
I-Light Applications Workshop 2002 Meeting Summary and Description

The first-ever I-Light Applications Workshop was held 4 December 2002 from 8:30 a.m. to 4:30 p.m. at the IUPUI University Place Conference Center, Indianapolis, Indiana. Total attendance exceeded 150 people.

Gary R. Bertoline, Associate Vice President for Visualization Computing, Data Mining and Research Interactions at Purdue University, welcomed attendees and opened the meeting with comments on the strength of the collaboration between Purdue University and Indiana University, and the importance of advanced networking to all aspects of information technology.

Michael A. McRobbie, Vice President for Information Technology and CIO at Indiana University, welcomed attendees as well and commented on the significance of this meeting just one year after the initial symbolic lighting of the I-Light network. Vice President McRobbie described the importance of this network as a driver for university research and development within the State of Indiana—which in turn is a driver for economic development and prosperity.

Dr. Larry Smarr was the keynote speaker for this event. Dr. Smarr is Institute Director of the California Institute for Telecommunications and Information Technology (CAL-(IT)²) and was the founding Director of the National Center for Supercomputing Applications (NCSA) at the University of Illinois. Dr. Smarr described several of his key visions for the future of information technology, including research activities currently going on with the participation of CAL-(IT)². Among the visionary projects he described were the Optiputer, a powerful distributed Grid “infostructure” to support data-intensive scientific research and collaboration, and BIRN, the Biomedical Informatics Research Network, which represents the first attempt to develop a “protocol” for this kind of collaborative research among neuroscientists and medical scientists.

The common thread in all of Dr. Smarr's remarks was the central role played by advanced networking in the future of all aspects of innovative information technology. Dr. Smarr closed his remarks by complimenting the two universities and the State of Indiana for their vision and commitment in creating the I-Light network, and for the ongoing leadership positions that both universities have achieved in information technology.

The last two speakers in the opening session of the Workshop were the associate vice presidents for telecommunications from the two universities. Brian Voss of Indiana University discussed the motivation behind I-Light, the process of building it, and highlighted its strategic value to the two universities. Steven Mayo of Purdue University talked about visions for possible future expansion of I-Light that will be of even greater benefit to research in the State of Indiana.

The largest portion of the day was devoted to presentations by faculty, students, and staff from Purdue University West Lafayette, Indiana University–Purdue University Indianapolis, and Indiana University Bloomington. The strength of the research done at all three research campuses was evident in the consistent excellence of the presentations and the

science being presented. One notable feature of the day was the excellent representation of accomplished women researchers in this traditionally male-dominated field.

A great diversity of disciplines was represented at the Workshop as well. These included computer science, chemistry, management, biology, engineering, informatics, genomics, astronomy, visualization, electrical and computer engineering, advanced networking, mechanical engineering, library and information science, digital video, fine arts, life sciences, and virtual reality.

Following in these proceedings are brief summaries of the talks, the presentation slides from those talks, and copies of the posters for the demonstrations presented at the Workshop.

Further information about I-Light is available at <http://www.i-light.org/>.

Further information about information technology at Purdue University is available at <http://www.itap.purdue.edu/>.

Further information about information technology at Indiana University is available at <http://it.iu.edu/> and at <http://www.indiana.edu/~uits/>.

Mid-morning Break and Demonstrations

The morning break featured interesting and innovative demonstrations, including collaboration (IU Bloomington), digital art (IU Bloomington), biomedical applications (IU), advanced visualization over I-Light (IU), homeland security simulations (Purdue University West Lafayette), and grid computing (Purdue University West Lafayette).

Morning Presentations

Real Time Response to Streaming Sensor Data

Beth Plale, Department of Computer Science, Indiana University Bloomington, discussed her research in distributed and grid computing. Data-driven applications that accept input from data streams originating at remote sensors must be supported by low latency middleware that does not impede rapid response to the occurrence of a complex event in the environment. Similarly, data streams must be responsive to the needs of data-driven applications, such as a weather forecasting model, with regards to synchronizing the data-stream notion of time with the model's notion of time. Dr. Plale's talk focused on her research to create the computer science and networking infrastructure that enables these needs to be met.

Measured Response: A Homeland Security Simulation

Alok Chaturvedi and Chih-Hui Hsieh, Krannert School of Management, Purdue University West Lafayette, discussed their simulations of homeland security situations. Their innovative simulation model takes into account the behavior of thousands of independent agents (people) in response to a terrorist attack. In the presentation, delivered by Ms. Mehta, both the results of the simulation, and the technical details of how IU and Purdue supercomputers were used together to perform this simulation, were discussed. This presentation was the first of the day that was directly related to homeland security issues.

Cell Modeling/Data Integration through a Web-Based Information Theory Approach

Dr. Peter Ortoleva, Distinguished Professor and Director of the Center for Cell and Virus Theory, Department of Chemistry, Indiana University Bloomington, discussed his group's work in developing computer models of cell function. To facilitate the accessibility of this technology to researchers worldwide, and to promote growth of a unified database of cell physiology, biochemistry, genetics, electrophysiology and other factors, the entire model/data integration is being implemented in a Web platform that is a prototype for the next-generation Internet-based research facility. Dr. Ortoleva talked in particular about his group's work modeling the cell functions of *Trypanosoma brucei*, the parasite that causes African Sleeping Sickness, and emphasized the important role that academic researchers must play in studying diseases that affect primarily economically disadvantaged areas of the world. This talk was one of three presentations that included work supported in part by the Lilly Endowment, Inc., through the Indiana Genomics Initiative.

Multi-mode Distributed Thin Client Collaboration on Large Geometric Models

Karthik Ramani, Mahendra Babu, Christoph Hoffman, Center for Information Systems in Engineering, Purdue University West Lafayette, discussed the performance of a distributed computing graphics application. This paper compared various means of distributing computational processes between Purdue and IU supercomputers. This discussion was one of several analyses of advanced computer science problems that leveraged the I-Light network to perform real applications and develop the future of grid computing.

Distance Visualization and Collaboration

Polly Baker is Associate Professor of Computer Science and School of Informatics and Distinguished Scientist and Director of the Visualization and Interactive Spaces Lab, Pervasive Technology Laboratories, Indiana University–Purdue University Indianapolis. Dr. Baker provided an overview of her research program in visualization and collaboration. Discussions included tele-collaboration tools that take advantage of high-speed networks, and novel and innovative collaborative display devices created in Dr. Baker's lab. Included in her discussion was a novel interactive collaboration device that allows multiple collaborators to interact with GIS data ranging from the entire earth to a small neighborhood within a city. Dr. Baker was one of two Directors from the Pervasive Technology Laboratories to speak at the Workshop. Pervasive Technology Laboratories at IU are funded in part by a grant from the Lilly Endowment, Inc.

Lunch

Lunch was held in the Bistro of the University Place Conference Center Hotel. During lunch, one of the key objectives of the Workshop was accomplished. Researchers who otherwise would not have met each other did so, found areas of common interest, and agreed to investigate collaborative projects. Demonstrations started during the latter part of the lunch time, and proved to be very popular. What had seemed like an abundant amount of space for the demonstrations—down a 75 yard stretch of a foyer—proved to be quite crowded due to the great interest shown by all participants at the Workshop.

First Afternoon Presentations

Genomics Data and Computation Sharing with I-Light

Rick Westerman, Genomics Center, Purdue University West Lafayette, discussed opportunities for accessing and sharing genomics data and the problems in managing these data. The challenges of managing the burgeoning quantities of genomics data and the importance of advanced networking in making it possible to use this data effectively were laid out clearly by Westerman. Westerman was the first speaker of the day to set out a specific opportunity for collaboration between IU and Purdue based on use of the I-Light infrastructure during a formal presentation.

Discovery in the Classroom - New Stars in Galaxy Andromeda

Dr. Caty Pilachowski, Department of Astronomy, Indiana University Bloomington, presented the day's most exciting application of I-Light in undergraduate education. Undergraduate students enrolled in a freshman-level course at Indiana University Bloomington participated in remote observing on the WIYN telescope in Arizona, using videoconferencing with on-site observers and VNC connection to the telescope. Students obtained digital images of the Andromeda Galaxy to discover new, previously unknown, exploding white dwarfs stars. The I-Light network enabled non-major students in Astronomy to participate in original astronomical research.

Deployment of Fine-Grained Grid Applications using I-Light

Ayon Basumallik, Seung-Jai Min, Rudi Eigenmann, Y. Charlie Hu, School of Electrical and Computer Engineering, Purdue University West Lafayette, described performance analyses of parallel supercomputing applications run locally at Purdue University and in a grid computing fashion—simultaneously at supercomputers in West Lafayette and Bloomington. This sort of real-time computer science research on a network that is in active production demonstrates the immediate value of I-Light at a time when leaders in other areas of the US are just now contemplating such a network.

Advanced Network Applications

Steve Wallace, Director of the Advanced Network Management Lab, Pervasive Technology Laboratories, Indiana University Bloomington, discussed several advanced network applications developed in his lab. *Tsunami* is an experimental high-speed network file transfer protocol being developed by the ANML, designed to overcome some of the difficulties associated with using TCP over very high-speed, long-distance networks. The discussion of *Tsunami* highlighted the role of I-Light as a connection to national and international high speed networks. Another area of research discussed was cybersecurity, an area in which ANML is taking a leadership position. This talk was the second talk of the day by a Director from the Pervasive Technology Laboratories (funded in part by the Lilly Endowment, Inc.), and the second of the day's talks that discussed research being done in Indiana that has direct application to homeland security.

Parallel Metacomputing of Solid-Fluid Interaction Problems via I-Light

Hasan Akay, Xiaoyin He, Resat Payli, Computational Fluid Dynamics Laboratory, Department of Mechanical Engineering, Indiana University–Purdue University Indianapolis, discussed a coupled Computational Fluid Dynamics (CFD) and Computational Structural Dynamics (CSD) code for aerodynamics. With the parallel computational features of the code, the computational task is distributed to several computers making

metacomputing and multidisciplinary code coupling across different computer clusters a reality, thanks to I-Light. This was the last of the talks throughout the day that demonstrated research accomplishments in grid computing made possible as a result of the I-Light network and the extensive collaboration that has developed between Indiana and Purdue Universities in information technology.

Afternoon Break and Demonstrations

Refreshments were available during the afternoon break as attendees continued to view the excellent demonstrations presented as part of the Workshop.

Second Afternoon Presentations

Genomes to Grids - Bio Data Distribution for Grid Computing

Dr. Don Gilbert, Center for Genomics and Proteomics, Indiana University Bloomington, discussed grid computing and bioinformatics. Biologists have discovered many millions of genes and genome features, now part of the bio-data “library” distributed on computers around the world. Dr. Gilbert discussed several ways of finding and using interesting genome knowledge from this mountain of data, including the flybase database of genomic information about fruit flies (*Drosophila*). This world-renowned database is maintained at Indiana University Bloomington and accessed by researchers worldwide via the I-Light network.

Towards an Infrastructure for Large-Scale Information Analysis, Visualization, Information Retrieval Research & Education

Katy Börner and Javed Mostafa, School of Library and Information Science and School of Informatics, Indiana University Bloomington, discussed their efforts to develop an advanced infrastructure for teaching and research in digital libraries, information retrieval, data mining/analysis, and information visualization. They are developing a data mining infrastructure that will be populated by millions of records held presently in the ACM portal and PubMed. This infrastructure will run on IU’s Sun E10000 supercomputer, and will be unique in its scope and its use of sophisticated open source tools for data retrieval.

Panel

Resources Accessible Through I-Light and How You Can Use Them to Enhance Your Research

Panelists Eric Wernert, Anurag Shankar, Mary Papakhian, and David Hart of Indiana University, and Bill Whitson, Dale Talcott, Dave Seaman, and Rick Westerman of Purdue University West Lafayette all discussed infrastructure available to researchers at Purdue University West Lafayette, IUPUI, and IU Bloomington. The purpose of this panel was to emphasize to Workshop participants the broad array of storage, computation, and visualization resources available at Indiana's state research institutions.

In the discussion, particular emphasis was placed on Purdue's new supercomputing facilities as well as their “recycled cluster” project. This latter project uses desktop computers, recently taken out of student computer labs, and creates with them a large Beowulf cluster for parallel

scientific computing. Work led by Purdue University modeled the crash of the Boeing 757 into the Pentagon on September 11, 2001. This simulation, done by expert engineers at Purdue University, was run on Indiana University's IBM SP supercomputer.

The Indiana University representatives discussed IU's supercomputers, including its 1 TFLOPS IBM SP. A preview of the NSF-funded AVIDD (Analysis and Visualization of Instrument-Driven Data) 1.1 TFLOPS distributed Linux cluster was also provided. The discussion by IU participants emphasized such important areas as advanced collaborative visualization over I-Light, and the use of new computing tools from IBM to provide simple access to multiple genomic databases to biomedical researchers.

A fitting end to the day was the discussion of I-Light as a mechanism to provide disaster-proof storage of massive data sets. IU maintains a massive data storage system capable of storing hundreds of terabytes of data, and copies of data are kept in two robotic tape silos—one at IUPUI and one at IU Bloomington. Data added to either location are copied overnight to the other, ensuring data integrity even in the event of a natural disaster. This was one of the many unique advantages provided in the State of Indiana by the I-Light network discussed during the day.

Closing Remarks

Dr. Michael A. McRobbie closed the workshop by thanking all of the participants for an exciting day outlining a prodigious suite of accomplishments. Dr. McRobbie noted the agreement between Purdue University and Indiana University that competition should take place on the football field and basketball court, but end there. The I-Light network is itself an excellent example of collaboration between Indiana University and Purdue University. Another is the *Research in Indiana* display put on each of the last three years at the annual Supercomputing Conference (<http://www.research-indiana.org/>).

Dr. McRobbie pointed out that the constant themes throughout the day were the value of the I-Light network to advanced research development at Indiana University and Purdue University, and to the innovative and important work being done by researchers taking advantage of I-Light. Dr. McRobbie announced the signing of a Memorandum of Understanding between Indiana University and Purdue University to formalize and codify the ongoing sharing of information technology resources between the two universities for research purposes.

Dr. McRobbie ended his comments by wishing everyone a safe return home at the end of the day, and pointed out, "I-Light is but one of the many examples of work Indiana University and Purdue University are engaged in to the benefit of the Indiana economy, the security of our country, and the well-being of people everywhere."

Session Conveners for the I-Light Applications Workshop 2002,

Craig A. Stewart

Director, Research and Academic Computing and Director, Indiana Genomics Initiative
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David P. Moffet

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