

**Annual report on training, education, and outreach activities
of the Indiana University Pervasive Technology Institute Technology Institute
and affiliated organizations**

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Executive summary

Education, outreach, and training are important priorities of the Indiana University (IU) Pervasive Technology Institute (PTI). Working largely through the units involved in PTI, we have a multi-pronged approach to education, outreach, and training, highlights of which include:

Outreach: We have two hands-on summer programs that inspire young people (K-12) to pursue careers in STEM. Ongoing diversity initiatives draw on a long-standing network developed with Minority Serving Institutions. We participate in an annual state fair to bring science to the residents of Indiana, and engaged in national policy and governance efforts around campus bridging, scientific data, and security. PTI has one of the premier security advocates in the country with the Center for Applied Cybersecurity Research (CACR). CACR is highly active in getting word out on security awareness to the state of Indiana and beyond.

Research experiences: One hundred and twenty-three graduate, undergraduate and postdoctoral students engaged in research with the internationally known faculty affiliated with PTI.

Training: PTI undertakes numerous initiatives to engage the Indiana University community through seminars, training sessions, and workshops. PTI extends this outreach to hosting a booth at the 10,000 attendee premier conference in high performance computing, the IEEE/ACM Supercomputing Conference, which is held annually in November in the United States. This year the IU/PTI booth was standalone and cooperated with the Global Research Network Operations Center (GNOC) to showcase both PTI research and GNOC innovative offerings in network monitoring.

EOT is a broad initiative consisting of numerous efforts by the individual research and service centers. We highlight some of the key successes for 2011 in this report.

Introduction

The mission of Pervasive Technology Institute (PTI) is “to improve quality of life in Indiana and the world by inventing, developing, deploying and delivering innovations in information technology.”⁴ Education, outreach, and training is an important aspect of this mission, reaching out to multiple constituent groups through:

- Outreach:
 - Inspiring young people (K-12) to pursue careers in advanced information technology
 - Diversity efforts nationally
 - Educating residents of the state of Indiana
 - Engagement in national science policy and governance
- Research experiences:
 - Giving graduate, undergraduate, and postdoctoral students research experience with the internationally known faculty affiliated with PTI
- Training:
 - Training and tutorial sessions
 - Opportunities to engage the IU community in research discussions
 - Reaching out regionally and internationally

This report highlights successes of PTI and its affiliated organizations in education, outreach, and training activities for 2011. The affiliated organizations include the Office of the Vice President for Information Technology, University Information Technology Services Research Technologies (RT) division, School of Informatics and Computing, and Maurer School of Law. This report is subdivided into sections corresponding to the education, outreach, and training bullets above. Within each section, we highlight particular events put on by PTI as a whole, or coordinated and led by one of the centers affiliated with PTI:

- Center for Applied Cybersecurity Research (CACR) <http://cacr.iu.edu/>
- Center for Research in Extreme Scale Technologies (CREST) <http://pti.iu.edu/crest>
- Data to Insight Center (D2I) <http://d2i.indiana.edu/>
- Digital Science Center (DSC) <http://www.pti.iu.edu/dsc>
- Research Technologies (RT) <http://www.pti.iu.edu/rt>

A related focus of PTI is economic development; a report on these activities can be found at <http://hdl.handle.net/2022/13559>.

Outreach and education activities are challenging to quantify, and the impact of such activities is evident only after time – sometimes decades. With these caveats on the limits of simple reporting of quantities, the number of people who are engaged in some sort of event is one measure of level of activity. The table below presents a conservative tally of attendees at some sort of PTI-affiliated education, outreach, and training event for 2011. This is a conservative tally, in that attendance was not kept at some of the events. This is also a tally specifically of *events*. For example, the number of people who listen to the CACR radio program “Security Matters” is not tallied here, nor is the number of people who viewed the web site featuring IU 3D science-oriented movies. The total number of event participants is conservatively estimated at more than 8,000. Many thousands more people have seen or

⁴ <http://pti.iu.edu/about/mission>

heard information disseminated by PTI through other mechanisms such as public radio and the Internet.

Type of Outreach Event	Total participants in outreach events in Calendar 2011
K-12 outreach	466
Outreach to traditionally underserved populations	73
Outreach to Residents of Indiana subtotal	379
Broader Education Within the IU Community	2,492
Outreach to the national research community subtotal	4,718
<i>Overall total participants in 2011 PTI education, outreach, and training events</i>	<i>8,128</i>

1. Outreach

1.1. Kindergarten through high school

There is ample evidence of a shortage of qualified researchers and professionals entering STEM (Science Technology Engineering and Mathematics) disciplines. This problem is at least in part a pipeline problem – not enough students being interested in STEM disciplines, and not enough students entering all fields with basic computational tool skills required to do research in other disciplines.⁵ PTI has developed a multi-prong outreach initiative at the K-12 levels with the objective to inform, encourage, and engage young Hoosiers about the many opportunities in information technology and informatics. An underlying philosophy for engagement is that education is effective when fun is mixed with education in hands-on activities.

Ready, Set, Robots camp.

The highly popular Ready, Set, Robots camp (coordinated by Research Technologies (RT)) returned for its fifth year in June 2011, offering both beginner and intermediate classes. Several camp alumni who had taken the beginner class in the prior year returned this year to participate in the intermediate class. A total of two sessions (four session-days) were offered in June, with a total of 40 students attending.



RT's Danko Antolovic working with students at "Ready, Set, Robots Camp" in June, 2011.

Bugbots.

Research Technologies staff participated in a "Bugbots" workshop held on August 13 at WonderLab's Wondercamp in Bloomington, Indiana. This event taught young students basic programming of robotic bugs. A total of 18 elementary and junior high school students attended.

1.2. Diversity and outreach to traditionally underserved populations

Minority Serving Institutions.

PTI faculty member Prof. Geoffrey Fox has been deeply engaged and committed over a long period of time to enhancing the capabilities of Minority Serving Institutions by means of cyberinfrastructure for purposes of research and education. This is a collaboration comprising San Diego Supercomputing Center, University of Houston, Association of Computer and Information Science/Engineering Departments at Minority Institutions (ADMI), American Indian Higher Education Consortium, Hispanic Association of Colleges and Universities, and National Association for Equal Opportunity in Higher Education. Prof. Fox visited two campuses this year including a Tribal College, Salish Kootenai College, and a

⁵ Atkinson, R.D. and M. Mayo. *Refueling the U.S. Innovation Economy: Fresh Approaches to STEM Education*. The Information Technology & Innovation Foundation. 2010. Available from: <http://www.itif.org/publications/refueling-us-innovation-economy-fresh-approaches-stem-education> [cited 24 Jan 2012]

Hispanic Serving Institution. During these visits he gave presentations and discussed opportunities for cyberinfrastructure at the campus.

Minority Engineering Advancement Program (MEAP).

MEAP summer camp is one of the most important technology outreach efforts sponsored by the School of Engineering on IU's Indianapolis campus (IUPUI). MEAP is a weeklong, summer, non-residential camp on the IUPUI campus for students who have completed 6th through 11th grade levels (see <http://www.engr.iupui.edu/meap/>). The camp is designed for underrepresented students interested in engineering and technology careers.



Carmel Clay's Lawrence Johnson shines a laser pointer through a bent translucent rod as scientist Danko Antolovic instructs and Ikenna Stovall, Dominique Gregory, and Marsquis Sailles observe

This year, as in prior years, Research Technologies staff led a program on the last day of MEAP titled "No Guts, No Glory." Twenty-four students participated in the assembly and analysis of components of a desktop computer and computer networks. RT staff also participated in other parts of the program, including a laser demonstration. The students were able to see how light is refracted through different media.

Research Experiences for Undergraduates (REU) and Historically Black Colleges and Universities (HBCU) Science Technology Engineering and Mathematics (STEM) Programs.

The SALSA HPC Lab has participated in the Indiana University HBCU STEM Summer Scholar Institute and hosted 23 REU students since 2009. The STEM scholars were recruited through ADMI and A4RC (Alliance for Advancement of African-American Researchers in Computing) with selected universities including Elizabeth City State University, North Carolina A&T State University, Mississippi Valley State University, and Hampton University. Students spend eight weeks in the summer on Indiana University campus and actively engage in faculty-mentored research with the SALSA group on data enabled science projects exemplified by life science, polar science and cyberinfrastructure supported by NSF [FutureGrid](#) and [CReSIS](#) projects.

1.3. Outreach to residents of Indiana

PTI is engaged in many activities that reach out to, educate, and inform the lay community of the state of Indiana. Several of these activities have already been discussed as part of K-12 outreach and outreach to traditionally underserved groups. Taxpayers of Indiana benefit from many of the activities of PTI – directly through information disseminated by PTI and indirectly through benefits of PTI activities in helping Indiana expand its high-tech economy. Here we outline some of the key activities that directly impact Hoosiers via outreach and educational activities delivered by PTI.

MINI University.

2011 marked the 40th anniversary of the award-winning weeklong educational program for adults offered each summer on the Bloomington Campus. MINI participants are older,

usually retired and highly educated. Fifty-three percent hold graduate degrees and they are hugely interested in science but are distinctly laypeople who, for example, enjoy the science section of The New York Times. Only the highest quality faculty are invited to teach during MINI University. In June 2011, Prof. Beth Plale and Data to Insight Center Project Manager Robert Ping presented “Storm tracking in real time: how technology makes it a contact sport” to an over-capacity crowd of 60 MINI University participants. As part of the program they featured the 3D film “Leading the Way,” created by the Advanced Visualization Lab of Research Technologies.

Celebrate Science Indiana Day.

The Indiana State Fair attracts thousands of Indiana residents and Indiana University has used the fair as an opportunity to reach out to residents of the state. PTI staff participated in the large Indiana University booth at the inaugural Celebrate Science Indiana event in 2011, demonstrating programming, password cracking, and light refraction using lasers in an effort to help Indiana residents . This day-long event was attended by over 130 central Indiana children, parents, and teachers. Planning is already underway for next year’s activities. This important effort helps residents of Indiana better appreciate the value of information technology and informatics to the state’s economy and to the global competitiveness of the US and its national security.

Security Matters.



The Center for Applied Cybersecurity Research produces Security Matters (<http://securitymatters.iu.edu>), a training series designed to help the general public increase their personal online security and privacy. While mainly focusing on web-based videos hosted on YouTube, Security Matters also utilizes public radio to promote online security. Security Matters episodes

address some of the most common questions nontechnical users have surrounding basic cybersecurity issues in addition to topical matters based on high profile events. From creating strong passwords to assisting with online banking, the series covers everyday issues affecting the general public, and has gained a dedicated following online and become a source of trusted information for those wishing to enhance their personal security. The Security Matters YouTube channel has grown exponentially in popularity over the last year, with nearly 10,000 combined episode views, a 2,200 percent increase over the previous year. The series aims to be informative, engaging, and easily accessible to an audience that may not possess strong technical skills or knowledge.

The episodes are conceptualized, written, and produced by CACR staff and posted weekly on YouTube, Twitter, and on a dedicated Facebook page (<http://facebook.com/cacrsecmatters>). New videos are typically posted once a week, and radio spots – featured on Indiana University's WFIU – run regularly throughout the week. In spring 2011, a US district judge awarded CACR \$300,000 as part of a class-action lawsuit settlement over Google Buzz. That \$300,000 is being devoted to continued production of Security Matters and will be used to create an expected 52 episodes in the coming year.

See Science web site.

A new web site – <http://3d.iu.edu> – has been developed to generate interest in science and technology through stereoscopic 3D videos. This site will serve as a mechanism for all members of the IU community to disseminate 3D video output as a means of sharing information with the general public. 3d.iu.edu features videos of astronomy projects and weather forecasting activities led by Beth Plale and the Data to Insight Center, with more content expected soon. One of the movies featured on this site – the Advanced Visualization Lab short film “A Universe of Questions” – has been named a 2011 3D Film Festival Winner in the Best of Shorts category. Aimed at middle school children as well as the general public, this five-minute stereoscopic 3D movie features video, computer-generated animation, and data simulations that demonstrate the value of computational science and its effects on theoretical astrophysics. The 3D Film Fest is the largest 3D film festival in the world and was held in Los Angeles in September. AVL members Albert William, Michael Boyles, Chauncey Frend, and Chris Eller created the movie with help from IU students and collaborators across the country.



3D Video - Computer Generated image of radiotelescopes from “A Universe of Questions” describes how tools are used in astronomy.

2. Research experiences

PTI continues to serve as an intellectually vibrant place where students of all levels from postdoctoral fellows to undergraduates actively seek out opportunities to engage with the internationally recognized experts in PTI in research experiences. In 2011, 123 students at different levels were actively engaged in research in PTI as broken out in the table below. The impact of this education is broad. Students are attracted to Indiana University because of the high caliber faculty that have been recruited to IU in part because of PTI. These students then go on to graduate, have successful careers in industry or academia in Indiana and beyond, and carry the word about the school, its strengths, and the state with them. Because of the strength of PTI and its research and service centers, PTI is able to give financial assistance to a sizeable number of Ph.D. students, which directly contributes to the health of the academic units that house the students, most notably the School of Informatics and Computing, IU Bloomington.

Type of student	Number of students engaged in research
Postdoctoral scholars	7
Ph.D. students	75
Masters students	30
Undergraduate students	10

3. Training: Broader education

3.1. Broader education within the IU community

The PTI Centers host a variety of talks, workshops, meetings, and training sessions to engage the university community. Talks, workshops, and meetings give the IU community a valuable resource in order to learn about cutting-edge research that may be going on at IU or abroad. In support of research and research education it is important to offer training sessions on an ongoing basis for incoming graduate students, new faculty, and for faculty and staff who have been at IU and are just now realizing that use of IU’s advanced research cyberinfrastructure may help accelerate their research activities or create new research opportunities.

Training sessions.

Training sessions or tutorials are designed to educate an audience. Leveraging resources and expertise at PTI, we hosted several training/tutorial events in 2011. Typical examples of training sessions include “HPC Systems for IU Researchers: An Introduction” and “HPC Systems for IU Researchers: Advanced Topics” offered by Research Technologies, and “Big Data Means your Metadata Must Work” offered by the Data To Insight Center.

Workshops, talks, and meetings.

PTI units serve as hosts or affiliates with several ongoing events on campus. These well-known and well-attended speaker series events serve as springboards for new collaborations and new insight among staff, students, and faculty. The Data to Insight Center Seminar Series hosted 13 talks, the School of Informatics and Computing Colloquia hosted more than 25 talks, and the Digital Library Brown-bag Series hosted another 16 talks while the Center for Applied Cybersecurity Research hosted 18 seminars.

CREST ribbon cutting.

A noteworthy event in terms of interest building and outreach to the IU community was the ribbon-cutting ceremony for the new Center for Research in Extreme Scale Technologies (CREST), held in November 2011 in the Wrubel Computing Center. The CREST ribbon cutting was an opportunity to inform the IU community that Dr. Thomas Sterling, who led the Beowulf revolution, had joined IU in collaboration with Dr. Andrew Lumsdaine to create this new PTI Research Center.

Tours.

PTI has components located in three new buildings: the Informatics & Communications Technology Complex in Indianapolis, the Cyberinfrastructure Building in Bloomington, and the Innovation Center in Bloomington. Each of these buildings has multiple high-end visualization systems. As a result, tours become a very useful way to provide information about PTI activities to a variety of constituencies. Tours are particularly popular with K-12 student groups and groups from the lay and business communities of Indiana.

3.2. Outreach at the national level

National science policy communities.

PTI, while having at its core strong technical research, also engages in issues of governance and policy at a national level. These efforts are summarized in the table below.

40 press releases and announcements	http://pti.iu.edu/news
NSF initiated campus bridging reports	http://pti.iu.edu/campusbridging
NSF sponsored DataNet/INTEROP meeting, Indianapolis, IN, January 2012	http://d2i.indiana.edu/data2012
Numerous talks related to campus bridging by Drs. Von Welch and Craig Stewart	http://hdl.handle.net/2022/13421

Outreach to the national research community.

The Pervasive Technology Institute is very active at the national level, educating leaders in government, the research community, the business community, and the lay community. PTI and RT led two important events aimed at the national scientific community – the 2011 High Performance Storage Systems (HPSS) Users Forum and the IU display at the annual IEEE/ACM Supercomputing Conference. This section highlights some of the key events IU has hosted and participated in at the national level.



High Performance Storage Systems (HPSS) Users Forum.

HPSS is one of the most important software systems for the secure storage of massive amounts of data. HPSS is supported as a product by IBM, Inc. but governed by an advisory committee of which IU is a member. It is used nationally by a variety of highly secure installations, and is used by IU to manage its archives of scholarly data. Such data may be artistic (e.g., images created by the Interior

Designs department) or sensitive (e.g., health records used in research) in nature. IU has been a leader within the HPSS community for more than a decade, and has hosted the annual meeting of the HPSS Users Forum three times prior to 2011. The 2011 HPSS Users Forum was hosted by Research Technologies in Bloomington, IN on October 18 through 21, 2011. More than 70 attendees from the US, Europe, and Asia discussed current best practices and future direction in developing software.

Supercomputing 2011.

The main goal of IU's participation in the annual Supercomputing Conference (SC) is to provide outreach to the national scientific community. This year, led by the Office of the Vice President for Information Technology's communications strategist, IU used the conference in a broader way with the goal of inspiring students to become interested in STEM disciplines.



The booth theme was "Moving Fast, Thinking Big," which focused on PTI Research Centers and new innovations by the Research Technologies and Networks divisions of UITS. The IU display at the annual Supercomputing booth is always one of the most popular and visited booths, and this year so many people visited the booth that we were not able to maintain a good estimate of the number of visitors. Based on the number of badges scanned, the number of visitors to the booth was conservatively 2,500.

The PTI Research Centers engaged in the booth through demonstration, display, or talks. Handouts from the booth included a superhero-themed booklet showcasing key projects and a one-page flier of pictures of the key leaders of PTI Research and Service & Cyberinfrastructure Centers. The Digital Science Center and RT held workshops at SC11. The Data To Insight Center organized one of the popular SC tutorials, this one on metadata. The Research Technologies division's Science Gateway group hosted the 2011 Gateway Computing Environments (GCE11), the sixth consecutive year for this event at the SC conference.

One of the key demonstration events at the SC11 was the SCinet Research Sandbox. (SCinet is the network set up specifically to support the supercomputing conference each year.) IU's entry, called "The Data Superconductor: An HPC cloud using data-intensive scientific applications, Lustre-WAN and OpenFlow over 100Gb Ethernet," demonstrated 100 Gigabit Ethernet transport over a wide area network. Networks in which any particular link operates at a data flow rate of 100 Gigabits

per second (Gbps) are one of the newest innovations in networking. PTI has participated in both public tests of such networks – one last year in Germany, and the SCinet data sandbox at SC11. Thanks to the innovative and hard work of the Networks and Research Technologies divisions of UITS, IU holds the record for fastest transfer of data ever achieved over 100 Gbps networks at long distances (i.e., over 1,000 miles). This demonstration showcased forward thinking approaches to solving the data movement problem that many

researchers encounter. This effort will be of practical value next summer, when Internet2 moves to 100 Gbps links and PTI is able to help IU researchers tame the data deluge.

Acknowledgments

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Appendix. Listing of PTI education, outreach, and training events

Table 1 below summarizes the education, outreach, and training events for PTI and affiliated organizations for calendar year 2011. This is a conservative tally, in that attendance was not taken at some events. This is also a tally specifically of *events*. For example, the number of people who listen to the CACR radio program “Security Matters” is not tallied here, nor is the number of people who viewed the web site featuring IU 3D science-oriented movies. The total number of event participants is conservatively estimated at more than 8,000. Many thousands more people have seen or heard information disseminated by PTI through other mechanisms such as public radio and the Internet.

PTI Center	Event Title	Month/Year	No. of Attendees	Type of Event
Outreach				
<i>Kindergarten through High School (K-12)</i>				
CREST	Sculpture, Geometry, and Computer Science	Dec-11	10	Presentation
D2I	TeraGrid Outreach	Feb-12	320	Presentations and demonstrations
RT	Washington High School Urban League Tour	Apr-11	10	Tour and demonstrations
RT	Pike Township Superintendent Group	May-11	5	Tour
RT	Ready, Set, Robots Summer Camp	Jul-11	40	Workshop / summer camp
RT	DEMA Middle School STEM Camp	Jul-11	62	Workshop / summer camp
RT	Bugbots Workshop (WonderLab)	Aug-11	18	Workshop / summer camp
RT	“Job Shadow” day for student	Oct-11	1	
<i>K-12 outreach participants subtotal</i>			466	
<i>Diversity – outreach to traditionally underserved populations</i>				
DSC	Research Experiences for Undergraduates	Throughout year	23 since inception of program in 2009	Research experiences
RT	MEAP Summer Camp	Jul-11	50	Workshop / summer camp
<i>Outreach to traditionally underserved populations subtotal</i>			73	
<i>Outreach to Residents of Indiana</i>				
CREST	Hoosier Guitar-building Workshop	Jun-12	10	Outreach to residents of Indiana
CREST	Plenoptic Camera demo	Nov-11	20	Outreach to residents of Indiana
D2I	MINI University	Summer 11	60	Lecture and video demonstrations
RT	Anacore, Inc.	Sep-11	4	Presentations and tour
RT	Indiana small business leaders	Sep-11	5	Presentations and tour

RT	Celebrate Science Indiana	Oct-11	130	Demonstration as part of Celebrate Science Indiana at Indiana State Fairgrounds
RT	2011 Statewide IT Conference Family Night	Sep-11	150	Tours
<i>Outreach to Residents of Indiana subtotal</i>			379	
Training: Broader Education				
<i>Broader Education Within the IU Community</i>				
CACR	A Collaborative Cyber Security Experiment Design and Analysis Framework	Jan-11	30	Workshops, Talks and Meetings
D2I	Web Accessibility in Digital Libraries	Jan-11	25	Outreach to IU community
CACR	Architectures for Practical Client-Side Security	Jan-11	26	Workshops, Talks and Meetings
CACR	Anonymity in the Context of Censorship and Censorship Circumnavigation	Feb-11	58	Workshops, Talks and Meetings
CACR	Is (Generic) Secure Two-Party Computation Practical?	Mar-11	30	Workshops, Talks and Meetings
CACR	The Price of Secure Collaboration	Mar-11	25	Workshops, Talks and Meetings
CACR	The Price of Secure Collaboration	Mar-11	25	Workshops, Talks and Meetings
CACR	Adversarial Stylometry: Attacking Authorship Recognition to Preserve Privacy and Anonymity	Apr-11	28	Workshops, Talks and Meetings
CACR	Understanding Cyberattacks as an Instrument of US Policy	Apr-11	22	Workshops, Talks and Meetings
CACR	CACR Higher Education Cybersecurity Summit	Apr-11	189	Workshops, Talks and Meetings
CACR	Was STUXNET an Act of War?	Apr-11	34	Workshops, Talks and Meetings
CACR	Reinforcing Bad Behavior: The Misuse of Security Indicators on Popular Websites	Apr-11	21	Workshops, Talks and Meetings
CACR	Can You Hear Me Now?: Law Enforcement Surveillance of Internet and Mobile Communications	Apr-11	24	Workshops, Talks and Meetings
CACR	Software in Medical Devices: Concerns Related to the 510(k) Process	Jun-11	25	Workshops, Talks and Meetings
CACR	re: CAPTCHAs	Sep-11	32	Workshops, Talks and Meetings
CACR	The Building Security in Maturity Model	Oct-11	24	Workshops, Talks and Meetings
CACR	Heuristics and Biases: Implications for Security	Nov-11	24	Workshops, Talks and Meetings

CACR	Privacy Preserving Data Publishing for Health Informatics	Nov-11	40	Workshops, Talks and Meetings
CACR	Malicious USB Devices	Nov-11	26	Workshops, Talks and Meetings
CACR	Integrity Based Trust for Networked Communication Systems	Dec-11	27	Workshops, Talks and Meetings
CREST	C++ Standards Committee meeting - summer 2011	Aug-11	50	Workshops, Talks and Meetings
CREST	CREST ribbon-cutting and open house	Nov-11	50	Workshops, talks, and meetings
D2I	Web Accessibility in Digital Libraries	Jan-11	25	Workshops, talks, and meetings
D2I	Invited Talk (internal)	Feb-11	28	Workshops, talks, and meetings community
D2I	Various Throughout Spring Semester	Spring 11	138	Workshops, talks, and meetings
D2I	Center Presentations	Mar-11	8	Workshops, talks, and meetings
D2I	Center Presentations	Mar-11	8	Workshops, talks, and meetings
D2I	Center Presentations	Apr-11	8	Workshops, talks, and meetings
D2I	Invited Talk (internal)	Apr-11	30	Workshops, talks, and meetings
D2I	Invited Talk (internal)	May-11	28	Workshops, talks, and meetings
D2I	Digital Humanities and the Future of Libraries	Jun-11	100	Workshops, talks, and meetings
D2I	Data, Baby: Identification and discussion of issues related to data stewardship in planning a VIVO implementation	Jun-11	25	Workshops, talks, and meetings
D2I	Integration of CEP into Scientific Workflows	Jul-11	10	Workshops, talks, and meetings
D2I	Research Experiences for Undergraduates	Jul-11	62	Workshops, talks, and meetings
D2I	The Data Document Initiative (DDI) schema	Jul-11	7	Workshops, talks, and meetings
D2I	Data and Search Specialization Promotion	Sep-11	55	Workshops, talks, and meetings
D2I	Understanding the I/O Performance of Virtualized Cloud Environments	Sep-11	30	Workshops, talks, and meetings
D2I	Efficient Association Discovery with Keyword-based Constraints on Large Graph Data	Oct-11	34	Workshops, talks, and meetings
D2I	Modeling Network of Scientists	Oct-11	12	Workshops, talks, and meetings

D2I	Addressing Scalability in Distributed Storage, Digital Preservation and Adaptive Networking	Oct-11	36	Workshops, talks, and meetings
D2I	Creating Functionality Around Non-Consumptive Research	Oct-11	25	Workshops, talks, and meetings
D2I	HathiTrust Research Center: Enabling computational access to 10 Million-- volume HathiTrust Repository	Nov-11	15	Workshops, talks, and meetings
D2I	Scalable storm surge forecasting with Windows Azure	Nov-11	8	Workshops, talks, and meetings
D2I	Metadata captures, metadata query: The value of the XMC Cat Metadata Catalog	Nov-11	12	Workshops, talks, and meetings
D2I	GENI - Global Environment for Network Innovations	Nov-11	18	Workshops, talks, and meetings
DSC	Distributed Systems Class B534 by Professor Judy Qiu	Jan-11	60	Workshops, talks, and meetings
DSC	Cyberinfrastructure and Its Application	Jul-11	20	Workshops, talks, and meetings
DSC	MapReduce Overview for FutureGrid	Jul-11		Workshops, talks, and meetings
DSC	Cloud Computing for Data Intensive Science Class	Fall-11	24	Class
DSC	Director of Complex Systems Track in PhD Program in Informatics, SOIC	Feb-11	Not recorded	Educating the IU community
DSC	Director FLAD Computational Biology Collaboratorium	Mar-11	Not recorded	Educating the IU community
DSC	Co-director Computational Biology Ph.D. program	Apr-11	Not recorded	Educating the IU community
DSC	Taught: I609 Complex Systems Advanced Seminar: http://informatics.indiana.edu/rocha/ic x2	May-11	Not recorded	Class
RT	IU Cinema Event	Jan-11	133	Workshops, talks, and meetings
RT	Tour for IU Trustees	Jan-11	2	Tour
RT	Power Up your Pedagogy	Feb-11	4	Workshops, talks, and meetings
RT	Lykins Class Tour "Seeing Sideways"	Feb-11	27	Tour
RT	Tech Center Tours	Mar-11	54	Tour
RT	SLIS Dean Tour	Mar-11	4	Tour
RT	IUPUI Ambassador Tour	Mar-11	8	Tour
RT	IU Cinema Event	Mar-11	90	Workshops, talks, and meetings
RT	Exhibit in VRT	Mar-11	22	Workshops, talks, and meetings
RT	Baik Lab Group meeting	Mar-11	14	Workshops, talks, and meetings

RT	Dolinsky Spring Project Tour	Mar-11	12	Workshops, talks, and meetings
RT	Katy Boerner Class Tour	Mar-11	19	Workshops, talks, and meetings
RT	WCC iQ Wall	Mar-11	9	Workshops, talks, and meetings
RT	Rob Meager Engineering Tour	Apr-11	1	Tour
RT	Professor Acheson Class Tour	Apr-11	7	Tour
RT	Tour for Tech Center Gamers Guild Students	Apr-11	12	Tour
RT	School of Nursing Tour	Apr-11	2	Tour
RT	Research Technologies Fair	Apr-11	9	Workshops, talks, and meetings
RT	Tour	May-11	1	Tour
RT	ICTC Summer Tours	Jul-11	13	Tour
RT	Research Technologies Fair	Jul-11	15	Workshops, talks, and meetings
RT	IUPUI Human-Computer Interaction Student Tour/Demos	Sep-11	10	Tours
RT	Family Night at CIB	Oct-11	60	Tour
RT	HPC Systems for IU Researchers: Advanced Topics	Oct-11	11	Training
RT	HPC Systems for IU Researchers: An Introduction	Oct-11	22	Training
RT	GIS Day	Nov-11	60	Workshops, talks, and meetings
RT	Polly Baker STARS Tour	Nov-11	6	Tour
RT	Tour Group for Todd Shelton N100 Class	Nov-11	60	Tour
RT	Tour Group for Joan Savage	Nov-11	8	Tour
RT	IUPUI School of Science Dean Tour	Nov-11	10	Tour
RT	Physics/Astronomy Open House	Nov-11	100	Workshops, talks, and meetings
<i>Broader Education Within the IU Community Subtotal</i>			<i>2,492</i>	
Broader Education Beyond IU Community				
<i>Outreach to the national research community</i>				
CREST	Basics of Supercomputing tutorial	Nov-11	70	Workshops, talks, and meetings
CREST	Revolutionary Approaches to Exascale Breakout Session	Oct-11	20	Workshops, talks, and meetings
CREST	CREST Ribbon Cutting Ceremony	Nov-11	40	Outreach to residents of Indiana
CREST	Multi-cell, Multi-scale Modeling	May-11	30	Workshops, talks, and meetings
D2I	Big Data Means Your Metadata Must Work	Nov-11	61	Training / tutorial
D2I	Invited Talk (external)	Mar-11	42	Workshops, talks, and meetings
D2I	Invited Talk (external)	Mar-11	28	Workshops, talks, and meetings

D2I	Invited Talk (external)	Apr-11	40	Workshops, talks, and meetings
D2I	Invited Talk (external)	Apr-11	45	Workshops, talks, and meetings
D2I	Panel on Alternative Career Paths	Jun-11	50	Workshops, talks, and meetings
DSC	FutureGrid Services I	Jul-11	40	Workshops, talks, and meetings
DSC	HPC, Hadoop and Eucalyptus on FutureGrid	Jul-11	40	Workshops, talks, and meetings
DSC	Cosmic Issues and Analysis of External Comments on FutureGrid	Jul-11	15	Workshops, talks, and meetings
DSC	Outsourcing Ecosystem for Science: Applications and Patterns at Workshop on Science Agency Uses of Clouds and Grids	Jul-11	15	Workshops, talks, and meetings
DSC	Analysis Tools for Data Enabled Science	Jul-11	200	Workshops, talks, and meetings
DSC	Classical and Iterative MapReduce on Azure	Jul-11	200	Workshops, talks, and meetings
DSC	Managing Appliance Launches in Infrastructure Clouds	Jul-11	50	Workshops, talks, and meetings
DSC	Towards Generic FutureGrid Image Management	Jul-11	75	Workshops, talks, and meetings
DSC	MapReduce	Jul-11	15	Workshops, talks, and meetings
DSC	FutureGrid: What an Experimental Infrastructure Can Do for You	Jul-11	15	Workshops, talks, and meetings
DSC	Status of Clouds and their Applications	Jul-11	10	Workshops, talks, and meetings
DSC	Distributed FutureGrid Clouds for Scalable Collaborative Sensor--Centric Grid Applications	Jul-11	10	Workshops, talks, and meetings
DSC	5th Annual CompuCell3D Workshop	Aug-11	15	Workshops, talks, and meetings
DSC	Cyberinfrastructure and Its Application	Aug-11	15	Workshops, talks, and meetings
DSC	FutureGrid Overview	Sep-11	10	Workshops, talks, and meetings
DSC	(When) Clouds will win!	Sep-11	10	Workshops, talks, and meetings
DSC	FutureGrid Services I	Sep-11	10	Workshops, talks, and meetings
DSC	FutureGrid Services II: Using HPC Systems, MapReduce & Eucalyptus	Sep-11	10	Workshops, talks, and meetings
DSC	Cloud Cyberinfrastructure and its Challenges & Applications	Sep-11	75	Workshops, talks, and meetings
DSC	Cyberinfrastructure Day	Apr-11	60	Workshops, talks, and meetings

DSC	Cyberinfrastructure Day	Mar-11	40	Workshops, talks, and meetings
DSC	FutureGrid Tutorial	May-11	40	Workshops, talks, and meetings
DSC	FutureGrid Tutorial	May-11	20	Workshops, talks, and meetings
DSC	FutureGrid Overview	Jul-11	50	Workshops, talks, and meetings
DSC	Overview of the FutureGrid Software	Jul-11	50	Training
DSC	Education and Training on FutureGrid	Jul-11	50	Training
DSC	FutureGrid Overview	Jul-11	40	Training
DSC	Science of Cloud Computing	Jul-11	200	Workshops, talks, and meetings
DSC	Analysis of Virtualization Technologies for High Performance Computing	Jul-11	40	Workshops, talks, and meetings
DSC	A Cloud View on Computing	Jun-11	15	Workshops, talks, and meetings
DSC	Computer Modeling, From Planes to Brains	Feb-11		Workshops, talks, and meetings
RT	GCE11 Workshop	Nov-11	40	Workshops, talks, and meetings
RT	CIB Dedication	Oct-11	300	Outreach to residents of Indiana
RT	Tour for MURI Students	Oct-11	1	Outreach to IU community
RT	HPSS User Forum	Oct-11	70	Hosting national conference
RT	VP Louisiana Tech Tour	Mar-11	1	Tours
RT	LYNDA.com Tour	Apr-11	4	Tours
PTI overall	Supercomputing 2011	Nov-11	2500 estimated visitors to booth (conservative)	Display at major international conference
<i>Outreach to the national research community subtotal</i>			<i>4,718</i>	
OVERALL TOTAL			8,128	

Table 1. Tally of education, outreach, and training events conducted by the Pervasive Technology Institute and its affiliated organizations. In some cases, it was possible only to estimate of the number of attendees; all such estimates are very conservative, so the total attendance figures represent an underestimate of the total impact of PTI outreach activities.