students trained and educated on Polar Grid also will participate in internships. Th research team started initial planning earlier this month, and they hope to begin e installation in late fall.

Source: EDITTECH I

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japan.internet.com

温暖化の影響をリアルタイムで研究する『Polar Grid』構築へ (インターネットコム)

米国の3つの大学が地球温暖化の影響をリアルタイムで研究する共同プロジェクト『**Polar Grid**』がこのほど、全米科学財団から196万ドルの補助金を獲得した。
同プロジェクトは、インディアナ大学 Community Grids Lab のディレクタ **Geoffrey Fox** 氏が指揮を執り、エリザベスシティ州立大学 (ノースカロライナ州)、およびカンザス大学が中心となってグリーンランドと南極の氷床を調査している Center for Remote Sensing of Ice Sheets (CReSIS) の研究者らが参加する予定だ。

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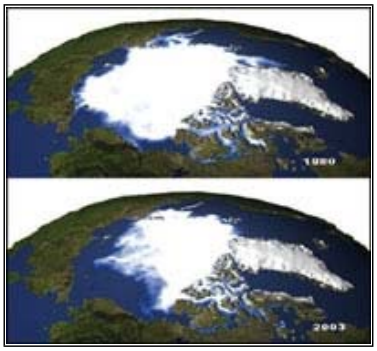

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InternetNews.com - Aug 21, 2007
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Indiana University Gets $1.9M for Polar Grid Research
GRIDtoday, CA - Aug 20, 2007
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BSU Bulldogs, MD - Aug 24, 2007
Our top returning players include, Christina Hager of **Elizabeth City State University** (163 kills, .249 pct, 99 total blocks) and Sha'Quanna Veney of the **...**

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CSTV.com, NY - Aug 23, 2007
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ECSU News & Events, NC - Aug 23, 2007
Elizabeth City State University along with the Elizabeth City Area Chamber of Commerce initiated the project that has attracted broad community support, **...**

BSU Football
BowieBlade.com, MD - Aug 2, 2007
... Order of Finish were recently announced with BSU picked to finish the upcoming season second in the division behind **Elizabeth City State University**. **...**

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WIS, SC - Aug 10, 2007
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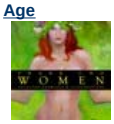

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Part of Yangze river, located between Chongqing and Yichang, China.(CC)

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From: Indiana University
Published August 25, 2007

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Scientists To Launch Polar Grid Research With Massive Computer Network

BLOOMINGTON, Ind. -- Researchers from Indiana University create a cyberinfrastructure that will help scientists better understand the current and future state of polar ice sheets. The National Science Foundation (NSF) has awarded an IU-led team $1.96 million to establish the computer network.

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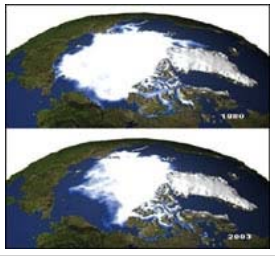

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Aug 27, 2007

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9/16/2007 More than two decades ago, Susan Solomon and her colleagues deciphered the chemistry of the Antarctic ozone hole. Today, NOAA continues to lead in this area, including producing 20 questions and answers for non-scientists about ozone depletion. More

Indiana University Research Labs Receive $1.9 million for Polar Grid to Study the State of Polar Ice Sheets

9/12/2007 NSF has awarded an IU-led team a grant to create cyberinfrastructure to better understand the state of polar ice sheets. The researchers will create a computer grid that will span the globe from the North to the South Pole More

USGS: Future Retreat of Arctic Sea Ice Will Lower Polar Bear Populations and Limit Their Distribution

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9/5/2007 Brent Christner, assistant professor of biological sciences, has spent a great deal of time in Antarctica, researching whether life can exist beneath the continent's ice sheets. More

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National Geographic Channel Television Special Focuses on South Pole Construction

9/4/2007 Produced with extensive support and cooperation from the National Science Foundation, which manages the U.S. Antarctic Program, "The South Pole Project" premiered this week on the National Geographic Channel. View a clip online. More

University of Alaska Anchorage Awarded $750,000 NSF Grant to Study Salmon Sustainability in the Arctic

9/4/2007 Researchers will use the grant to study how Yup'ik and Chukchi communities in remote areas of western Alaska and the Russian Far East adapt to changes subsistence salmon resources. More

Live Webcast Aug. 31: Media Panel to Explain Latest Developments in Antarctic Earth Sciences

8/31/2007 Several leading U.S. scientists will brief the media about the latest earth-science research in Antartica. The briefing will be Webcast live at 6:30 p.m. Eastern on Aug. 31 here: http://www.it.id.ucsb.edu/isaes.mov More

USGS Releases New Oil and Gas Assessment of Northeastern Greenland

8/28/2007 The U.S. Geological Survey has released an assessment of undiscovered oil and gas resources in the East Greenland Rift Basins Province, suggesting that there may be a large amount to be discovered. More

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Webテクノロジー　2007年8月22日 12:10

Webテクノロジー・ バックナンバー

温暖化の影響をリアルタイムで研究する『Polar Grid』構築へ

著者: Paul Shread　オリジナル版を読む プリンター用 記事を転送
▼2007年8月22日 12:10 付の記事
■海外internet.com発の記事

米国の3つの大学が地球温暖化の影響をリアルタイムで研究する共同プロジェクト『**Polar Grid**』がこのほど、全米科学財団から196万ドルの補助金を獲得した。

同プロジェクトは、インディアナ大学 Community Grids Lab のディレクタ **Geoffrey Fox** 氏が指揮を執り、エリザベスシティ州立大学 (ノースカロライナ州)、およびカンザス大学が中心となってグリーンランドと南極の氷床を調査している Center for Remote Sensing of Ice Sheets (CReSIS) の研究者らが参加する予定だ。

プロジェクトチームは今後、北極から南極までをカバーするコンピュータグリッドを構築する。具体的には、耐久性の高いノートパソコンとクラスタシステムを南北極域に配備し、データを詳細に分析するための大規模クラスタシステム2台を米国内に配備する。

この2台については、インディアナ大学に17テラフロップス (1テラフロップスは、1秒間に1兆回の浮動小数

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デベロッパー
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- 15 seconds
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最新コラム一覧

点演算を実行する能力) のシステムが、エリザベスシティ州立大学に5テラフロップスのシステムが設置される。この2台のクラスタでは、高性能コンピュータの使い勝手を向上させる Web 2.0 およびポータル的アプローチを採用し、サイエンス ゲートウェイを通じて簡単にアクセスできるようにする計画だ。

これによって、極域の氷床の変化を即時分析できるようになるという。

Fox 氏は声明の中で次のように述べている。「Polar Grid プロジェクトは、米国の氷床研究能力を変えるだろう。この技術によって、たった1度の調査旅行の間に、データの収集、調査、分析、およびその分析結果を用いたデータ収集方法の最適化までを実行できるようになる。このことは、海面上昇の潜在的な影響、および海面上昇と地球の気候変動の関連性を、研究者がより短期間に把握する上で役立つ。地球の気候変動は緊急を要する問題だ」

⇒ Web テクノロジー 最新ニュース一覧

関連記事

- 「環境」「バイオメトリクス」関連ニュース2題
- オーシャンブリッジ、スロベニアの XLAB と提携
- グリッド市場の経験をデータセンター仮想化に活かす戦略
- 日本 IBM、野村證券の金融特化型グリッド基盤を構築開始
- Oracle、次期『Siebel CRM On Demand』を発表

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- 旅行

★最新トップニュース

- 本番 Linux 環境向け Web システムを Windows 環境で開発するためのツール(8月27日 18:00)

  ゼンドと SRA OSS が、Windows 環境向け Web システム開発環境構築ツール「Zend Core for PowerGres on Windows」の販売を9月3日から開始する。

- フラットスライド採用の薄型スライド「P704i」が8月31日に発売(8月27日 18:00)

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InternetNews August 21, 2007 Paul Shread	**Grid Spans the Globe** A new 'Polar Grid' will help scientists measure the effects of global warming in real time.
Chemistry World August 20, 2007 Ned Stafford	Chemists Take Unique River Jaunt An international team assembled to test environmental pollution and water quality in the River Danube will be sleeping in bunks aboard the Hungarian ice breaker Szecheny.
InternetNews August 16, 2007 Andy Patrizio	IBM Supercomputer The Latest Olympic Entry A high-performance system will be used to predict the weather around Beijing and how bad the pollution is at any given hour.
IEEE Spectrum August 2007 Sarah Adee	Energy Regulators Adjust to a Tidal Gold Rush The number of real opportunities for tidal energy -- where incoming and outgoing tides drive underwater turbines -- is small. But the Federal Energy Regulatory Commission is trying to clear the path

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NCAA News

CAREER LADDER

Most recently, Flanagan was at Indiana University, where he completed his fellowship in medical oncology and hematology. Before that, Flanagan was a resident in internal medicine at the University of Iowa.

Grid Spans the Globe

The effort, funded by a $1.96 million grant from the National Science Foundation, will be led by Geoffrey Fox, director of the Community Grids Lab at Indiana University, joined by partners from Elizabeth City State University and the University of Kansas Center for the Remote Sensing of Ice Sheets.

First Murfreesboro Youth Choir meets Saturday

While studying music, Jones performed as a chorus member and soloist with many ensembles, including the Indiana University Opera and The African American Choral Ensemble. She has also traveled to New York to perform Mendelssohn's "Elijah" at Carnegie Hall under the direction of world-renowned baritone Sherill Milnes.

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INDIANA UNIVERSITY

IU News Room

IU News from all eight campuses

Thursday, October 11, 2007

Last modified: Wednesday, October 10, 2007

IU research labs receive $1.69 million to develop scientific research gateway

FOR IMMEDIATE RELEASE

Oct. 10, 2007

BLOOMINGTON, Ind. -- In an ever-changing digital research environment, scientists everywhere need better access to some of the world's most advanced supercomputers and large scientific data storage facilities to run computational experiments more efficiently. To make that happen, scientists need more user-friendly software tools.

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INSIDE INDIANA BUSINESS WITH GERRY DICK
INDIANA'S BUSINESS NEWS LEADER

Scientists need more user-friendly software tools, and to create them, IU's Pervasive Technology Labs and School of Informatics has been awarded a grant totaling more than $1.69 million from the National Science Foundation.

updated: 10/10/2007 2:21:53 PM

IU Project Receives Funding From National Science Foundation

InsideINdianaBusiness.com Report

Indiana University's Pervasive Technology Labs and School of Informatics have received a grant of more than $1.69 million from the National Science Foundation to produce user-friendly software tools. The "Open Grid Computing Environments (OGCE) Software for Science Gateways" will work to design software to create new Web gateways.

Source: Inside INdiana Business

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Source: Indiana University

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Indiana University research labs receive $1.69 million to develop scientific research gateway

Bloomington 10 October 2007 *In an ever-changing digital research environment, scientists everywhere need better access to some of the world's most advanced supercomputers and large scientific data storage facilities to run computational experiments more efficiently. To make that happen, scientists need more user-friendly software tools. This is how researchers from Indiana University's Pervasive Technology Labs and School of Informatics describe the goal of a new project titled "Open Grid Computing Environments (OGCE) Software for Science Gateways". The project has been awarded a grant totaling more than $1.69 million from the National Science Foundation.*

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Source: Indiana University

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October 11, 2007

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Breaking News:

IU Research Labs Get $1.7M for Scientific Research Gateway

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The Leading Source for Global News and Information Covering the Ecosystem of High Productivity Computing / October 12, 2007

Software:

IU Research Labs Receive $1.69M for Scientific Gateway

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Source: Indiana University

Indiana University briefs

From H-T Reports

October 13, 2007

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Two professors awarded Mellon fellowships

Two Indiana University-Bloomington professors have earned Andrew W. Mellon Emeritus Fellowships for 2007-08. Alexander Rabinowitch, a professor emeritus of history, and Albert Valdman, Rudy Professor emeritus of French and Italian, both earned the fellowships.

The fellowships are designed to support a full year of research and other related expenses for “officially retired” faculty members who are still active in the humanities and humanistic social sciences.

Only invited universities are allowed to submit nominations for the awards. Those invited can then only submit three nominations.

In the three years IU has been invited to submit nominees, IU scholars have received six awards out of nine total nominees.

Rabinowitch plans to use his fellowship in St. Petersburg, Russia, working on the preparation and publication of formerly secret documents about the Bolsheviks and the 1917 Russian Revolution.

Valdman aims to support the production of a Louisiana Regional French dictionary, a language in the advanced stage of loss.

Research labs receive science software grant

Researchers at IU’s Pervasive Technology Labs and School of Informatics have received a $1.69 million grant to help create more user-friendly software tools for scientists.

The grant will be used on a project called “Open Grid Computing Environments Software for Science Gateways.”

The goal is to develop software that will allow scientists across the world to create their own Web gateways. Where a site like Amazon.com lets customers find and buy items, a scientific gateway gives users a logical interface to online resources for scientists. If successful, the software would give scientists a powerful tool to help them access supercomputing and data storage resources.

The grant is from the National Science Foundation.

Four MBA students earn top honors

Four second-year master of business administration students at the Kelley School of Business have won first place in the 2007 Dell & Microsoft Marketing Case Competition at the National Society of Hispanic MBAs’ 18th annual conference and career expo earlier this month.

The Kelley team — composed of Rob Bakalar, Justin Chafe, Carolina Hoyos and Peter Kuo — was selected from 40 entrants who submitted responses to business situations proposed by Dell and Microsoft.

Finals for the competition were held in Houston, Texas, on Oct. 3 and consisted of a five-hour marketing strategy case analysis. Executives from both Dell and Microsoft then had a chance to ask questions of the team.

For winning, the Kelley team members each received a Dell laptop computer and a Microsoft Xbox 360.

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Indiana University: Two Major Awards

Friday, 12 October 2007

SCIENTIFIC RESEARCH GATEWAY

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NATIONWIDE MEDICAL RECORDS SYSTEM

The IndyStar reports that **"Indiana University** is getting the first crack at building a nationwide computerized medical records and information systemhe federal government on Thursday awarded a $2.5 million contract to the IU School of Medicine to start work on a trial implementation of the Nationwide Health Information Network.

It would be designed to allow doctors, hospitals and other authorized users to securely and privately exchange patient information over computer networks. The grant will allow researchers from the Regenstrief Institute, a health-care research organization, and the Indiana Health Information Exchange, a clinical messaging system, to continue work on the new national system. The effort to build such a national system was announced in 2005. The nonprofit Indiana Health Information Exchange is a service used by a growing number of hospitals across the state for doctors and other caregivers to access information, such as patient laboratory or electrocardiogram reports, using a secure Web site" **Full Story Here**

(Note: In August 07 Indiana also received $1.9 million for Polar Grid research. **Full PR Here**)

Last Updated (Friday, 12 October 2007)

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Awards

IU research labs receive $1.69 million to develop scientific research gateway

Wednesday, Oct 10 @ 18:08 EDT

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EGEE bids to become EGEE-III

For more information on Pervasive Technology Labs: www.pervasive.iu.edu.

For more information on the IU School of Informatics: its Web site.

For more information on the TeraGrid: www.teragrid.org.

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News

IU research labs receive $1.69 million to develop scientific research gateway

Bloomington, Ind., Oct 10, 2007 -- In an ever-changing digital research environment, scientists everywhere need better access to some of the world's most advanced supercomputers and large scientific data storage facilities to run computational experiments more efficiently. To make that happen, scientists need more user-friendly software tools.

This is how researchers from Indiana University's Pervasive Technology Labs and School of Informatics describe the goal of a new project titled "Open Grid Computing Environments (OGCE) Software for Science Gateways." The project has been awarded a grant totaling more than $1.69 million from the National Science Foundation. Scientists need more user-friendly software tools, and to create them, IU's Pervasive Technology Labs and School of Informatics has been awarded a grant totaling more than $1.69 million from the National Science Foundation.

The OGCE project will be led by Marlon Pierce, assistant director of the of the IU Pervasive Technology Labs (PTL); Dennis Gannon, science director of PTL and professor for the IU School of Informatics; and Nancy Wilkins-Diehr, TeraGrid area director for Science Gateways.

"Scientists studying climate change or searching for new drugs to treat illness benefit greatly from grid computing resources such as the TeraGrid, a national network of supercomputers and data storage facilities, but they are not usually experts in the complex software that powers these resources and binds them together. They need tools that will make this technology easy to use, so they can remain focused on their science," said Pierce, project principal investigator.

Researchers with the OGCE project seek to develop software that can easily be used by new groups to create their own powerful Web gateways. Much like a commercial Web portal such as Amazon.com that allows users to browse and purchase products, a science gateway provides a logical interface to essential online resources for scientists. Gateways provide capabilities such as personalized views of computing resources, collaborative search tools, and mechanisms for conducting and archiving online experiments and sharing results. Since many scientists also are not experts in high-performance computing or grid middleware, science gateways are valuable in helping them access the supercomputing and data storage resources required to support today's leading-edge scientific discovery.

A Web portal such as this also provides an easy and secure way for scientists and students from minority-serving institutions and smaller institutions without their own supercomputing facilities to tap into the nation's advanced high-performance computing resources for research and education.

IU Professors Geoffrey Fox and Beth Plale from the School of Informatics also are involved in leading this project. Additional collaborators include the Rochester Institute of Technology, the Texas Advanced Computing Center, the San Diego Supercomputer Center, San Diego State University (SDSU), and the Renaissance Computing Institute (RENCI).

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FOR IMMEDIATE RELEASE: November 8, 2007
Contact: Julie Wernert
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INDIANA UNIVERSITY
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

News Release

IU cyberinfrastructure and science gateways showcased at annual supercomputing conference

Bloomington, IND., Nov. 8, 2007 – Information technology leaders and experts from around the world will learn the vital role Indiana University's advanced cyberinfrastructure plays in scholarly innovation and research during the SC07 supercomputing conference being held next week in Reno, Nevada. The IU exhibit, titled "Foundations for Innovation: Gateways to Insight" will include presentations on IU-developed science gateways and other tools that make supercomputers easier for researchers to access and use. Visitors can also learn about the IU supercomputers, Big Red and Quarry, and a new state of the art data center currently under construction on the IU Bloomington campus.

Exhibits at the annual conference, considered the premier U.S. event in the field of supercomputing, will be open to the public from November 13-15 at the Reno Sparks Convention Center. The IU exhibit features speakers from IU, as well as presentations by scientists and researchers from other institutions collaborating with IU on innovative projects involving advanced information technology.

IU exhibit highlights include presentations on technology education opportunities and polar science within IU's new Polar Grid cyberinfrastructure project given by Professor Linda Hayden of Elizabeth City State University at 10:00 am and by Professor Prasad Gogineni of the University of Kansas Center for Remote Sensing of Ice Sheets at 2:00 pm, both on November 14.

In support of the "Gateways to Insight" theme, IU's Marlon Pierce, assistant director of the Community Grids Lab, will speak on November 13 at 10:00 am about the newly-funded Open Grid Computing Environments, a large-scale collaborative project funded by the National Science Foundation to develop software for building science portal gateways. Craig Stewart, associate dean for research technologies at Indiana University will provide an overview of IU's core IT equipment and services on November 13 at 5:00pm.

In addition, two Indiana University teams will participate in competitions held during the conference. The High Performance Bandwidth Challenge is an annual competition designed to test the limits of network capabilities and applications that support supercomputing. An IU team, led by Stephen Simms, will use IU's 535 TB Data Capacitor to demonstrate data collection, analysis, and visualization across distance. Researchers from IU, the Rochester Institute of Technology, and the Technische Universitaet Dresden will assist in the demonstration, running a range of data-intensive applications from a variety of disciplines.

IU will also host a team in the Cluster Challenge, a new competition in which teams of undergraduate students assemble and run benchmarks on a small cluster on the exhibit floor. The team of IU undergraduate students has been working on its competition "Red Delicious" Apple Xserve cluster under the leadership of team facilitator Andrew Lumsdaine, along with guidance from researchers and graduate students from the IU School of Informatics and University Information Technology Services. Corporate partners for the Cluster Challenge include Apple, Intel, Myricom and Fujitsu.

For more details on the Indiana University exhibit, and to view the complete schedule of speakers, visit http://supercomputing.iu.edu.

The Leading Source for Global News and Information Covering the Ecosystem of High Productivity Computing / November 9, 2007

Conferences:

IU Showcases Cyberinfrastructure and Science Gateways

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For more details on the Indiana University exhibit, and to view the complete schedule of speakers, visit http://supercomputing.iu.edu.

Source: Indiana University

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IU cyberinfrastructure and science gateways showcased at SC07

Saturday, Nov 08 @ 19:04 EST

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Panasas ActiveStor Parallel Storage Powers New Holland Computing Center

For more details on the Indiana University exhibit, and to view the complete schedule of speakers, visit its Web site.

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November 13, 2007

Informatics students competing in supercomputing challenge

A team of undergraduate students representing the Indiana University School of Informatics think their computing skills are, well, super. That's because they're competing in Supercomputing 07, a global competition for university students to harness the power of a modern high-performance computing cluster.

Sponsored by IEEE/ACM, the academic challenge brings together teams of students November 10-16, at the Reno-Sparks Convention Center in Reno, Nev., to match wits and speeds against undergrads from other institutions. The IU team members include Joseph Blaylock; Andrew Schwenker; Adam Hinz; Val Savage; Sarah Loos; and Greg Smith.

The group will travel to Reno with their Apple computer cluster – affectionately named Red Delicious. The green flag drops on Monday night of SC07 for teams to construct, test and tune their respective cluster systems. The informatics team's challenge is to optimize "Red-D" for a number of pre-designated workloads and programs. Teams gain points based on the level of optimization achieved during the event.

Competition teams must use a single 19" rack for their system, which cannot exceed a single 30amp, 100-volt circuit. Penalties are issued if the power thresholds are exceeded. The list of Cluster Challenge benchmark applications include:

- High Performance Computing Challenge [HPCC]
- Parallel Ocean Program [POP]
- General Atomic and Molecular Electronic Structure System [GAMESS]
- Persistence of Vision Ray-Tracer [POV-Ray]

These scientific applications will be OS-neutral and will provide real-world workloads, which has great instructional benefit. When the competition begins, teams will be handed media with data sets for the applications. Points are awarded for successful processing of data sets and displaying output on the monitors for visitors to follow. Additional information about the Supercomputing 07 Challenge is available at: http://insidehpc.com/2007/10/25/sc07-cluster-challenge/.

Featured Article: **TMO at MWSF - Announcing The Mac Observer Editors' Choice Award Winners for Macworld 2008**

IU Builds Apple Cluster for Super Computing Show [UPDATED]

by **John Martellaro**, 3:05 PM EST, November 12th, 2007

Under the direction of professor Andrew Lumsdaine, Indiana University has built an Apple Xserve cluster called "Red Delicious" to compete in the **SC07 Cluster Challenge**

This year's **supercomputing conference** is being held at the Reno-Sparks Convention Center. The conference brings together the researchers from all over the world who showcase their developments in the art of supercomputers. Major attendees include the U.S. National Laboratories, universities and industry leaders in supercomputing and cluster hardware and software development.

"The Cluster Challenge was conceived of by Brent Gorda, of Lawrence Livermore National Laboratory, and Chip Smith, of Lawrence Berkley National Laboratory. Over a year ago, these two men begin planning the event as a way showcase HPC, but more importantly, to provide an opportunity for undergraduate students to interact with cutting edge technology," said Andrew Lumsdaine, of the IU School of Informatics.

Six IU students, under the direction of Dr. Lumsdaine, "Team 500," have been involved in a semester-long hands on laboratory course developed around the goals of the challenge. "For the course, the students assembled the hardware, installed and administered the software, met with discipline scientists to learn about the HPC applications in the challenge, and gained an appreciation for the interactions and trade-offs involved in high-performance computing systems," said Dr. Lumsdaine.

At SC07, students will have to test and tune their cluster, then be given a **suite of programs to benchmark**. In addition to other rules, one stipulation is that the cluster must pull no more than 26 amps. Systems that pull more current will be penalized, and those that pull more than 30 will be disqualified. According to Rich Knepper with Indiana University's Information and Technical Services, the Apple Xserve was chosen for its superior performance to electrical power ratio.

The IU cluster, dubbed "Red Delicious" by the students is a nine node **quad core Xeon Xserve** system with two networks connecting the nodes: a 10 Gbps administrative network on a Fujitsu switch and a Myrinet (from **Myricom**) high speed switching fabric. Each Xserve compute node has 8 GB of RAM and is running Tiger Server.

Apple's education division provided technical assistance. Other IU sponsors included Intel, Fujitsu and Myricom. In addition, Chevron, Morgan Stanley, and Western Geco contributed significant financial resources to make the overall Cluster Challenge event possible.

A cluster of this size, likely in the 100+ gigaflops range, according to Mr. Knepper, would have been one of the fastest computers in the world ten years ago. One of the highlights of the SC show is its annual list of the fastest supercomputers in the world in its Top 500 list.

The results of the Challenge will be available later this week along with the Top500 results. This article will be updated when the results become available.

Apple started attending Supercomputing in 2000 in Dallas, however this is the first year since 2001 that Apple has not had its own booth at the show.

[This article was updated with additional information for clarity.]

Student-run Xserve cluster competing in Cluster Challenge

By Justin Berka | Published: November 13, 2007 - 08:16AM CT

Although it's not exactly selling them in the same quantities as, say, iPods, Apple still does manage to move a fair number of Xserves. In my mind, successive iterations of the Xserve have been gradually more attractive in terms of space needs and power utilization, ultimately making Xserves more attractive for clustering. So attractive, in fact, that a group of students have entered an Xserve cluster in a supercomputing challenge at Indiana University.

The event is the inaugural SC07 Cluster Challenge, which is being held at the SC07 high-performance computing conference. In it, groups of six undergraduate students will be given several benchmarks to run on their clusters. The teams will also be given scientific data sets that they must analyze and execute on their clusters in order to score points. Clusters are limited to one full-height, 19-inch rack, but are penalized for power draws over 26 amps, and will trip their breakers at 30 amps. Thus, the competition is focused on creating efficient clusters and further tuning them to run the competition data, rather than on having racks and racks of servers.

Students from Indiana University are entering their Xserve cluster, as pointed out by The Mac Observer, called "Red Delicious." Sure, they only have nine nodes, but all nine Xserves are new quad-core Xeon models with 8GB of RAM. There's a mesh network involved as well, so the cluster is expected to deliver over 100 gigaflops (floating point operations per second). That's not too shabby, especially for a student-run and vendor-sponsored cluster. The contest is running throughout the week, so we'll let you know on Friday how the Apple cluster fares.

Filed under: Xserve, education, cluster, HPC, more...

Reader comments

ghub005

> quote:
> but all nine Xserves are new quad-core Xeon models with 8GB of RAM.

AFAIK there aren't any quad-core XServes, or even any new XServe models.

Apple is still selling the same old dual Woodcrest dual-core machines they've been peddling for the last 14 months.

November 13, 2007 @ 09:18AM

The Leading Source for Global News and Information Covering the Ecosystem of High Productivity Computing / November 23, 2007

Features:

SC07 Holds First Cluster Challenge

by Brent Gorda
SC07 Cluster Challenge Committee Chair

The SC07 Cluster Challenge was held in conjunction with the SC07 conference in Reno, Nevada. The event sought to create an exhibition and competition in which teams of undergraduate students would compete in a demonstration of talent, technology and accessibility of entry-level supercomputing. The activity was intended to highlight the gains in hardware performance, ease of use of clusters and the power and availability of simulation software.

To whet peoples' appetites, the Cluster Challenge Committee challenged that a half rack of a modern cluster would be competitive with the number one system on the TOP500 from only 10 years ago! In fact, the top Linpack score realized in the Challenge was 420 gigaflops, which would have made the TOP500 list only three years ago. This announcement was made during the TOP500 BoF session at SC07 and was met with loud cheers and applause from the attendees.

The rules of the Challenge were simple: a maximum of 26 amps max power (at 110 volts) were to be used, and no team member may have completed an undergraduate degree. Six teams and their vendor partners chose to compete:

- Stony Brook University + Dell.
- National Tsing Hua University + ASUSTek.
- University of Colorado + Aspen Systems.
- University of Alberta + SGI.
- Indiana University + Apple.
- Purdue University + HP.

Each team partnered with a vendor who loaned the equipment for the event and, in some cases, provided travel funds to the team. In most cases, the teams had access to the equipment for a few months, but some only had it for a few weeks prior to shipping. On Saturday, Nov. 10, teams arrived to find (or not, in some cases) their equipment waiting in the contest area. Saturday and Sunday were then spent rebuilding systems, optimizing power, and finalizing the benchmarks and applications for the start of the competition.

Teams were asked to run the HPC Challenge benchmarks at the beginning of the event at 8:00 PM on Monday. Once the results were submitted, teams were given access to data sets for the three previously announced applications: GAMESS, POP and POVRay. Teams then spent the remainder of their time -- up to 4:00 PM on Wednesday -- completing as many of the data sets as they could. At the end of the competition, judges interviewed the teams and awarded points based on this interaction. The judges were lead by Jack Dongarra (University of Tennessee and ORNL) and included Dona Crawford (LLNL), Satoshi Matsuoka (Tokyo Tech) and Tim Lyons (Morgan Stanley).

For about 44 straight hours, teams worked on the benchmarks and applications in shifts. About halfway through the event, around Tuesday at noon, there was a general power interruption to the section of Reno where the convention center is located. All teams experienced a hard crash and had to scramble to recover. The event couldn't have asked for a more brutal real-life experience. Some of the teams lost upwards of ten hours of compute time and others lost hardware and time associated with debugging the failure. In the end, however, all teams were back online within a couple of hours and some chose to run with automatic checkpoint restart, as available in some of the applications, to protect against further interruption.

Ultimately, the winner of the contest was the team from The University of Alberta in Edmonton, Canada. While that team did not have the fastest system on paper, a combination of good preparation and good fortune during the brief power outage gave them the advantage.

The quality of teams, systems and computational work exceeded all expectations. While one could attribute this to individuals standing up to the challenge, the committee's opinion is that a larger force is also at work. This is that the entry barrier to

supercomputing has dropped significantly. The results show that if you have a need for simulation computing, it is reasonable to believe that you can use local college or university talent and commonly available software and applications to get started on that work.

Another significant outcome of the event is its impact on the curricula of the participating institutions. Half of these schools decided to modify their undergraduate offerings in the future to include cluster and parallel computing classes.

Computational simulation, driven by continued advances in hardware, availability and maturity of cluster OS software, and enabled by parallel application software, has reached a point where it is clearly accessible and available. These tools are now available to industry and we predict the technology will soon be considered critical to enhance competitiveness of businesses of all sizes and in all markets.

In closing, there are numerous people and organizations to credit for the event itself. Starting with the ACM and IEEE (sponsors of SC07), the individual team vendor partners (Dell, ASUSTek, Aspen Systems, SGI, Apple and HP) and the event partners (Chevron, WesternGeco and Morgan). The results are exciting and we are already planning for the next event at SC08, Nov. 15-21, in Austin, Texas.

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Biting the hand that feeds IT

Original URL:
http://www.theregister.co.uk/2007/11/15/cluster_challenge_alberta_wins/

Canada wins the great co-ed cluster challenge

By Ashlee Vance in Reno
Published Thursday 15th November 2007 22:18 GMT

SC07 Canuck pride carried Team Canada to victory in the first ever Cluster Challenge event here at Supercomputing.

Six university teams gathered at the Supercomputing conference to take part in the Cluster Challenge. The rules of the contest stated that only undergraduates could build the clusters. In addition, the teams only had 26 amps to play with, forcing them to concentrate on keeping power consumption low.

Brent Gorda, an engineer at Lawrence Livermore National Lab, helped put the challenge together and set these limits with a couple of goals in mind. First off, the organizers wanted to show that clusters have become very accessible. Machines that would have counted as top-of-the-line supercomputers years ago can now be built by undergraduates. Hopefully, more students, engineers and businesses will take a crack at building their own systems now that they've seen what can be done.

Obviously, there was an emphasis placed on power consumption as well. Going green has become all the rage in the computing industry, and youngsters ought to start thinking about how to deal with these power limitations.

The teams - University of Colorado (Aspen Systems), Indiana University (Apple), University of Alberta (SGI), Purdue University (HP), National Tsing Hua University (Taiwan) (ASUS), and Stony Brook University (Dell) - came up with somewhat similar designs. For example, five of the teams crafted boxes with Xeon chips and five ran versions of the Linux operating system. Purdue bucked the chip trend by picking Opterons, while Indiana ran Apple's OS X. All of the teams used InfiniBand as an

interconnect except Indiana which did Myrinet 10G over 10GigE.

Our heroes

The number of cores ranged from 100 with Stonybrook's box to 36 on the Apple system.

And now we find that Alberta's 64-core (Xeon 2.66GHz) system with 20Gbit InfiniBand and 16GB of memory running Scientific Linux is the best box. In this type of event, however, everyone is a winner. (Yes, let's all share a collective hug.)

The teams have enjoyed their own display space here at the Supercomputing show where their systems have cranked away on high performance computing workloads for days. The computers had to handle Linpack - the benchmark used to rank the world's top supercomputers - along with tests (http://icl.cs.utk.edu/hpcc/index.html) for memory bandwidth, latency and message flow.

(A power outage at the show (http://www.theregister.co.uk/2007/11/13/worlds_biggest_reboot/) temporarily wrecked some of the benchmark testing. You can read about the episode in the comments section of the linked story where an Alberta team member gives a first person account.)

More crazy kids

Along with the benchmarks, the teams were graded with some beauty pageant metrics. For example, they had to discuss their hardware and software in an eloquent fashion when probed by judges.

We've been impressed by the enthusiasm (http://www.rcac.purdue.edu/sc07/) demonstrated by the students. These are bright kids who really seem to enjoy what they're doing.

Can an Average Joe build a cluster just like the kiddos?

Well, no. These guys really know their sockets from their GPGPUs.

The race, however, has shown that a bit of effort and brains can result in a very, very fine cluster. Which is nice.

And we're particularly pleased to see *Reg* readers take the top prize. You see, kids, biting the hand that feeds IT pays. Or something like that. ®

Register editor Ashlee Vance has just pumped out a new book (http://theduckrabbit.com/?page=featured) that's a guide to Silicon Valley. The book starts with the electronics pioneers present in the Bay Area in the early 20th century and marches up to today's heavies. Want to know where Gordon Moore eats Chinese food, how unions affected the rise of microprocessors or how Fairchild Semiconductor got its start? This is the book for you - available at Amazon US here (http://www.amazon.com/dp/0762742399?tag=tennisherald-20&camp=14573&creative=327641&linkCode=as1&creativeASIN=0762742399&adid=0JDWWDWKGYRWFQ9EV9QC&) or in the UK here (http://books.theregister.co.uk/catalog/browse.asp?id=866452&advert=ashleevance).

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Cisco Unveils High Performance InfiniBand Gateway Platform and Fabric Analysis Tools

Cisco to Showcase High Performance Computing Solutions at SuperComputing 2007

marketwire

November 13, 2007: 08:00 AM EST

SuperComputing 2007 -- Cisco® (NASDAQ: CSCO) today announced new products and tools to support high performance computing environments. The new Cisco SFS 3504 Multifabric Switch is a gateway switch designed to accelerate server to storage application performance using centralized high speed storage uplinks. Customers with intense storage I/O needs will benefit from higher throughput to centrally shared storage resources by deploying the SFS 3504 as an aggregation gateway. Cisco is also introducing the Fabric Analysis and Correlation Toolkit (FACT), a set of tools which can be used to analyze and manage an entire InfiniBand fabric. FACT shortens the time for initial bring-up for computational clusters and detects errors that may affect performance. Together, these new products will help customers to improve storage access performance, simplify fabric management, and improve diagnostics and troubleshooting.

The Cisco family of high performance computing (HPC) products includes a comprehensive line of Ethernet, InfiniBand and Fibre Channel switches offering best-in-class scalability, high availability, and security, with common management tools, common configuration interfaces, and a common virtualization provisioning platform designed to provide comprehensive and consistent management regardless of the protocol used. Together, these solutions support Data Center 3.0, Cisco's strategy to help its customers develop next generation data centers.

HPCwire Readers' Choice Award

At SuperComputing 2007 Cisco was honored with the 2007 HPCwire Readers' Choice Award for Most Important HPC Networking Technology. The coveted HPCwire Readers' Choice Award, determined through online polling of the global HPCwire audience, represents important industry recognition by the people who deploy and manage HPC technology. Supporting some of the world's largest server clusters, Cisco technology has been deployed in research and commercial HPC environments throughout the United States, Europe, and Asia-Pacific.

SFS 3504 Gateway Platform

The Cisco SFS 3504 is a next generation InfiniBand double data rate gateway designed to interconnect highly distributed server resources together to centrally shared storage arrays in storage area networks and network attached storage. The SFS 3504 is modular, provides up to four gateway expansion slots, and has a best-in-class multi-terabit-capable backplane for scaling to hundreds of servers across a single chassis. Because the gateway modules are compliant with Fibre Channel and Ethernet switching standards, no changes are required to existing storage networks. NetApp has been collaborating with Cisco to test, benchmark, and validate the Cisco SFS 3504 gateway switch with NetApp Data ONTAP® GX Systems and Data ONTAP® 7G Systems for high performance computing environments.

"NetApp provides a unique value proposition to our customers through our unified storage architecture, extensive data management services, and operational simplicity," said Joel Reich, general manager of the NetApp SAN and iSCSI business unit. "The combination of these benefits combined with Cisco InfiniBand solutions provides additional business value to our joint customers that are deploying high performance computing storage infrastructures that require enterprise-class data protection and management."

SFS 3504 Gateway Modules

The SFS 3504 gateways are hot-pluggable expansion modules. This allows on-the-fly capacity expansion to both Fibre Channel and Ethernet storage devices. By sharing aggregated gateway ports in conjunction with the 20Gigabit per second (Gbps) InfiniBand connection, clustered servers gain access to more bandwidth, than an individually connected server could access. The SFS 3504 gateway switch will offer twelve 20Gbps

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double data rate (DDR) InfiniBand ports, a six-port 1GE InfiniBand-to-Ethernet gateway, a two-port 10GE InfiniBand-to-Ethernet gateway and a four-port 4Gbps InfiniBand-to-Fibre Channel gateway.

Fabric Analysis and Correlation Toolkit (FACT)

The Fabric Analysis and Correlation Toolkit (FACT) is a set of tools which can be used to quickly analyze an entire InfiniBand Fabric and detect errors in the fabric. FACT provides a central monitoring and management platform for computational networks, pin-pointing components in the fabric such as cables and host channel adapters (HCAs), which may need attention. The toolkit simplifies deployment and management of InfiniBand fabrics, providing syslog integration for proactive fabric-wide monitoring, and includes high-availability features. FACT also securely authenticates with all devices (SSH / SSL) and verifies the HCA and switch operating system firmware across the fabric.

Collaboration with HP

In addition, Cisco and HP have collaborated on validated and integrated configurations for the high performance computing market. This includes testing a variety of interconnected blade system configurations across low latency, high bandwidth InfiniBand fabrics, including the new HP Cluster Platform Workgroup System based on the HP BladeSystem c3000. Access to these validated and benchmarked solutions can help customers simplify and speed system deployment.

Cisco Booth # 1121 at SC07

The new Cisco SFS 3504 gateway switch will be showcased at SC07 in the Cisco booth # 1121. Throughout each day at the in-booth Cisco theater, conference attendees can learn more about Cisco HPC solutions in a series of educational talks by Cisco, its customers, and partners including Dell, EMC, HP, IBM, and Microsoft. Sample customer presentations include:

```
--  Dr. Gerald Lotto, assistant director, information technology,
    Department of Chemistry and Chemical Biology, Harvard:  "InfiniBand as a
    Unified Cluster Fabric"
--  Tim Mattox, research associate, Indiana University:  "MPI Is Dead?
    Long Live MPI! Evolving MPI for the Next Generation of Supercomputing"
```

Cisco is also hosting two "birds of a feather" conference sessions: "Scaling I/O Capability in Parallel File Systems" on Nov. 13 at 5:30 p.m. and "Open MPI State of the Union" on Nov. 14 at 12:15 p.m.

Ethernet Alliance Demonstration

At the Ethernet Alliance booth, Cisco and Intel will jointly demonstrate the 10GBASE-T technology as an interconnect for HPC applications. 10GBASE-T will complement the 10 Gigabit Ethernet data center interconnect options available today such as 10GBASE-CX4 and 10GBASE-SR. Based on the IEEE 802.3an standard, the 10GBASE-T interconnect will enable 10 Gigabit Ethernet links over 100 meters with cost-effective copper cabling and standard connectors.

Cisco Data Center 3.0

The Cisco vision for Data Center 3.0 entails the real-time, dynamic orchestration of infrastructure services from shared pools of virtualized server, storage and network resources, while optimizing application service levels, efficiency and collaboration.

About Cisco

Cisco (NASDAQ: CSCO) is the worldwide leader in networking that transforms how people connect, communicate and collaborate. Information about Cisco can be found at http://www.cisco.com. For ongoing news, please go to http://newsroom.cisco.com.

For direct RSS Feeds of all Cisco news, please visit "News@Cisco" at the following link:

http://newsroom.cisco.com/dlls/rss.html

Press Contact:
Lee Davis
Cisco

INDIANA UNIVERSITY

IU News Room

IU News from all eight campuses

Tuesday, January 22, 2008

Last modified: Friday, November 16, 2007

Team led by IU wins Supercomputing Bandwidth Competition

FOR IMMEDIATE RELEASE

Nov. 16, 2007

BLOOMINGTON, Ind. -- A team led by Indiana University, with partners from the Technische Universitaet Dresden, Rochester Institute of Technology, Oak Ridge National Laboratory and the Pittsburgh Supercomputing Center, was awarded first place in an international competition for leading-edge, high-bandwidth computing applications. The award was presented Thursday at SC07, the world's largest international conference for high performance computing, networking, storage and analysis, being held this week in Reno, Nevada.

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Using the IU Data Capacitor, a system designed to store and manipulate massive data sets, the IU team achieved a peak transfer rate of 18.21 Gigabits/second out of a possible maximum of 20 Gigabits/second. This performance was nearly twice the peak rate of the nearest competitor. The IU team achieved an overall sustained rate of 16.2 Gigabits/second (roughly equivalent to sending 170 CDs of data per minute) using a transatlantic network path that included the Internet2, GÉANT, and DFN research networks.

"This project simultaneously pushed the limits of networking and storage technology while demonstrating a reproducible model for remote data management. Best of all, we did this using a variety of research applications that we support every day at Indiana University," said Data Capacitor and Bandwidth Challenge project leader Stephen Simms.

During the competition, the IU-led team ran several cutting edge computer applications, all of which depend upon the Data Capacitor's ability to read and write data at extreme speeds. A key aspect of the demonstration was the ability to simultaneously support a mix of several different applications from the sciences and humanities, including:

- Modeling and analysis of the amyloid peptide, which is thought to be the cause of Alzheimer's disease, using IU's Big Red Supercomputer, led by Mookie Baik of the IU School of Informatics and IU Bloomington Department of Chemistry.
- Live acquisition of x-ray crystallography data, led by D.F. "Rick" McMullen, of Pervasive Technology Labs at Indiana University.
- Digital preservation of ancient Sanskrit manuscripts, led by P.R. Mukund of the Rochester Institute of Technology.
- Performance analysis of a computational fluid dynamics application by the Technische Universitaet Dresden using its Vampir/VampirTrace software package, led by Matthias Mueller of the Center for Information Services and High Performance Computing.
- Simulations of a high energy physics reaction between the basic particles of matter, led by Scott Teige of Indiana University Information Technology Services.

"IU continues to develop deep and complementary skills in advanced networking, data storage, grids and scientific gateways," said Brad Wheeler, IU vice president for information technology and chief information officer. "This accomplishment demonstrates the cumulative expertise that we are able to apply to research problems of interest from the life sciences to humanities.

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IU's Big Red Supercomputer was funded in part by a grant from the Lilly Endowment, Inc. for the Indiana METACyt Initiative. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation or the Lilly Endowment Inc.

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About Pervasive Technology Labs at IU

Pervasive Technology Labs at IU (pervasive.iu.edu), established in 1999 by a grant from Lilly Endowment, Inc., performs leading-edge research based on the ubiquity of information technology in today's world, creating new inventions, devices, and software that extend the capabilities of information technology in advanced research and everyday life. Fundamental to its mission are efforts to attract, encourage, educate, and retain Indiana 's workforce of tomorrow, and to accelerate economic growth in the State through the commercialization of new inventions and by forming and supporting new start-up companies. In carrying out its mission, Pervasive Technology Labs is helping IU maintain its position of international leadership in information technology research and, as a result, is helping to enhance the prosperity of the entire State of Indiana.

About the IU School of Informatics

The IU School of Informatics offers a unique, interdisciplinary curriculum that focuses on developing specialized skills and knowledge of information technology. The School has a variety of undergraduate degrees and specialized master's and doctorate degrees in bioinformatics, chemical informatics, health informatics, human-computer interaction, laboratory informatics, new media and computer science. Each degree is an interdisciplinary endeavor that combines course work and field experiences from a traditional subject area or discipline with intensive study of information and technology.

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IU is one of the oldest state universities in the Midwest and also one of the largest universities in the United States, with more than 110,000 students, faculty and staff on eight campuses. IU has a national reputation in the areas of information technology and advanced networking.

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November 19, 2007

Indiana U. Wins Supercomputing Contest

The prize for using a supercomputer to come up with the fastest solutions to huge problems goes to Indiana University, with help from several other institutions. Honors were handed out late last week in Reno, Nev., at SC07, an international meeting on high-performance computing and networking.

The idea wasn't to produce the fastest supercomputer, but to jam the biggest program, and the most data, through a system in the shortest time. The Indiana-led team hit a peak transfer rate of 18.21 gigabits per second, nearly twice the rate of the nearest competitor. The feat involved zipping much of the data through high-speed cables to team partners at the Dresden University of Technology, in Germany; the Rochester Institute of Technology; the Oak Ridge National Laboratory, in Tennessee; and the Pittsburgh Supercomputing Center.

This was not an abstract test. The team had to tackle several daunting real-world problems, including real-time acquisition of X-ray crystallography data, modeling an amyloid peptide (thought to be the molecular culprit behind Alzheimer's disease), and digitally scanning and preserving ancient Sanskrit manuscripts.—*Josh Fischman*

Posted on Monday November 19, 2007 | Permalink |

Commenting is closed for this article.

Previous: Tech Therapy: College Presidents Should Think About Technology
Next: The Musical Laptops of York

INSIDE INDIANA BUSINESS WITH GERRY DICK
INDIANA'S BUSINESS NEWS LEADER

IU partnered with Technische Universitaet Dresden, Rochester Institute of Technology, Oak Ridge National Laboratory and the Pittsburgh Supercomputing Center in the competition.

updated: 11/16/2007 11:46:19 AM

Team Led by IU Wins International Computing Competition

InsideINdianaBusiness.com Report

A team led by Indiana University has won first place in an international competition for high-bandwidth computing applications. The competition challenges students and technologists from some of the nation's most elite supercomputing facilities to test the limits of modern computer networks.

Source: Inside INdiana Business

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INDIANA BUSINESS NEWS

- Muncie Company Adds New Jobs
- New Leader Named for South Bend Hall of Fame
- Federal Reserve Cuts Interest Rates
- Lawmaker Reportedly Hospitalized
- Interactive Intelligence System Named Product of the Year
- Cook Medical Begins New Clinical Trial
- Businesses, Residents Urged to Report Flood Damage
- Health Care Startups Attract Record Investments
- Universal Forest Products to Close Indiana Plants

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BLOOMINGTON, Ind. -- A team led by Indiana University, with partners from the Technische Universitaet Dresden, Rochester Institute of Technology, Oak Ridge National Laboratory and the Pittsburgh Supercomputing Center, was awarded first place in an international competition for leading-edge, high-bandwidth computing applications. The award was presented Thursday at SC07, the world's largest international conference for high performance computing, networking, storage and analysis, being held this week in Reno, Nevada.

The Bandwidth Challenge competition invites teams of technologists from the nation's most elite supercomputing facilities to push the limits of modern computer networks. The competition this year was based on the theme "serving as a model." Competitors were challenged to create methods for fully utilizing a high-speed network path to support end-to-end network applications running across a grid that included the conference's exhibit floor and the participant's home institutions using production networks.

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"This project simultaneously pushed the limits of networking and storage technology while demonstrating a reproducible model for remote data management. Best of all, we did this using a variety of research applications that we support every day at Indiana

University," said Data Capacitor and Bandwidth Challenge project leader Stephen Simms.

During the competition, the IU-led team ran several cutting edge computer applications, all of which depend upon the Data Capacitor's ability to read and write data at extreme speeds. A key aspect of the demonstration was the ability to simultaneously support a mix of several different applications from the sciences and humanities, including:

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Source: Indiana University

Indiana U. team wins SC07 Bandwidth Challenge with 18.2Gbps transfer rate

By Joel Hruska | Published: November 20, 2007 - 09:45PM CT

A team from Indiana University (IU), with members from Oak Ridge National Laboratory, the University of Dresden, the Pittsburgh Supercomputing Center, and the Rochester Institute of Technology, was announced as the winner of SC07's Bandwidth Challenge. The goal of the challenge as defined (PDF) by the Super Computing 2007 committee (the event itself is referred to as SC07), was to demonstrate full utilization of a 10 Gig path from the conference's location in Reno, Nevada, to the team's home location.

One of the crucial components behind the team's victory was the IU Data Capacitor. The Data Capacitor, which only came online earlier this year, is a high-speed/high-bandwidth research system built on an array of 52 Dell servers running Red Hat Enterprise Linux, 24 10-gigabit Ethernet cards, and 535TB of usable storage. This new system currently services all Indiana University campuses and all users of the National Science Foundation's TeraGrid. The TeraGrid is a network infrastructure that ties multiple supercomputers and other high-end research systems together across a nation-wide network. The Data Capacitor actually set a record not long after its unveiling when it managed a single client/single 10 gigabit connection transfer rate of 977 MB/s across the TeraGrid to a system based at the Oak Ridge National Library.

As impressive as the Data Capacitor's single client transfer speed is, it's dwarfed by what the IU team demonstrated at SC07. Peak demonstrated transfer speed at the event was a massive 18.21 Gbps (out of a theoretical maximum of 20 Gbps), while the sustained transfer rate was 16.2 Gbps. These rates were far higher than any other competitor's score—the second-place team's peak transfer speed was barely half of what IU demonstrated. Data was streamed to the Data Capacitor via national and transatlantic networks, including GEANT, DFN, and Internet2. One of the Bandwidth Challenge conditions required that the entrants demonstrate real-world use of their various networks and explain the impact and application of their designs. The IU team ran a number of simulations, (presumably simultaneously), including:

- High energy physics simulations
- Performance analysis of computational fluid dynamics software
- Digital preservation of ancient Sanskrit manuscripts
- Modeling the amyloid peptide
- Live acquisition of x-ray crystallography data

Ultimately, IU's demonstration is an excellent example of how modern unified data centers can make efficient use of network resources while simultaneously allowing multiple researchers and universities to exchange data on a variety of projects simultaneously. The real-world creation of this type of model is what the Bandwidth Challenge was designed to foster, and is an important step towards creating next-generation networks that can handle the tremendous flow of data that future HPC projects and universities will require.

Filed under: SC07, Indiana University, IU Data Capacitor, Internet2, more...

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PrimeurWeekly delivers the news each week in your e-mail box.

Team led by Indiana University wins Supercomputing Bandwidth Competition

Bloomington 16 November 2007 *A team led by Indiana University (IU), with partners from the Technische Universitaet Dresden, Rochester Institute of Technology, Oak Ridge National Laboratory and the Pittsburgh Supercomputing Center, was awarded first place in an international competition for leading-edge, high-bandwidth computing applications. The award was presented at SC07, the world's largest international conference for high performance computing, networking, storage and analysis, being held past week in Reno, Nevada.*

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iSGTW INTERNATIONAL SCIENCE GRID THIS WEEK

Current Issue: 05.12.2007

Results from the SC07 Challenges: Analytics, Bandwidth, Cluster and Storage

Every year competitors in the Supercomputing Challenges thrash it out in a match of fastest, cleverest and best.

The winners of November's SC07 Challenges are no different.

Find out who walked away with blue ribbons...

Read more

Was this system among the winning entries? Find out...
Image courtesy of Indiana University

Feature - Leadup to the LHC

Open Science Grid crunches through CMS simulations

In the last 15 months Open Science Grid resources have simulated 126 million CMS events, consuming about 5.5 million CPU hours.

Ajit Mohapatra runs through what has been achieved as part of this massive international effort.

Read more

Feature - Earthsystem science

The world's climate data from a one-stop-shop

Grid computing is offering earthsystem scientists their most dynamic look yet at the interactions between biosphere, economy and climate.

Hannelore Hämmerle talks to researcher Kerstin Ronneberger about future directions for this work.

Read more

Link of the week

Sharkrunners

Your ship is virtual, but the sharks are real. Real-world data gathered from a network of sensors offers gamers the chance to track actual great whites.

Join an institute, gather data and race your rival for the funding dollar.

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Image of the week

Journey to the center of the Sun

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In this week's *iSGTW*

Feature - Results from the SC07 Challenges

Feature - OSG crunches through CMS simulations

Feature - The world's climate data from a one-stop-shop

Link - Sharkrunners

Image - Journey to the center of the Sun

Announcements

Maine students to benefit from new scientific grid portal

Applications open: Florida International Grid School

Call for participation: International Workshop on Campus Grids and Scientific Applications, Austria

Mark your diary

December

5-7, Parallel and Distributed Systems, Hsinchu, Taiwan

10-13, e-Science and Grid Computing, Bangalore, India

10-13, BioinfoGRID Symposium 2007, Milan, Italy

12-13, Open Science Grid site administrators meeting, Fermilab, Illinois

12-13, Digital Curation Conference, Washington, U.S.

News from IU

November 17, 2007

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IU-led team wins computing competition

An Indiana University-led computing team won an international competition for high-bandwidth computing applications. The award was presented Thursday at SC07, the world's largest international conference for high-performance computing and networking, which was held in Reno, Nev.

IU's team was partnered with members from the Technische Universitat Dresden, the Rochester Institute of Technology, the Oak Ridge National Laboratory and the Pittsburgh Supercomputing Center.

The team was able transfer data at a rate of 18.21 gigabits per second, out of a possible maximum level of 20 gigabits per second, using the IU Data Capacitor.

That's roughly the size of 170 CDs' worth of data being transferred every second. IU's performance was nearly double that of its nearest competitor. The IU team earned an honorable mention in last year's competition.

Online resource helps teach Indiana history

A new link at the Indiana Magazine of History's Web site will allow educators to teach students about Indiana history in a cutting edge way.

Teachers will now have access to diaries, letters, memoirs, photos and other historical documents that are now archived on the public Web site. The site provides electronic lesson plans designed to get students involved in history but through a modern perspective. For example, fourth-grade teachers can now get a complete lesson plan on Hoosier poet James Whitcomb Riley by searching the 1920-present link on the site.

"The IMH has been publishing research on Indiana's history for more than a century," said Eric Sandweiss, Carmony Chair of History at IU and IMG editor, in a statement. "With this program we're able to get lesson plans directly into the hands of Hoosier teachers, who want primary materials that can make history come alive for their students." The URL is www.indiana.edu/~imaghist/online_content/index.html.

Fair Trade Bloomington to hold holiday sale

A local nonprofit organization will hold its third annual holiday sale later this month.

Fair Trade Bloomington, a group created by Indiana University Students in Free Enterprise organization, will hold the sale on Nov. 29-Dec. 1. It will take place at two locations.

Fair Trade Bloomington was organized to provide residents the opportunity to purchase goods that adhere to the fair trade principles. SIFE students use the sale as a way to explain how local consumer purchases of holiday gifts can benefit people worldwide. Proceeds from the sales are directed to areas around the world where living standards need improvement.

The sale will take place 11 a.m.-4 p.m. Nov. 29 in the Indiana Memorial Union, and 11 a.m.-4 p.m. Nov. 30 and Dec. 1 at University Baptist Church, 3740 E. Third St.

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Breaking News:

Team Led by IU Wins Supercomputing Bandwidth Competition

BLOOMINGTON, Ind., Nov. 16 -- A team led by Indiana University, with partners from the Technische Universitaet Dresden, Rochester Institute of Technology, Oak Ridge National Laboratory and the Pittsburgh Supercomputing Center, was awarded first place in an international competition for leading-edge, high-bandwidth computing applications. The award was presented Thursday at SC07, the world's largest international conference for high performance computing, networking, storage and analysis, being held this week in Reno, Nevada.

The Bandwidth Challenge competition invites teams of technologists from the nation's most elite supercomputing facilities to push the limits of modern computer networks. The competition this year was based on the theme "serving as a model." Competitors were challenged to create methods for fully utilizing a high-speed network path to support end-to-end network applications running across a grid that included the conference's exhibit floor and the participant's home institutions using production networks.

Using the IU Data Capacitor, a system designed to store and manipulate massive data sets, the IU team achieved a peak transfer rate of 18.21 Gigabits/second out of a possible maximum of 20 Gigabits/second. This performance was nearly twice the peak rate of the nearest competitor. The IU team achieved an overall sustained rate of 16.2 Gigabits/second (roughly equivalent to sending 170 CDs of data per minute) using a transatlantic network path that included the Internet2, GÉANT, and DFN research networks.

"This project simultaneously pushed the limits of networking and storage technology while demonstrating a reproducible model for remote data management. Best of all, we did this using a variety of research applications that we support every day at Indiana University," said Data Capacitor and Bandwidth Challenge project leader Stephen Simms.

During the competition, the IU-led team ran several cutting edge computer applications, all of which depend upon the Data Capacitor's ability to read and write data at extreme speeds. A key aspect of the demonstration was the ability to simultaneously support a mix of several different applications from the sciences and humanities, including:

- Modeling and analysis of the amyloid peptide, which is thought to be the cause of Alzheimer's disease, using IU's Big Red Supercomputer, led by Mookie Baik of the IU School of Informatics and IU Bloomington Department of Chemistry.
- Live acquisition of x-ray crystallography data, led by D.F. "Rick" McMullen, of Pervasive Technology Labs at Indiana University.
- Digital preservation of ancient Sanskrit manuscripts, led by P.R. Mukund of the Rochester Institute of Technology.
- Performance analysis of a computational fluid dynamics application by the Technische Universitaet Dresden using its Vampir/VampirTrace software package, led by Matthias Mueller of the Center for Information Services and High Performance Computing.
- Simulations of a high energy physics reaction between the basic particles of matter, led by Scott Teige of Indiana University Information Technology Services.

"IU continues to develop deep and complementary skills in advanced networking, data storage, grids and scientific gateways," said Brad Wheeler, IU vice president for information technology and chief information officer. "This accomplishment demonstrates the cumulative expertise that we are able to apply to research problems of interest from the life sciences to humanities.

"We were pleased to earn an honorable mention in the SC06 competition, and winning this year with outstanding results is a testament to the team's advanced skills," Wheeler said.

The Bandwidth Challenge competition was just one aspect of IU's involvement in networking at SC07. IU was among the sponsors of the SC07 network, and IU staff helped build and manage a massive network that included more than 80 miles of fiber optic cable installed to support the SC07 conference.

The Data Capacitor is powered by the open source Lustre file system and the Linux operating system. It is currently accessible to U.S. researchers though IU's participation in the TeraGrid. The Data Capacitor was developed by a team from IU University Information Technology Services, the IU School of Informatics, and Pervasive Technology Labs at Indiana University. Corporate partners for the IU Bandwidth Challenge effort include Data Direct Networks, Dell, Myricom, Inc., Force 10 Networks, Inc.

The Data Capacitor project is supported in part by the National Science Foundation under NSF Award Number CNS0521433 (Craig Stewart, PI; Stephen Simms, Co-PI and project manager; Caty Pilachowski, Randall Bramley and Beth Plale, Co-PIs). IU's involvement in the TeraGrid is supported in part by NSF grants ACI-0338618l, OCI-0451237, OCI-0535258, and OCI-0504075.

IU's Big Red Supercomputer was funded in part by a grant from the Lilly Endowment, Inc. for the Indiana METACyt Initiative. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation or the Lilly Endowment Inc.

About UITS

University Information Technology Services at IU, with offices on the Bloomington and Indianapolis campuses, develops and maintains a modern information technology environment throughout the university in support of IU's vision for excellence in research, teaching, outreach, and lifelong learning.

UITS provides tools and services to support the academic and administrative work of the university, including a high-speed campus network with wireless access, central web hosting, a rich selection of free and low-cost software for personal use, tools and support for instruction and research, and supercomputers for data analysis and visualization.

About Pervasive Technology Labs at IU

Pervasive Technology Labs at IU (www.pervasive.iu.edu), established in 1999 by a grant from Lilly Endowment, Inc., performs leading-edge research based on the ubiquity of information technology in today's world, creating new inventions, devices, and software that extend the capabilities of information technology in advanced research and everyday life. Fundamental to its mission are efforts to attract, encourage, educate, and retain Indiana 's workforce of tomorrow, and to accelerate economic growth in the State through the commercialization of new inventions and by forming and supporting new start-up companies. In carrying out its mission, Pervasive Technology Labs is helping IU maintain its position of international leadership in information technology research and, as a result, is helping to enhance the prosperity of the entire state of Indiana.

About the IU School of Informatics

The IU School of Informatics offers a unique, interdisciplinary curriculum that focuses on developing specialized skills and knowledge of information technology. The School has a variety of undergraduate degrees and specialized master's and doctorate degrees in bioinformatics, chemical informatics, health informatics, human-computer interaction, laboratory informatics, new media and computer science. Each degree is an interdisciplinary endeavor that combines course work and field experiences from a traditional subject area or discipline with intensive study of information and technology.

About Indiana University

IU is one of the oldest state universities in the Midwest and also one of the largest universities in the United States, with more than 110,000 students, faculty and staff on eight campuses. IU has a national reputation in the areas of information technology and advanced networking.

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Wednesday, Nov 19 @ 13:02 EST
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Added by Lauren Rotman, last edited by Lauren Rotman on Nov 21, 2007
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View the full news release online:
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Indiana University grabs Bandwidth Challenge crown

University achieves a peak transfer rate of over 18Gbps out of possible max 20Gbps

By Brad Reed, Network World, 11/21/07

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IU's Bandwidth Challenge Team included partners from the Technische

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Indiana University grabs Bandwidth Challenge crown

23.11.2007, 00:00 Uhr

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18Gbps transfer rate earns Supercomputing Bandwidth Challenge crown

Team led by Indiana University nearly doubles peak transfer rate of nearest competitors

Brad Reed (Network World) 26 November, 2007 08:13:30

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Brad Reed *(Network World)*

26/11/2007 08:13:30

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It is dangerous to mindlessly invalidate the experiences of a person for whom the internet is not a luxury, but a lifeline (Howard Rheingold)

Indiana U. team wins SC07 Bandwidth Challenge

This story is from the category **Connectivity**

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Posted by: ***Site Administration***
Date posted: 23/11/2007

A team from Indiana University was announced as the winner of SC07's Bandwidth Challenge. The goal of the challenge this year was to demonstrate full utilisation of a 10 Gig path from the conference's location in Reno, Nevada, to the team's home location.

Peak demonstrated transfer speed at the event was a massive 18.21 Gbps (out of a theoretical maximum of 20 Gbps), while the sustained transfer rate was 16.2 Gbps.

One of the Bandwidth Challenge conditions required that the entrants demonstrate real-world use of their various networks and explain the impact and application of their designs. The IU team ran a number of simulations, including:

* High energy physics simulations
* Performance analysis of computational fluid dynamics software
* Digital preservation of ancient Sanskrit manuscripts
* Live acquisition of x-ray crystallography data

The real-world creation of this type of model is what the Bandwidth Challenge was designed to foster, and is an important step towards creating next-generation networks that can handle tremendous flow of sustained data throughput.

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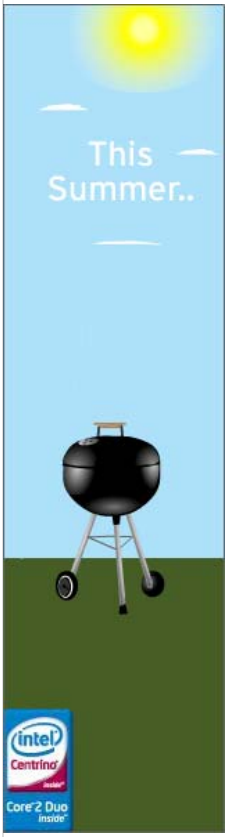

News

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Last year's Bandwidth Challenge was won by a team from the University of Chicago, which achieved sustained transfer rates of 8Gbps and a peak transfer rate of 9.18Gbps.

More about Leader Computers, Simms International, Computer Applications, Oak Ridge National Laboratory, CROWN, SIMMS, Leader

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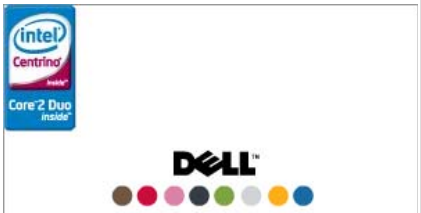

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Indiana University Grabs Bandwidth Challenge Crown

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Indiana University wins bandwidth challenge with 18.21 Gbps

Published November 22, 2007 funny , gadgets , news , technology
Tags: bandwidth, challenge, fast, indiana, rate, transfer, university

One of the crucial components behind the team's victory was the IU Data Capacitor. The Data Capacitor, which only came online earlier this year, is a high-speed/high-bandwidth research system built on an array of 52 Dell servers running Red Hat Enterprise Linux, 24 10-gigabit Ethernet cards, and 535TB of usable storage. This new system currently services all Indiana University campuses and all users of the National Science Foundation's TeraGrid. The TeraGrid is a network infrastructure that ties multiple supercomputers and other high-end research systems together across a nation-wide network. The Data Capacitor actually set a record not long after its unveiling when it managed a single client/single 10 gigabit connection transfer rate of 977 MB/s across the TeraGrid to a system based at the Oak Ridge National Library. (link)

0 Responses to "Indiana University wins bandwidth challenge with 18.21 Gbps"

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11.15.07

DataDirect Networks' S2A9550 Storage System Helps Indiana University Win 2007 Supercomputing Bandwidth Challenge

DataDirect Networks Proves Yet Again That its Storage Systems can Handle the World's Most Computationally-Intense Applications

Reno, Nev., November 15, 2007 - DataDirect Networks Inc., a leading provider of scalable storage systems for performance and capacity-driven applications, today announced that the company's S2A9550 was the storage system used by Indiana University to win this year's prestigious Supercomputing '07 bandwidth challenge.

The challenge, which was held at Supercomputing '07 in Reno, Nevada, is an annual competition for leading-edge network applications developed by teams of researchers from around the world. The event provides a showcase for the technologies and people who provide the networking capabilities crucial to supercomputing. The Bandwidth Challenge is designed to test the limits of network capabilities.

Bandwidth Challenge Methodology
Each participant this year had to fully utilize one 10 Gig path, end-to-end, disk-to-disk, from SC07 in Reno, Nevada back to their home institution, using the actual production network back home. Participants had to demonstrate and publish the configuration, troubleshooting, tuning and policies, not only to show off at SC07, but to leave a legacy at their home institution whereby the institute's scientists can achieve the same results after the participant has left the institution.

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"We have been ecstatic with the level of performance we have achieved with DataDirect Networks' S2A9550. DDN has been a perfect match for IU's Data Capacitor because their disk system is capable of accommodating even the most aggressive data fire hose," said Stephen Simms, manager of the Data Capacitor project at Indiana University.

DataDirect Networks' S2A9550 employs the company's award-winning Silicon Storage Architecture technology and is the industry's highest performing and densest storage solution. The system enables the creation of differentiated high performance, high capacity NAS and SAN storage, parallel and shared file system storage, primary and nearline storage and virtual tape library storage solutions and incorporates enterprise-class data protection such as on-the-fly parity checking of all read I/Os and hardware RAID 6. The S2A9550's pioneering hardware-based DirectRAID engine protects data in the event of a double disk failure in the same redundancy group, without adversely affecting data availability or system performance.

"We are pleased to learn that the S2A9550's powerful parallel, hardware-accelerated storage engine was instrumental in Indiana University's win today," said Alex Bouzari, Chief Executive Officer and co-founder of DataDirect Networks. "We look forward to continuing our partnership with Indiana University into the future as they develop bold new applications that require data-intensive computing and advance storage solutions."

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Alex Sayyah
DataDirect Networks Inc.
Tel: (818) 700-7600
Email: asayyah@datadirectnet.com

The Leading Source for Global News and Information Covering the Ecosystem of High Productivity Computing / November 23, 2007

Storage:

DataDirect Helps IU Win SC07 Bandwidth Challenge

RENO, Nev., Nov. 16 -- DataDirect Networks Inc., a leading provider of scalable storage systems for performance and capacity-driven applications, today announced that the company's S2A9550 was the storage system used by Indiana University to win this year's prestigious Supercomputing '07 bandwidth challenge.

The challenge, which was held at Supercomputing '07 in Reno, Nevada, is an annual competition for leading-edge network applications developed by teams of researchers from around the world. The event provides a showcase for the technologies and people who provide the networking capabilities crucial to supercomputing. The Bandwidth Challenge is designed to test the limits of network capabilities.

Bandwidth Challenge Methodology

Each participant this year had to fully utilize one 10 Gig path, end-to-end, disk-to-disk, from SC07 in Reno, Nevada back to their home institution, using the actual production network back home. Participants had to demonstrate and publish the configuration, troubleshooting, tuning and policies, not only to show off at SC07, but to leave a legacy at their home institution whereby the institute's scientists can achieve the same results after the participant has left the institution.

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- Support of science mission.
- Use of production network at home institution.
- Serving as a Model.
- Efficient Bandwidth Utilization -- maximum 1 x 10 Gbps.
- Innovative use of protocols.
- End-to-end, disk-to-disk applications.

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Indiana University demonstrated a model for remote data collection using the Lustre filesystem across the wide area network. Using distributed filesystem mounts located in Reno, NV, Rochester, NY, Dresden, Germany and Bloomington, Indiana, IU ran five simultaneous applications representing fields as diverse as high energy physics and digital humanities. In each test, Indiana University demonstrated a complete workflow, producing, analyzing and visualizing the data. Using a full-duplex 10 Gigabit link, Indiana University reached a peak bandwidth of 18.2Gbits/sec using Internet2 to connect to their home network. Among the physical tests they ran included:

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"We have been ecstatic with the level of performance we have achieved with DataDirect Networks' S2A9550. DDN has been a perfect match for IU's Data Capacitor because their disk system is capable of accommodating even the most aggressive data fire hose," said Stephen Simms, manager of the Data Capacitor project at Indiana University.

DataDirect Networks' S2A9550 employs the company's award-winning Silicon Storage Architecture technology and is the industry's highest performing and densest storage solution. The system enables the creation of differentiated high performance, high capacity NAS and SAN storage, parallel and shared file system storage, primary and nearline storage and virtual tape library storage solutions and incorporates enterprise-class data protection such as on-the-fly parity checking of all read I/Os and hardware RAID 6. The S2A9550's pioneering hardware-based DirectRAID engine protects data in the event of a double disk failure in the

same redundancy group, without adversely affecting data availability or system performance.

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New features built into the S2A9900 StorageScaler include support for 8Gbps Fibre Channel and 20Gbps Infiniband DDR host connections. The system leverages the latest serial attached SCSI (SAS) protocol to communicate to the drives it manages, providing a future-proof roadmap to the latest disk drive technologies, speeds and capacities. With enhancements to DirectRAID and SATAssure, customers have full system bandwidth in both reads and writes, providing the utmost in data protection. In addition, the system's performance is not impacted by single or multiple drive failures, enabling very high quality service and performance predictability. And the new Sleep Mode allows the S2A to 'spin down' drives when they are not actively accessed based on user-definable policies. Sleep Mode reduces the operational costs of storage by saving power and cooling requirements while still maintaining near-instant accessibility to data.

Systems will be available for delivery in March 2008.

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Source: DataDirect Networks

Leading HPC Solution Providers

Business Wire - Press Release

DataDirect Networks' S2A9550 Storage System Helps Indiana University Win 2007 Supercomputing Bandwidth Challenge

11.16.07, 4:11 PM ET

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Press Release Source: DataDirect Networks Inc.

DataDirect Networks' S2A9550 Storage System Helps Indiana University Win 2007 Supercomputing Bandwidth Challenge

Friday November 16, 4:10 pm ET

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Awards

Supercomputing Online 2007 Product of the Year Award

Supercomputing Online 2006 Product of the Year Award

DataDirect Networks helps IU win Supercomputing '07 bandwidth challenge

Wednesday, Nov 19 @ 07:06 EST
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Sponsors

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Panasas ActiveStor Parallel Storage Powers New Holland Computing Center

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DataDirect Networks' S2A9550 Storage System Helps Indiana University Win 2007 Supercomputing Bandwidth Challenge

DataDirect Networks Proves Yet Again That its Storage Systems can Handle the World's Most Computationally-Intense Applications

SC07

RENO, Nev.--(BUSINESS WIRE)--DataDirect Networks Inc., a leading provider of scalable storage systems for performance and capacity-driven applications, today announced that the company's S2A9550 was the storage system used by Indiana University to win this year's prestigious Supercomputing '07 bandwidth challenge.

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Print

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DataDirect Networks' S2A9550 Powers Winners of the 7th Annual Bandwidth Challenge at SC'06

HPCwire's 'Best Price / Performance Storage Solution' Enables UIC, Cal Tech and IU's HPC Initiatives - Winners of Bandwidth Challenge

LOS ANGELES, Dec. 27 /PRNewswire/ -- DataDirect Networks' S2A9550 was the HPC storage solution of choice by the National Center for Data Mining (NCDM) at UIC, the winner of this year's prestigious Bandwidth Challenge at SuperComputing '06 held in Tampa, Florida. The S2A9550 also powered the 2nd and 3rd place winners, Cal Tech and Indiana University.

A team of experts from the University of Illinois at Chicago's NCDM, Northwestern University and Johns Hopkins University won the 7th annual Bandwidth Challenge by transporting the 1.3 TB Sloan Digital Sky Survey Data (SDSS) from the University of Illinois at Chicago to the SC'06 floor at Tampa with a sustained data transfer rate of 8Gb/s over a 10GbE link, and a peak rate of 9.18 Gb/s. The data set was the BESTDR5 catalog data set from the Sloan Digital Sky Survey and when compressed consisted of 60 files of about 23 GB each and totaling 1.3 TB.

The technology that made this easy was an open source peer-to-peer storage solution, powered by DataDirect's high performance S2A9550, called SECTOR that NCDM. SECTOR is built using UDT, an open source high performance network transport protocol designed to distribute large e-science data sets such as the Sloan Digital Sky Survey. This was a major new milestone that demonstrated that it is now practical for working scientists to transfer large data sets from disk-to-disk over long distances using a 10GbE network versus traditional physical mail carriers.

Additionally, DataDirect's S2A9550 high performance storage system also enabled the 2nd and 3rd place winners of the Bandwidth Challenge. The 2nd place team consisted of CalTech, CERN, University of Florida and the University of Michigan for their project "High Speed Data Gathering, Distribution and Analysis for Physics Discoveries at the Large Hadron Collider." The 3rd place team consisted of Indiana University, Pittsburgh SuperComputing Center and the Oak Ridge National Laboratory for their project "All in a Day's Work: Advancing Data Intensive Research with the Data Capacitor."

DataDirect Networks was also the recipient of the HPCwire 2006 Readers' Choice Award for the "Best Price / Performance Storage Solution." This is the third consecutive year that DataDirect Networks has won the award for the best customer valued storage solution and is based on its innovative Silicon Storage Appliance (S2A) solutions.

More on DataDirect Networks and the Silicon Storage Appliance

Over the last three years, DataDirect Networks has achieved an astounding 150 percent growth in the storage capacity shipped to its HPC customers, becoming the storage of choice for many government, academia and corporate supercomputing sites, and ranked as the 5th largest independent storage provider by Gartner.

DataDirect Networks' Silicon Storage Appliance (S2A) family of products are in production in 7 of the top 10 clusters in the world and 35 of the Top 100 supercomputing sites in the world with major installations at Lawrence Livermore National Laboratories, Sandia National Laboratories, PCS, NCSA, NOAA, NASA and NASA Ames, NERSC, SDSC, LNXI, ORNL, Argonne National Laboratory, CEA, Dresden TUD, and many others. DataDirect Networks' successes have included the deployment of more than one petabyte (a thousand terabytes) of storage behind the world's fastest supercomputer, IBM's Blue Gene/L, at Lawrence Livermore National Laboratories as well as with a cluster of Bull NovaScale SMP servers and power "Tera10" in Europe.

DataDirect Networks' success is driven by its industry leading S2A technology, a 7th generation RAID storage networking system and solutions with FC-4 and InfiniBand front end server connectivity, and Fibre Channel and SATA back-end disk support. The S2A delivers ultra-high levels of performance (3 GB/s), scalability (1,000 disks) and reliability (multiple levels of redundancy including RAID 6 and parity checking of all read I/Os without performance loss) across a broad range of computational, visualization, and nearline environments. DataDirect Networks' S2A offers broad infrastructure support powering compute clusters from IBM, Dell, Cray, SGI, Bull and others.

DataDirect Networks works closely with OEMs, well known systems integrators, and advisors who serve the needs of Government and High Performance Computing community.

About DataDirect Networks

DataDirect Networks is the recognized leader in high performance, high capacity network storage solutions. Focused on driving customer-centric innovation, DataDirect Networks has created the Silicon Storage Appliance as the essential building block for high performance computing, oil and gas, internet-based services and rich media storage solutions. DataDirect Networks' award winning Silicon Storage Appliance enables the creation of differentiated high performance, high capacity NAS and SAN storage, parallel and shared file system storage, primary and nearline storage, and virtual tape library storage solutions. Each solution offers unsurpassed performance, high availability, cost effective scalability and simplified management delivering the industry's best price-per-performance and best per-capacity-per-square foot solutions.

Launched in 1998 and headquartered in California, DataDirect Networks has an established global presence with research and development, and operations in the United States, Europe and Asia. For more information, contact DataDirect Networks at +1-800-TERABYTE (837-2298) or info@datadirectnet.com.

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cj_chan@chanandassoc.com

SOURCE DataDirect Networks

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19:14 Did You Hear the One About the
19:14 Europas Börsen schließen
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19:13 Deutsche Aktien uneinheitlich
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DataDirect Networks' S2A9550 Storage

16. November 2007 | 22:12 Uhr Kommentieren | Artikel drucken | Artikel versenden

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Se ci si pensa è veramente incredibile

Nov 21st, 2007 by Alfonso Fuggetta

> Indiana U. team wins SC07 Bandwidth Challenge with 18.2Gbps transfer rate
> A team from Indiana University (IU), with members from Oak Ridge National Laboratory, the University of Dresden, the Pittsburgh Supercomputing Center, and the Rochester Institute of Technology, was announced as the winner of SC07's Bandwidth Challenge. The goal of the challenge as defined (PDF) by the Super Computing 2007 committee (the event itself is referred to as SC07), was to demonstrate full utilization of a 10 Gig path from the conference's location in Reno, Nevada, to the team's home location.
>
> One of the crucial components behind the team's victory was the IU Data Capacitor. The Data Capacitor, which only came online earlier this year, is a high-speed/high-bandwidth research system built on an array of 52 Dell servers running Red Hat Enterprise Linux, 24 10-gigabit Ethernet cards, and 535TB of usable storage. This new system currently services all Indiana University campuses and all users of the National Science Foundation's TeraGrid. The TeraGrid is a network infrastructure that ties multiple supercomputers and other high-end research systems together across a nation-wide network. The Data Capacitor actually set a record not long after its unveiling when it managed a single client/single 10 gigabit connection transfer rate of 977 MB/s across the TeraGrid to a system based at the Oak Ridge National Library.

Posted in Technology

One Response to "Se ci si pensa è veramente incredibile"

1. *on 21 Nov 2007 at 3:21 pm*1*nunzio*

   Mi sembra fosse gia' tutto previsto in questo articolo di qualche anno fa…
   http://www.aplab.it/downloads/voodootech.pdf

   PS prof se nei suoi giri ha occasione di incontrare l'autore di visual studio non vorrebbe schiaffeggiarlo da parte mia?

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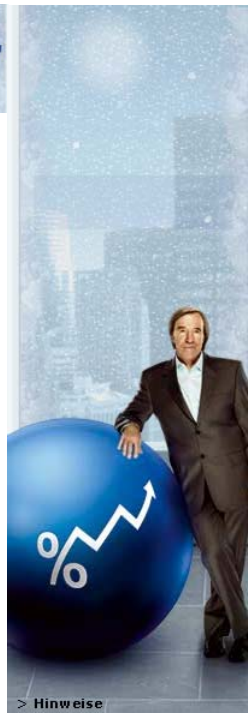

16.11.2007 22:13

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Quelle: Business Wire

Myricom at SC07

Reno, Nevada
10-16 November 2007

Myri-10G: 10-Gigabit Ethernet with a Supercomputing Heritage

512-port Myri-10G multi-protocol switch on display
Myri-10G 10-Gigabit Ethernet NICs show great performance with VMware ESX Server
QSFP ports and QSFP-terminated ribbon-fiber cables

Indiana University wins the SC07 Bandwidth Challenge with Myri-10G 10GbE NICs

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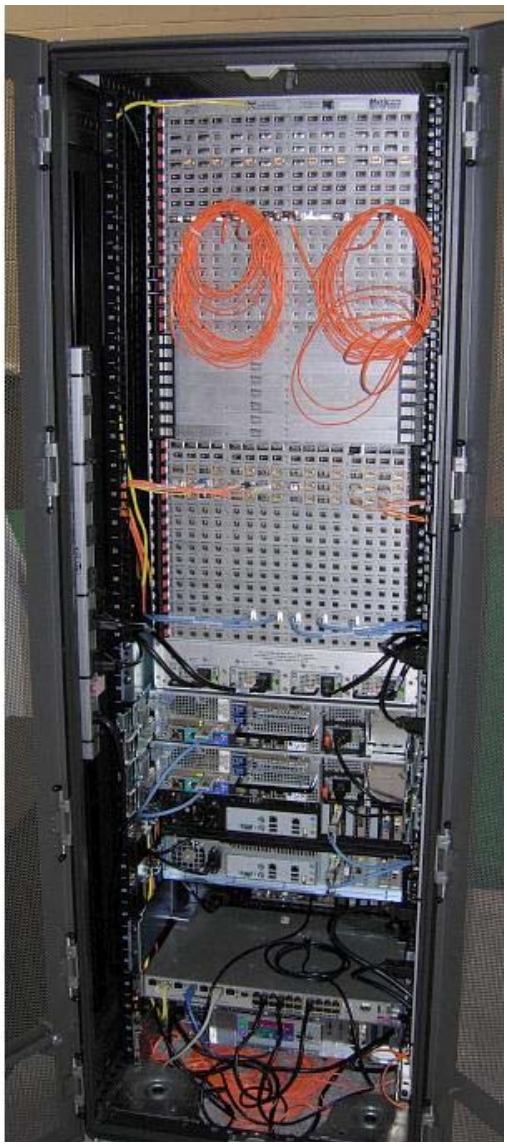
Myri-10G is 10-Gigabit Ethernet from Myricom, and more. This fourth generation of Myricom networking products is a convergence at 10-Gigabit/s data rates of Myrinet cluster-interconnect technology with mainstream Ethernet.

As shown by several contestants in the SC07 Bandwidth Challenge and by many other SC07 exhibitors, Myri-10G 10-Gigabit Ethernet NICs provide near-wire-speed performance for conventional TCP/IP Ethernet applications. In addition, all of the capabilities of Myrinet, including kernel-bypass operation for low latency and low host-CPU load, are available with Myri-10G NICs over either 10-Gigabit Ethernet or 10-Gigabit Myrinet networks. Finally, Myri-10G switches – multi-protocol 10-Gigabit Ethernet and 10-Gigabit Myrinet – are economically scalable to thousands of ports.

This 4-page flyer (pdf, 1.4MB) provides an overview of Myri-10G technology and applications.

Myricom's exhibit at SC07 emphasized Myri-10G capabilities introduced during the past year. In addition, Myri-10G networking was conspicuous in many other SC07 booths and in the SC07 Bandwidth Challenge.



The 512-port Myri-10G multi-protocol switch shown in the photo to the right drew crowds of visitors almost continuously through SC07. This 21U switch is mounted at the top of a 36U rack with four 2U servers below it, and also a Coraid AoE (ATA over Ethernet) EtherDrive® storage appliance. The Coraid storage appliance uses Myri-10G NICs internally.

The Myri-10G switch provided connectivity to the four servers (10GBase-CX4, blue cables, Myrinet protocols), to the Coraid storage appliance, to 10-Gigabit Ethernet clients (10G-Base-SR, orange fiber cables, Ethernet protocols) in the three other corners of the Myricom booth, and to SCinet (10GBase-LR, orange fiber cable, Ethernet protocols).

Myricom announced this new family of Myri-10G switches at ISC07 (see the Myricom at ISC07 news item), and has subsequently shipped the first twelve 21U switches to customers, both for HPC-cluster applications and for data-storage systems. With the successes of these early installations,

Myricom is now expanding production of this new family of Myri-10G switches.

Just prior to SC07, Argonne National Laboratory and IBM announced a 445-Teraflops expansion of the Blue Gene/P system at the Argonne Leadership Computing Facility (ALCF), and the role that Myri-10G switches play in providing a very high performance file system for Blue Gene/P installations. In this ALCF press release, Argonne notes that "Myricom's economical, low-latency modular switches represent the heart of the ALCF's data-management system. The nine-switch complex supports up to 2,048 connections, each of which simultaneously exchanges data at around 1 billion bytes per second."

VMware ESX Server demo. Although virtualization is not ***yet*** a hot topic in traditional HPC, a demonstration and benchmarks of Myri-10G 10-Gigabit Ethernet NICs under VMware's ESX 3.5 attracted many visitors interested in higher performance for data centers.

The demonstration and benchmarks showed that a single virtual machine on a modest-performance server was able to send data at 9.85 Gb/s (essentially 10GbE line rate), and was able to receive at 8 Gb/s. Two virtual machines running in parallel could receive at 9.86 Gb/s. This aggregate receive performance is made possible through the use of multiple queues in the Myri-10G NIC, which may each be assigned to individual virtual machines along with the associated interrupt for each queue.

A recent Techworld article reports that many users are finding that running multiple virtual servers are overwhelming Gigabit Ethernet NICs, and 10-Gigabit Ethernet NICs are required to provide the aggregate network bandwidth required. The advent of multi-core processors allows a single server to run far more simultaneous virtual machines than before, driving this demand for bandwidth.

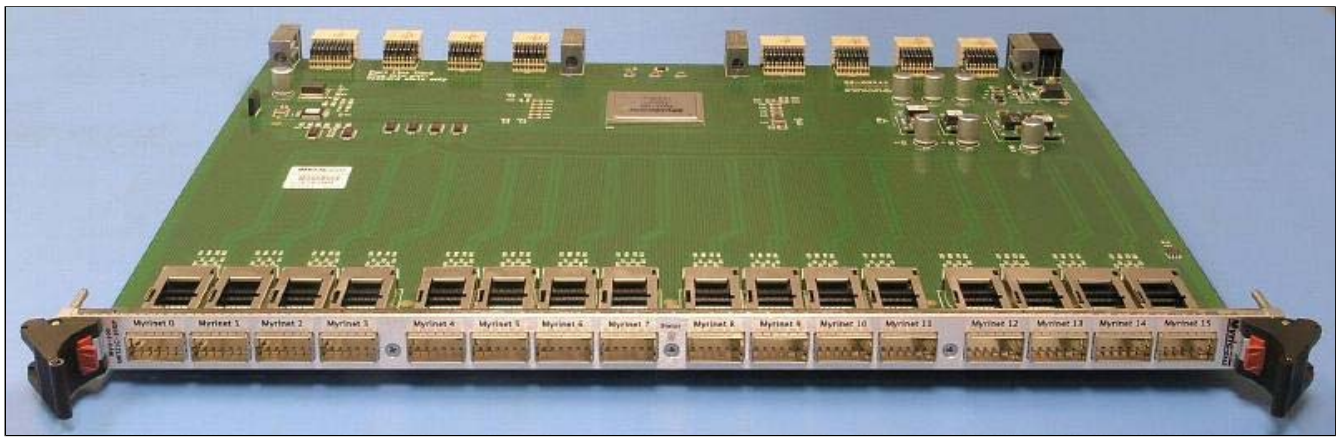
The native I/O virtualization in the Myri-10G NIC allows efficient sharing of NIC resources while minimizing the involvement of a hypervisor to steer I/O to or from the appropriate virtual machine. This approach frees processors to do the work of the virtual machines instead of spending all their cycles on I/O.

QSFP ports and EOE cables. Two acronyms that we recommend that you learn if you don't know them already:

- EOE = "Electrical-Optical-Electrical," referring to optical-fiber cables in which the electrical-optical conversion is performed in the cable end.
- QSFP = "Quad Small-Form-factor Pluggable," a multi-source module format and connector for quad-ribbon-fiber transceivers. (The Multi Source Agreement is published here.)

Myricom was involved at SC07 in demonstrating new EOE cables from three companies. The orange cable hoops in the photo above of the 512-port switch are QSFP-terminated Zlynx cables from Zarlink, which distributed this press release at SC07. Luxtera also announced QSFP-terminated EOE cables, and demonstrated these cables in their SC07 booth with a Myri-10G switch line card with 16 QSFP ports (photo below). Finally, Finisar announced their Laserwire serial-fiber EOE cable for XFP or SFP+ 10-Gigabit Ethernet ports, with the demonstration in the Finisar booth being with Myri-10G 10GBase-R NICs. EOE cables offer economy (improved manufacturing margins due to an end-to-end solution), and the safety and reliability of electrical termination (no Class-1M laser-safety warnings, and no problems with dust in a pluggable optical-fiber port).

In order to take advantage of these new EOE cables, Myricom introduced and demonstrated at SC07 switch line cards with QSFP ports:



10G-SW32LC-16QP switch line card with 16 QSFP ports on the front panel

These front-panel ports can accommodate either QSFP transceivers to MTP/MPO-terminated ribbon fiber, or QSFP-terminated EOE cables. Myricom will shortly also be offering Myri-10G NICs with QSFP ports, which provide the same alternatives. In fact, QSFP ports may become nearly universal. The port connector provides power, required if a transceiver is plugged into the port, and other companies have announced "active" copper cables with signal-conditioning circuitry in the QSFP cable ends.

The SC07 Bandwidth Challenge. We are pleased that a team led by Indiana University, with partners from the Technische Universität Dresden, Rochester Institute of Technology, Oak Ridge National Laboratory, and the Pittsburgh Supercomputing Center, was awarded first place in the SC07 Bandwidth Challenge. From the IU press release: "Using the IU Data Capacitor, a system designed to store and manipulate massive data sets, the IU team achieved a peak transfer rate of 18.21 Gigabits/second out of a possible maximum of 20 Gigabits/second. This performance was nearly twice the peak rate of the nearest competitor." In fact, the IU team was the only team to employ full-duplex transfers. Corporate sponsors for the IU Bandwidth Challenge effort included Data Direct Networks, Dell, Myricom, and Force 10 Networks. The IU site and installation at SC07 used Myri-10G NICs exclusively.

The complete Bandwidth Challenge results are at https://scinet.supercomp.org/2007/bwc/. Teams other than IU using Myri-10G NICs included the National Center for Data Mining (NCDM) and the University of Delaware. In addition, a Caltech team set a wide-area record outside of the Bandwidth Challenge framework with a sustained bi-directional flow of more than 80 Gbits/s using Myricom and Intel NICs.

Myri-10G in other exhibits. Myricom is pleased that many of our customers and partners displayed Myri-10G networking in their exhibits. For example, to the right is a photo of the innovative new SiCortex multicomputer, which uses Myri-10G 10-Gigabit Ethernet Express Module NICs for I/O. Fujitsu's exhibit of their low-latency, 20-port, XG2000 10-Gigabit Ethernet switches was driven by Myri-10G NICs. Myricom was included as a partner in the Microsoft booth, and remote Windows cluster demonstrations, including at a Myri-10G cluster at the Microsoft Partners Solutions Center, were included in the Myricom booth. In the SC07 Cluster Challenge, the Indiana University team built an Apple Xserve cluster using Myri-10G NICs with MX over Ethernet and a Fujitsu 10-Gigabit Ethernet switch.

Reno was a convenient venue for SC07, with the convention center and hotels being close to each other and to the Reno airport. For readers who are not familiar with the annual SC conference, it is in a different city each year. SC is not only a technical conference and exposition, but is a convention of HPC people. Myricom technical and sales people saw many old friends and made some new friends both on the exposition floor and at numerous off-site visits with our customers and partners.

The Myricom SC07 booth early one morning before the exhibits opened.
The booth was almost always crowded during exhibit hours.

The Exhibit Team. The Myricom team attending and exhibiting at SC07 were **Scott Atchley**, Member Technical Staff; **Susan Blackford**, Member Technical Staff; **Dr. Nan Boden**, Executive Vice President; **Bob Brown**, Microsoft Business Development; **John Daley**, Senior Programmer; **Reese Faucette**, Senior Software Architect; **Dr. Markus Fischer**, Senior Software Architect; **Tom Leinberger**, Director of Sales - Central Region; **Dr. Patrick Geoffray**, Senior Software Architect; **Dave PeGan**, Vice President, Sales; **Justin Pratt**, Member Technical Staff; **Dr. Loic Prylli**, Senior Software Architect; **Dr. Wolfgang Rühmer**, Director of EMEA Sales; **Scott Schweitzer**, Director of OEM Business Development; **Dr. Chuck Seitz**, CEO; **Dr. Jakov Seizovic**, CTO; **Dr. Ruth Sivilotti**, Member of the Technical Staff; **Marty Stewart**, Executive Assistant; and **Tim Sticklinski**, Director of Sales - Western Region.

We're now looking forward to ISC08, to be held 17-20 June 2007 in Dresden, Germany, and to SC08, to be held in 15-21 November 2008 in Austin, Texas.

Myricom

Last updated: 3 December 2007

News Release

For Immediate Release

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Best Research in High Performance Computing Honored at SC07
Gordon Bell Prize, Challenges, Best Papers and Poster Winners Announced

Reno, NV — November 15, 2007 — Top researchers in high performance computing were recognized today at the SC07 conference, where the winners of the Best Paper, Best Student Paper, Best Poster, ACM Student Research Competition, Analytics Challenge, Bandwidth Challenge, Storage Challenge, and Gordon Bell Prize were presented.

Sponsored by ACM and the IEEE Computer Society, SC07 showcases the latest advances in high performance computing, networking, storage and analysis.

The following are this year's awards:

Seymour Cray Award
Kenneth Batcher (Kent State University)

Sidney Fernbach Award
David Keyes (Columbia University)

Gordon Bell Prize
James Glosli, Kyle Caspersen, David Richards, Robert Rudd, Frederick Streitz (Lawrence Livermore National Laboratory) and John Gunnels (IBM, Inc.), *Extending Stability Beyond CPU-Millennium: Micron-Scale Atomistic Simulation of Kelvin-Helmholtz Instability*

Best Paper Award
Dennis Abts, Abdulla Bataineh, Steve Scott, Greg Faanes, James Schwarzmeier, Eric Lundberg, Tim Johnson, Mike Bye, Gerald Schwoerer (Cray, Inc.), *The Cray BlackWidow: A Highly Scalable Vector Multiprocessor*

Best Student Paper Award
Serkan Ozdemir, Gokhan Memik, Ja Chun Ku, Arindam Mallik, Yehea Ismail (Northwestern University), *Variable Latency Caches for Nanoscale Processor*

Best Poster Award
Zhengji Zhao, Juan Meza, and Lin-Wang Wang Name (Lawrence Berkeley National Laboratory), *A New O(N) Method for Petascale Nanoscience imulations*

ACM Student Poster Award
First Place: Junquin Sun (University of Tennessee, Knoxville), *Obtaining High Performance via Lower-Precision FPGA Floating Point Units*
Second Place: Timothy Hartley (The Ohio State University), *Storing and Searching Massive Scale-free*

Graphs
Third Place: Alexandru Iosup (Delft University of Technology), *GrenchMark: A Framework for Testing Large-Scale Distributed Computing Systems*

ACM / IEEE Computer Society HPC Ph.D. Fellowship Award
Winner: Chao Wang, North Carolina State University
Winner: Mark Hoemmen, University of California, Berkeley
Winner: Arpith Chacko Jacob, Washington University of St. Louis
Honorable Mention: Kamesh Madduri, Georgia Institute of Technology
Honorable Mention: Yong Chen, Illinois Institute of Technology

Analytics Challenge
Robert Grossman, Anushka Anand, Shirley Connelly, Yunhong Gu, Matt Handley, Michal Sabala, Rajmonda Sulo, David Turkington, Leland Wilkinson (University of Illinois at Chicago), Ian Foster, Ti Leggett, Mike Papka, Mike Wilde (University of Chicago and Argonne National Laboratory), Joe Mambretti (Northwestern University), Bob Lucas and John Tran (University of Southern California), *Angle: Detecting Anomalies and Emergent Behavior from Distributed Data in Near Real Time*

Bandwidth Challenge
Winner: Stephen C. Simms, Matthew Davy, Bret Hammond, Matt Link, Craig Stewart, S. Teige, Mu-Hyun Baik, Yogita Mantri, Richard Lord, Rick McMullen, John C. Huffman, Kia Huffman (Indiana University), Guido Juckeland, Michael Kluge, Robert Henschel, Holger Brunst, Andreas Knuepfer, Matthias Mueller (Technical University Dresden), P.R. Mukund, Andrew Elble, Ajay Pasupuleti, Richard Bohn, Sripriya Das, James Stefano (Rochester Institute of Technology), Gregory G. Pike (Oak Ridge National Laboratory), Douglas A. Balog (Pittsburgh Supercomputing Center), *Using the Data Capacitor for Remote Data Collection, Analysis, and Visualization*
Honorable Mention (for "making it look easy"): Scott A. Friedman (University of California, Los Angeles), *iWarp-based Remote Interactive Scientific Visualization*

Cluster Challenge
Team Canada: Paul Lu, Paul Greidanus, Gordon Klok, Chris Kuethe, Stephen Portillo, Antoine Filion, Andrew Nisbet (University of Alberta)

Storage Challenge
Large System: Pavan Balaji (Argonne National Laboratory), Wu-chun Feng and Jeremy Archuleta (Virginia Tech), Heshan Lin (North Carolina State University), P*araMEDIC: Parallel Metadata Environment for Distributed I/O and Computing*

Small System: Michael S. Warren and John Wofford (Los Alamos National Laboratory), *Astronomical Data Analysis with Commodity Components*

About SC07
SC07, sponsored by ACM and IEEE Computer Society, will showcase how high-performance computing, networking, storage and analysis lead to advances in research, education and commerce. This premiere international conference includes technical and education programs, workshops, tutorials, an exhibit area, demonstrations and hands-on learning. For more information, please visit http://sc07.supercomputing.org/.