# 2020 External Review of the Pervasive Technology Institute

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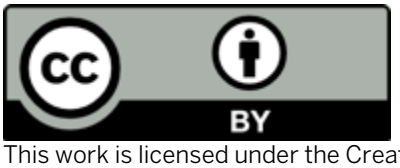
Indiana University
PTI Technical Report PTI-TR20-005
May 31, 2020

Please cite as:
Stewart, C.A., Slavin, S., & Ping, R. (2020). *2020 External Review of the Pervasive Technology Institute* (PTI Technical Report PTI-TR20-005). Indiana University. Retrieved from http://hdl.handle.net/2022/25626.

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PERVASIVE TECHNOLOGY INSTITUTE

# Contents

# 1. Introduction

In keeping with Indiana University Policy RP-11-002, "Establishment of Centers and Institutes" (https://policies.iu.edu/policies/rp-11-002-establishment-centers-institutes/index.html), an external review of the Indiana University Pervasive Technology Institute was proposed in 2019 and carried out from 13-15 May 2020. Per IU policy effective at the time, the review was conducted remotely via teleconference.

The review panel included a majority of representatives from outside IU:

- Chair: Lizanne DeStefano, Georgia Tech (https://www.ceismc.gatech.edu/about/staffdirectory/dr-lizanne-destefano). Dr. DeStefano is Professor of Psychology, and the Executive Director of the Center for Education Integrating Science, Mathematics, & Computing (CEISMC) at Georgia Institute of Technology. She has done (and been funded to do) more evaluations of cyberinfrastructure organizations than any other person working in open (unclassified) research. She is funded to evaluate the following existing programs: the Georgia Tech Center for Brains, Minds, and Machines (CBMM), the NSF-funded Emergent Behaviors of Integrated Cellular Systems Science and Technology Center, Center for Sustainable Nanotechnology, XSEDE (Extreme Science and Engineering Discovery Environment), and the Blue Waters educational program.
- Ewa Deelman (https://deelman.isi.edu). Dr. Deelman is Research Professor and Research Director at the USC Information Sciences Institute (ISI) and a Fellow of AAAS and IEEE. She is an expert in distributed computing, and has sustained her own research group for now more than a decade at ISI. She has keen insight into ISI's sustainability strategies and regularly serves on NSF advisory committees and review panels.
- Bill Kramer (www.ncsa.illinois.edu/assets/php/directory/contact.php?contact=wkramer). Dr. Kramer is the Senior Associate Director for the Blue Waters Project Office at the National Center for Supercomputer Applications at the University of Illinois, Urbana-Champaign. He was the PI for the NSF grant to create Blue Waters, at one point the fastest unclassified supercomputer in the world. He has worked at NCSA for more than a decade, and recently turned down an offer to head up the Pittsburgh Supercomputer Center. As such, he has insights about the finances, operations, and sustainability of two of the most long-standing supercomputer centers in the US.
- Nancy Wilkins-Diehr (http://users.sdsc.edu/~wilkinsn/). Dr. Diehr is now retired from decades of leadership at the San Diego Supercomputer Center. She was formerly the PI for the Science Gateways Community Institute and a co-PI for XSEDE. She has extensive knowledge of SDSC's sustainability strategies, and she is a leader nationally and internationally in the area of science gateways, where CIRC does most of its funded research.

Two members of the IU community (a minority of the committee as a whole) were included in this review:

- Professor Scott Michaels (College / Department of Biology, https://biology.indiana.edu/about/faculty/michaels-scott.html). Professor Michaels is a former collaborator with NCGAS, and has himself led the Center for Genomics and Bioinformatics. He is extremely well positioned to speak to (and serve as a resource

for the review panel on) matters of successfully operating a sustained research center within IU.
- Jennifer Schopf (OVPIT, https://it.iu.edu/structure/bios/jmschopf). Dr. Schopf is the Director, International Networking within the Networks Division of UITS, and PI and Director of the NSF-funded Engagement and Performance Operations Center (EPOC). Dr. Schopf is also the PI of all of IU's current NSF grant awards to operate international networks. She was formerly on staff at the NSF. Dr. Schopf is one of the three people within OVPIT most successful in obtaining funding from the NSF, and has keen insight about NSF strategies. She is not formally affiliated with PTI, and never has been.

The membership of the review panel was approved before the review by IU VP for Research Fred Cate.

The review committee represents people with leadership knowledge of four of the nation's leading cyberinfrastructure and supercomputer centers: NCSA (National Center for Supercomputing Applications), PSC (Pittsburgh Supercomputer Center), SDSC (San Diego Supercomputer Center), and ISI (Information Sciences Institute of the University of California). They also have expertise in most of the areas of research in which PTI is involved. There are no cybersecurity experts involved in this panel, intentionally. With CACR already approved as a university-level Center, it has its own review processes established and among PTI-affiliated centers also has the best current sustainability plan.

This technical report consists of the following sections and documents:
- A summary of the report by the external review committee
- Materials shared with the external review committee in advance:
    - Materials prepared collectively by PTI leadership, or which already exist and are published:
        - Schedule for review
        - A charge document with agenda
        - *Final Report to Lilly Endowment Inc. Indiana University Pervasive Technology Institute.* 8/31/2014, Michael A. McRobbie (although actually mostly written by Beth Plale). Also available from http://hdl.handle.net/2022/19787
        - Application - IU PTI University Level Institute 2020_apr_20_FINAL_REV8 (Application for the IU Pervasive Technology Institute to be categorized as a "university level" institute with fiscal and management authority retained by OVPIT.) This document includes as an appendix the current policies for distribution of facilities & administration funds returns for OVPIT.
        - A revised version of The Pervasive Technology Institute at 20: Two decades of success and counting (http://hdl.handle.net/2022/22607)
    - Materials prepared by Center for Survey Research:
        - Survey of IU faculty to determine amount of awareness and utilization of PTI and PTI-affiliated centers
- Slides from presentations by PTI leaders presented during the review
- Supplemental Information

# 2. Summary Report

Indiana University Pervasive Technology Institute (PTI)
External Advisory Committee Report
EXECUTIVE SUMMARY
May 31, 2020

## 2.1 Background

The inaugural meeting of the Pervasive Technology Institute (PTI) External Advisory Committee (EAC) was held virtually on May 13-15, 2020. Members of the committee are: Lizanne DeStefano, Center for Education Integrating Science, Mathematics and Technology, Georgia Institute of Technology (chair); Ewa Deelman, University of Southern California Information Sciences Institute; William Kramer, National Center for Supercomputer Applications; and Nancy Wilkins-Diehr, San Diego Supercomputer Center, retired; Jennifer Schopf, OVPIT, IU; and Scott Michaels, Department of Biology, IU.

In this inaugural review, the EAC was asked to address five specific areas: 1) General effectiveness; 2) Branding; 3) Centralized Services; 4) Diversified Funding; and 5) Sustainability.

## 2.2 Findings

In addition to the original Lilly Foundation charge to "enhance the campus' technological capabilities," Brad Wheeler stated at the outset of the review that PTI's key role is to "build connections across departments and schools across campus." Though the EAC has not been asked to comment on the existence or continuation of PTI, it is worth mentioning that PTI provides a very valuable focal point for those inside and outside IU to identify and collaborate with technology experts at the university and should definitely be continued. PTI's leadership on the successful implementation of Jetstream is just one example of its tremendous impact.

It is clear that over its 20-year history, PTI has engineered an impressive positive trajectory in terms of the amount of sponsored project funds, internal and external research collaborations and state and federal HPC leadership. Member centers and laboratories acknowledge PTI's valuable assistance with grant proposal preparation and submission; outreach, dissemination, communication, and nurturance of synergies and collaboration within and beyond PTI. IU and Center leadership appreciate PTI's leadership in response to federal and state needs. One out of three respondents on a recent survey of the IU campus community were aware of the Pervasive Technology Institute. These are all positive indications of PTI's value and visibility.

Acknowledging PTI's current successes, the EAC believes that there is more work to be done in terms of branding and optimizing PTI's impact on faculty recruitment, research productivity, and technology advancement for the next 20 years. It is in that spirit that we offer our assessment and recommendations.

## 2.3 General Assessment of Effectiveness

Overall, the EAC concludes that PTI has been highly effective as an organization in terms of its Intellectual Impact (technical publications, software and services produced and offered); Broader Impacts (workforce development, education of students, enrichment of public awareness of science and technology), and Collaborative Opportunities and Advantages, relative to levels of investment by IU and in comparison to relevant peers.

The unique composition and organizational structure of PTI made it difficult to identify "relevant peers," however, given differences in history, charges, and structures between PTI and its peers. It is certainly useful to use peer benchmarking to gauge the impact and progress of PTI, but gross comparisons with existing computing centers seem inadequate or potentially misleading.

Recommendation: As part of future strategic planning and branding, PTI should create benchmarks with specific aspects of peer centers, or identify other, more appropriate, peers.

## 2.4 Branding

Over the last 20 years, PTI's reputation and visibility has increased dramatically within IU and within the broader research computing community, rising to one of the top six computing centers in the U.S. Despite this rise, the PTI "brand" is not as prominent as TACC or NCSA. In fact, EAC saw quite a bit of variability in how member centers characterize PTI's "brand," the priority that they give to PTI over Center recognition, and the way that they describe PTI's mission and vision. These findings lead us to conclude that it is an excellent time for PTI to embark on a branding and marketing exercise that will position it well for the next 20 years and increase its value to IU and the state.

Recommendation: PTI should embark on a branding exercise that will position it well for the next 20 years and increase its value to IU, the state of Indiana, the nation and the world.

## 2.5 Central Services

There was widespread agreement that the grant writing support provided by PTI has been extremely valuable, particularly for new staff members or those new to the proposal writing process. Support provided by RT and by the Executive Director for technology development, outreach and collaboration that, as one participant describes, "move at the speed of business rather than academia" was also highly valued and effective. It is clear that PTI functions well as a solver of problems, particularly when centers do not fit well within existing administration policies. There was perhaps less awareness of the range of services available and the process for and benefits of affiliating with PTI that one might expect in a 20-year-old entity.

Recommendation: PTI should develop a communication strategy that fully represents opportunities and services for new (and existing) projects and a process for adding new services and retiring others. This could also include a mapping of current scientific and technological cross-cutting areas across existing centers and processes for becoming a part of PTI.

## 2.6 Funding

Over the 20 years of its existence PTI has been able to successfully bring in funding, raising over $136M from federal and non-federal sources. It was also able to win multi-million dollar, multi-year awards from NSF, particularly in the areas of cyberinfrastructure and cybersecurity. Overall, the vast majority of external PTI funding has come from NSF. However, with its varied research and services portfolio, PTI could and should broaden its funding to other federal agencies and industry partners.

Recommendation: PTI should deploy a targeted approach to pursue large funded projects and diversify sponsors. The approach should include direct engagement of likely internal and partners through seed funding, a campus-wide solicitation of priorities, and increased interaction with potential funders.

## 2.7 Sustainability

PTI organizations account for substantial external funding to IU, as well as managing significant internal IU investments. PTI and its affiliated research organizations are net income producers for IU. The large majority of PTI affiliate funding relies on NSF, in particular the CISE and OCI organizations. PTI, in its application to become a University-wide institute, indicates that IU ranks within the top six computing centers in the nation that receive most of their funds from the National Science Foundation. NSF funding, particularly for computer infrastructure and most of the areas PTI is involved in, has been contracting in real dollars for the last decade and awards are getting smaller. PTI has correctly identified the need to diversify the funding stakeholders and should move to do this with focus and investment.

Regarding PTI's specific desire to grow work and funding with DOD and DOE, most of the successful academic institutions with strong connections to DOE and DOD have staff, and leadership, who have spent significant parts of their careers at the labs or in Washington. It is not clear whether the PTI leadership have people who worked at DOE, DOD or other federal agencies.

Recommendation: PTI should develop a strategy to opportunistically hire people with significant reputation and experience with the targeted agencies. PTI also should provide support for IU staff to serve as rotating staff in federal agencies such as DOD, DARPA, IC, DOE, etc.

## 2.8 Summary

The EAC appreciates the opportunity to offer its collective opinions and advice in support of PTI's future development. Given PTI's successful 20-year history and its likely approval as a recognized Indiana University Institute, it is an ideal time to set a vision and course for the next decade or so. This vision is likely to include expansion to include the broader IU campus, greater attention to staff recruitment, retention and development, diversification of funding sources, movement toward new areas of research and development and away from less relevant areas, and, of course, development of support services and leadership to continue PTI's positive trajectory. IU support for PTI and computing in general has been strong and

essential for all that has been accomplished. Continued support will be necessary for PTI and IU to maintain and enhance its prominence in data and computational research.

# 3. Materials Shared with External Review Committee in Advance

## 3.1 PTI External Review Schedule

| Date/Time (EST) | Allotted time (min) | Topic | Speaker |
|---|---|---|---|
| 13-May | | | |
| 16:00 | 60 | Meet and greet: Each center and lab director introduces themselves, provides brief introduction of group's activity; discussion of objectives for review | Center/lab directors |
| | | | |
| 14-May | | | |
| 10:00 | 10 | Formal introduction and welcome | Brad Wheeler, VP for IT, CIO |
| 10:10 | 20 | Introductory discussion - Mission, Vision, Goals and History of PTI (after which Stewart departs) | Stewart |
| 10:30 | 20 | Center for Applied Cybersecurity Research (CACR) | Von Welch |
| 10:50 | 10 | 10 minute stretch break | |
| 11:00 | 20 | Cyberinfrastructure Research Center (CIRC) | Marlon Pierce |
| 11:20 | 20 | Data to Insight Center (D2I) | Beth Plale |
| 11:40 | 20 | Hathi Trust Research Center (HTRC) | John Walsh |
| Noon | 60 | PTI participants released for lunch; Review committee has lunch and discussion | Led by Lizanne DeStefano |
| 13:00 | 20 | National Center for Genome Analysis Support | Tom Doak |
| 13:20 | 20 | Research Technologies Division of UITS | Matt Link |
| 13:40 | 20 | R&D Done by the Office of the Executive Director (Stewart returns at this point) | Craig Stewart |
| 14:00 | 10 | Break | |

| | | | |
|---|---|---|---|
| 14:10 | 50 | Discussion of incubating function of PTI, focused on eLearning and Discovery Lab, Crisis Technologies Innovation Lab, and a possible new lab focused on networking and system performance | Ben Motz (eLearning), David Wild, Robert Henschel, Matt Link, CTIL, Martin Swany, potential new center leader, open discussion |
| 15:00 | 10 | Break | |
| 15:10 | 50 | Discussion with PTI Executive Director (without Center / Lab leaders) | Topics to discuss include: Nancy's question about how Lilly funding came to be, her question about agency funding, the rise and fall of CREST, question about AI |
| 16:00 | 15 | Break | |
| 16:15 | 45 | Open Discussion: sustainability strategies, amounts of university support, looking forward to? | Discussion led by review panel; all PTI leadership included |
| | | | |
| 15-May | | | |
| 10:00 | 45 | Discussion with a small group of PTI staff | No PTI leadership present; Kelli Shute (kelshute@iu.edu), CACR; Eroma Abeysinghe (eabeysin@iu.edu), CIRC; Robert Ping (robping@iu.edu), Former D2I Staff / RT / Ex. Director's Office; Gary Miksik (gmiksik@indiana.edu), Digital Science Center (DSC); Marie Ma (yuma@iu.edu), HTRC; Sheri Sanders (ss93@iu.edu), NCGAS; Winona Snapp-Childs (wsnappch@iu.edu), RT; Brian Voss (bvoss@iu.edu), Ex. Director's Office |
| 10:45 | 15 | Review Committee works alone on laying out writing plan, preparing a verbal report out | |

| | | | |
|---|---|---|---|
| 11:15 | 30 | Verbal report out to PTI leadership, relevant SICE and VPIT leaders | PTI Center & Lab Directors; Executive Director; Eric Stolterman, Executive Associate Dean, Luddy School; Jill Piedmont, Director of Finance & Strategic Planning, Luddy School; Dan Calarco, Chief of Staff, OVPIT |
| no later than 11:45 | | Adjourn | |
| | | | |
| 31-May | | Review Committee delivers report to Stewart, Wheeler. Connelly | |

# 3.2 Charge Document: IU Pervasive Technology Institute 2020 Review: charge and some background information (1 May 2020)

## 3.2.1 Charge for the Review Committee

IU policy requires that all institutes and centers be reviewed every five years by a review board comprising a majority of members from outside the IU community. The Pervasive Technology Institute (PTI) and before it the Pervasive Technology Labs have never had an outside review in the traditional form - partly because PTI predated this policy, and partly because many of the purposes of a review were served by two earlier and comprehensive sets of reporting materials: the 2008 proposal to the Lilly Endowment, Inc. that secured 2nd round funding to transform the Pervasive Technology Labs into the Pervasive Technology Institute; and 2012 final report to the Lilly Endowment in 2014, marking the end of the Endowment's support for PTI.

Now, however, PTI is just over 20 years old. We can foresee a day when the President of the University is not the person who was the principal investigator on the two proposals to the Lilly Endowment that collectively led to the creation of what today is PTI. It makes sense to have an external review to document a traditional, formal review of PTI and benefit from the collective wisdom and experience of a truly extraordinary review panel.

The entity being reviewed is the Pervasive Technology Institute, in terms of its collaborative structure, administrative placement, and the effectiveness of its core supporting functions. In general, individual Centers and Labs are not being reviewed, although a rational review of PTI overall must necessarily consider its aggregate outputs and impacts. The primary focus of this review is then about PTI's overall effectiveness (given its inherent collaborative structure as a constraint that it is not possible to change) and about the services that the office of the Executive Director offers (or should offer) to affiliated Labs and Centers.

The particular questions we would like to put before the review panel are as follows:

1. Overall, has PTI been effective as an organization in terms of its intellectual impact (technical publications, software and services produced and offered); and in terms of its broader impacts (workforce development, education of students, enrichment of public awareness of science and technology), relative to levels of investment by IU and in comparison to relevant peers? The review panel itself has extensive knowledge of some peer organizations. There is additional information about organizations we consider to be peers, and organizations we would someday like to have as peers, in Appendix 3 of the document "The Pervasive Technology Institute at 20: Two decades of success and counting" included in your briefing materials.
2. What is the best way to think of PTI? Options include "House of Brands," "Branded house (like TACC or NCSA)," or "As an incubator and/or coordinator of intellectual assets for Indiana University.
3. What central services should PTI be providing to affiliated Centers and Labs that it is not currently providing? What is "PTI Central" doing that it should not be doing?

4. How can PTI and its affiliated centers and labs be more effective in getting funds from sources other than the NSF and NIH. In particular, what can we do to be more effective in obtaining funds from the DOD, DOE, and private charitable trusts?
5. Thinking beyond just funding sources, what strategies and tactics for sustainability and sustained value to IU, the State of Indiana, and the US might we adopt that we are not already pursuing?

We would appreciate it if the review committee chair can convey by 31 May a concise written report to IU Vice President and CIO Brad Wheeler, PTI Executive Director Craig Stewart, Luddy School Dean Dennis Groth, and Luddy School Associate Dean for Research Kay Connelly.

### 3.2.2 List of Documents to be shared with the Review Committee

Documents specific to this review and related processes of having PTI certified by the Vice President for Research and ready for External Board Review as of 4 May 2020:

Background documents for the review committee (all currently under NDA, please, save item 3)

1. PTI External Review Schedule – DRAFT. The agenda. All agendas are drafts of course subject to change until the event is over!
2. IU Pervasive Technology 2020 Review_charge and some background information. This document; it has the charge and also some other background info on our tactical plans as well as some questions we have been musing over ourselves.
3. IUPTI-to-LEI-Final-Report_2014_aug_28.pdf. This is publicly available. It was the final report put together under Beth Plale's leadership at the end of the second round of Lilly Endowment funding. It's outdated in some ways but has some good information in it, and a lot of informative content regarding how we saw ourselves at that point.
4. Application - IU PTI University Level Institute_2020_apr_21_FINAL_REV8. Application for the IU Pervasive Technology Institute to be categorized as a "university level" institute. The need for this document may be a bit of "inside baseball" but it contains a lot of useful info about finances, strategies, and how we see ourselves today. This document includes as an appendix the current policies for distribution of facilities & administration funds returns for OVPIT, and the internal-to-IU proposal to have this review!
5. PTI-at-20_2020_may_1. The latest (penultimate, I hope) version of a 20 year report for PTI is just chockablock with tallies and lists of accomplishments.

Materials to be provided to review panel at time of review

1. For each center and lab, a very concise set of slides about the center / lab (probably 3 slides per center or lab).

### 3.2.3 OVPIT IT Tactical Plan - PTI Items

Indiana University's rise from mediocrity to significant accomplishment in use of information technology and cyberinfrastructure was guided by two university-level strategic plans for IT: one created in 1999, one created in 2009. Both were useful. The more recent plan is also now so old it does not provide useful guidance; the recommendations contained in it have either been achieved, proved impossible to achieve, or proved irrelevant. One to two years before a

changeover in the University President is not the time to start on a new university-wide IT planning effort. But now is also not a time to be operating without a plan for the University's IT operations. For that reason, IU VP for IT and CIO Brad Wheeler has prepared an 18 month IT Tactical Plan for the Office of the VP for IT. The elements of that plan relevant to PTI are listed below in the form of two goals, and action items associated with each goal.

Goal: Expand Pervasive Technology Institute engagement with and value delivered to the IU research community

Action Items:

- Obtain certification of PTI as a university-level institute by the Office of the Vice President for Research, increasing awareness of PTI and providing VPR's imprimatur of PTI's value.
- Expand awareness and use of services provided by PTI-affiliated centers throughout IU: use of HathiTrust Research Center text analysis tools by humanists and scientists; use of services of National Center for Genome Analysis Services by biomedical researchers, biologists, and bioinformaticians.
- Expand use of Science Gateways at IU in two ways: publicize the availability of discipline-specific software tools now available to the IU community through dozens of existing Science Gateways; aid IU researchers developing new software tools in deploying their software within a Science Gateway, which will ensure security, ability to use complex and diverse by as ways to secure and support new software tools developed by IU researchers.
- Continue education and outreach efforts, including training delivered to local and national audiences, and operation of the online publication Science Node (www.sciencenode.org), as a public good and as a mechanism for expanding IU competitiveness for NSF grant funding.

Goal: Continue and expand PTI's role in promoting collaboration among faculty, staff, librarians and students to address emerging and evolving state and national needs

Action Items:

- Working with faculty of the Luddy School, the College, the IU School of Medicine, IU's two schools of Public Health, the O'Neill School, and other academic units as appropriate, continue facilitating and obtaining funding for computationally-intensive research related to COVID-19 and related topics likely to be important for some time: pandemics epidemiology, virology, e-health research and infrastructure.
- Continue to expand accomplishments of and grant funding for the Crisis Technologies Innovation Lab and eLearning Research and Practice Lab to facilitate their expanding value to IU and the nation in this current time of crisis and expanded use of eLearning.
- Within the bounds of IU policy, pursue defense-related funding from the Department of Defense and Department of Energy, particularly related to defense against use of hypersonics technology.
- Working with faculty of the Luddy School, the College, and the IU School of Medicine, continue facilitating and obtaining funding for AI-based research in medicine and science.
- Continue and expand success in pursuit of federal and industry funding for national and local cyberinfrastructure ecosystem support, including facilitation of cloud computing for research, distributed computing, and analysis of Return on Investment for university and federal government spending on advanced computing facilities.

### 3.2.4 Questions we have been asking ourselves as we prepare for this review

The following questions are the questions we have been asking ourselves, in some cases, since the creation of the Pervasive Technology Labs and most acutely as we prepare for this review:

- What is PTI?
- Is there a better name for the "Pervasive Technology Institute"?
- What would not have happened if PTI had never existed? What has PTI aided because it exists?
- What if the centers operated independently with no overarching organization/communication (i.e., if PTI went away)? How would things be worse off? Conversely, how does PTI create something that is more than the sum of its parts? If you were to create PTI from scratch in 2020, how might it be different?
- What is the balance between "a house of brands" and "a branded house" in publicizing PTI and its affiliated centers within and beyond IU?
- Managing a non-static collection of centers is a major goal for the period 2020-2025. If PTI is to be measured as healthy, new centers will be coming in and existing ones will be transitioning, one way or another. What is the lifecycle of a PTI center, particularly:
    - Incubation as a lab and promotion to a Center?
    - What is the proper scope and mission of a PTI center?
    - When do you close a center?
    - How do you distinguish between PTI and its member centers and other (OVPR) university centers and institutes? This may be a bit of "inside baseball" but being clear about this seems useful.
    - Do all centers operate under the same rules?
    - How many centers should PTI have at any given time? What would too many centers be under the current structure? How much should PTI scale up?
    - What defines a PTI center? Can anyone with a grant who would like a big chunk of
    - What are PTI's governance (decision making) structure and mechanisms?
- What services does PTI offer to its centers and why (that is, are these aligned with our mission and vision)? Are these the right ones, and do we have the right organizational mechanisms to execute them?
- What were PTI's lessons-learned over the previous five years?
- What should PTI's 2025 vision of itself be?
- What is PTI's plan for its own continuity beyond 2025?
- Based on goals for 2025 and beyond, what are the right metrics for PTI?

New points of attention and consideration that have arisen since the emergence of the current COVID-19 pandemic as a national thread:

- What will PTI's role become as we settle someday into a new normal - whatever that is?
- How does PTI engage with AI initiatives locally and nationally?
- What are the implications of the continued slippage of NSF compared to DoE and industry in computer science and cyberinfrastructure? What are the implications of continued decrease of attention to HPC and cyberinfrastructure as research areas with attention focused on AI, in spite of AI's dependence on HPC?

- How do we factor in the growing importance of open-source GitHub as a publication mechanism in our outreach and dissemination plans in an environment where more and more dissemination of research results and research products will be rapid and virtual rather than metered by conferences and appearance of new issues of scientific and technical journals?
- What is PTI's role locally and nationally in educating people about the importance of science and scientific research?

## 3.3 Final Report to Lilly Endowment Inc.

PDF available from http://hdl.handle.net/2022/19787

# 3.4 Application for the IU Pervasive Technology Institute to be categorized as a "university level" institute with fiscal and management authority retained by OVPIT

Craig Stewart, Director, IU Pervasive Technology Institute
21 April 2019

## 3.4.1 Executive Summary

The IU Pervasive Technology Institute (Web: pti.iu.edu, Twitter: @IU_PTI) was initially created as the Pervasive Technology Labs in 1999 with a grant from the Lilly Endowment, Inc. It transformed into the IU Pervasive Technology Institute in 2008 with an additional round of funding from the Lilly Endowment. This funding ended in 2015, and PTI has operated successfully since, primarily on the basis of federal funding. PTI is a collaborative organization with eight affiliated centers: six traditional multi-lab R&D centers; the Office of the Executive Director; and as an eighth affiliated center, the Research Technologies Division of UITS. Since its founding in 1999, PTL and PTI have acquired more than $120M in funding from NSF, DHS, DoD, the Hathi Trust, Microsoft, Inc., and others (as of the end of Q1 FY2020).

PTI consists of the following subunits:

- Center for Applied Cybersecurity Research (CACR)
- Cyberinfrastructure Integration Research Center (CIRC)
- Data to Insight Center (D2I)
- Digital Science Center (DSC)
- Hathi Trust Research Center (HTRC)
- National Center for Genome Analysis Support (NCGAS)
- Research Technologies Division of UITS
- Office of the Executive Director of PTI

PTI predates IU Policy RP-11-002 (Establishment of Centers and Institutes[1]). The purpose of this proposal is to designate PTI as a university-level institute, with this designation given under the auspices of VPR per IU policy RP-11-002, with administrative authority for leadership of and fiscal agency for PTI remaining with the Office of the Vice President for Information Technology (OVPIT). PTI already includes faculty, students, and staff from OVPIT; the Luddy School of Informatics, Computing, and Engineering; the Maurer School of Law; the Kelley School of Business. If approved, this proposal will:

1. Establish PTI as a university-wide institute with leadership and fiscal authority delegated from VPR to OVPIT;
2. Provide a review of PTI that offers valuable advice regarding future sustainability;
3. Advance IU's research capabilities in advanced cyberinfrastructure and related technologies with funding drawn primarily from federal sources, but also from private industry and non-governmental foundations and charities;
4. Advance IU's capabilities in scientific research and humanities scholarship by solidifying existing ties with the College of Arts and Sciences and the Luddy School of Computing, Informatics, and Engineering, and fostering collaborations with the IU School of Medicine;

5. Advance IU's capabilities in advancing scientific research through use of Artificial Intelligence within scientific computing applications.

### 3.4.2 PTI Mission Statement

The Indiana University Pervasive Technology Institute (PTI) seeks to transform new innovations in cyberinfrastructure, computer science, and information technology into robust tools enabling breakthroughs in research, scholarship, and artistic creation; to deliver such tools and support their use at academic institutions and in the private sector; to accelerate the growth of Indiana's economy; and to help build Indiana's 21st century workforce.

### 3.4.3 Background

The IU Pervasive Technology Institute was initially created as the Pervasive Technology Labs in 1999 with a grant from the Lilly Endowment, Inc. entitled "IPCRESS: the Indiana Pervasive Computing RESearch Initiative." That grant award provided $15M to create six labs that made up the Pervasive Technology Labs, and another $15M to provide "ramp up" funding for the then-new School of Informatics. This grant award, notably, was the first of the now many large grant awards from the Lilly Endowment, Inc. to IU and to other universities in Indiana. The initial success of PTL led directly to the Indiana Genomics Initiative grant award of $105M the following year.

The current structure and name of the IU Pervasive Technology Institute were adopted in 2008 with an additional round of funding from the Lilly Endowment. At that time PTI implemented the following basic structure, which remains in place today:

- PTI reports administratively to OVPIT.
- PTI comprises a collaborative group of centers, each affiliated with PTI but not necessarily reporting to PTI.
- Each center consists of multiple labs.
- PTI is organized under the leadership of an Executive Director, who reports directly to the VP for IT. Governance is administered collaboratively by the Executive Director and the Directors of PTI-affiliated Centers, each of whom also has the title Associate Director, PTI.
- PTI's structure fosters flexibility and allows for rapid response to institutional and societal needs. Part of that responsiveness emerges from a requirement that PTI-affiliated centers remain sustainable through constant renewal of external funding. PTI operates across academic and Responsibility Center boundaries within IU, enabling it to pull together a mix of faculty, staff, and students to approach today's most pressing issues and questions.

PTI currently consists of the following centers and the office of the Executive Director:

- Center for Applied Cybersecurity Research (CACR), led by Von Welch. In existence since 2003, and affiliated with PTI since 2008.
- Cyberinfrastructure Integration Research Center (CIRC), led by Marlon Pierce. In existence as a PTI-affiliated Center since 2013, and as a management group with UITS since 2009.
- Data to Insight Center (D2I), led by Professor Dr. Beth Plale, who founded D2I in 2009.

- Digital Science Center (DSC), led by Distinguished Professor Dr. Geoffrey C. Fox. DSC grew out of the Community Grids Lab, founded in 2001 as the first of the six initial PTL labs. It expanded and gained center status at the time of PTI's 2008 Lilly Endowment funding.
- Hathi Trust Research center (HTRC), led by Associate Professor Dr. John Walsh. In existence as a PTI-affiliated Center since 2018, with funding as a center by the Hathi Trust.

HTRC was incubated as a subunit of D2I for three years before securing center status in 2008.

- National Center for Genome Analysis Support (NCGAS), led by Senior Research Scientist Dr. Thomas Doak. In existence as a PTI-affiliated Center since 2011.
- Research Technologies Division of UITS, led by Matt Link. In existence in its current form since 1997 as a subunit of UITS; formally affiliated with PTL (and then PTI) since 2005.
- Office of the Executive Director of PTI, led by Dr. Craig A. Stewart. Established in its current form with PTI's 2008 Lilly Endowment funding.

PTI is a collaborative organization. Centers may report organizationally and fiscally to academic units (two currently report to the Luddy School), leaders within OVPIT (two report directly to the Executive Director, and one is a dotted line report); or elsewhere (CACR reports jointly to VPR and VPIT; the Research Technologies Division of UITS reports to the VPIT and CIO directly).

PTI serves an "incubating" function within IU. When there is interest in creating a new research group, such new units are typically created as a lab within an existing center. Two new labs were added in 2019 as subunits of existing centers, with plans for their growth and expansion to full center status over time:

- eLearning Research and Practice Lab, led by Ben Motz, Research Scientist in the Department of Psychological and Brain Sciences at Indiana University Bloomington, and Anastasia Morrone, Professor of Educational Psychology in the School of Education at Indiana University-Purdue University Indianapolis (IUPUI), Associate Vice President for Learning Technologies in the OVPIT, and Dean of Information Technology at IUPUI.
- Crisis Technologies Innovation Lab, led by David Wild, Professor of Informatics and Computing and OVPIT staff members Matthew R. Link and Robert Henschel.

PTI's structure also allows for resilience when federal and societal needs change, or when leadership of an individual center or lab fails. [1] Since the initiation of PTL in 1999, one lab has been phased out due to changes in federal priorities; three labs and one center have been phased out due to failure to maintain continuity of external funding. Lilly Endowment funding for PTI ended in 2015, and since then, it has sustained itself primarily on the basis of competitively awarded federal funding. An extensive report of PTI's 20 years of success is available online here: *Stewart, C.A. V. Welch, T.G. Doak, T. Miller, B. Plale, J.A. Walsh, M.R. Link, W. Snapp-Childs. 2019. The Pervasive Technology Institute at 20: Two decades of success and counting. (PTI Technical Report PTI-TR19-001). Indiana University* [http://hdl.handle.net/2022/22607](http://hdl.handle.net/2022/22607).

PTI involves and engages faculty members, non-tenure track academic appointees, professional staff, and students, as indicated in the table below. In this table, the large PTI

aggregate is subdivided into two components: the affiliated organizations that function as traditional R&D labs and the Research Technologies Division of UITS.

Table 1. Faculty, staff, and students affiliated with PTI.

| PTI Units & Affiliations | Academic Appointees | | | | | | Staff | | Students* | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Full / Dist. | Assoc. | Asst. | NTT | Vis./Fellows | Postdoc | Professional | Admin. | Grad | Ugrad | |
| PTI R&D Centers & Labs | | | | | | | | | | | |
| CACR | 2 | 7 | 3 | | 1 | 1 | 17 | 2 | | 1 | 34 |
| CIRC | | | | | | | 11 | | 1 | | 12 |
| CTIL | 1 | | | 1 | | | 2 | | | | 4 |
| D2I | 2 | | 1 | | 2 | | 2 | 1 | 2 | | 10 |
| eLearning Lab | 1 | | | 1 | | | | | | | 2 |
| DSC | 1 | 2 | | | 2 | | 6 | | | 10 | 21 |
| HTRC | 1 | 1 | | | 1 | | 10 | 1 | | | 14 |
| NCGAS | | | | 1 | | | 3 | | | 7 | 11 |
| PTI Exec. Dir. | | | | | | | 6.5 | 1 | | 1 | 8.5 |
| Subtotal of R&D Centers | 8 | 10 | 4 | 3 | 6 | 1 | 57.5 | 5 | 3 | 19 | 116.5 |
| | | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| UITS Divisions (majority of funding overall for services to IU) | | | | | | | | | | | |
| Research Technologies (exclusive of NCGAS) | | | | 1 | | | 88 | 1 | 6 | 5 | 101 |
| Subtotal of UITS Divisions | | | | 1 | | | 88 | 1 | 6 | 5 | 101 |
| | | | | | | | | | | | |
| Total | 8 | 10 | 4 | 4 | 6 | 1 | 145.5 | 6 | 9 | 24 | 217.5 |

*The "students" column here refers to students who have an appointment in, or ongoing relationship with, a group (e.g., their advisor is affiliated with the group; they are doing an internship, REU, or independent study with the group).

### 3.4.4 Scholarly Program

PTI engages in five major activities:

- Creating knowledge, inventing technology, and supporting creativity
- Supporting and sustaining delivery of value from new technology inventions:
    - PTI transforms new technology from "successful proof of concept" to "widely used R&D tool in academia and research."
    - PTI provides, supports, enhances, and maintains hardware and software.
- Leading or supporting the commercialization of Indiana University-developed technology
- Serving the state of Indiana
- Aiding PTI-affiliated centers, and developing new centers and areas of excellence within IU

A more extensive explanation of these activities is available online in the aforementioned report.

The activity mentioned above, which transforms new technology from "successful proof of concept" to "widely used R&D tool in academia and research," bears additional comment. One often reads about "the valley of death" between invention of a new technology and its widespread adoption. This offers a limited view, though, as pointed out in testimony given

before Parliament in the United Kingdom.[2] It is more appropriate to think of technology development as involving two valleys of death, as shown below in Figure 1.

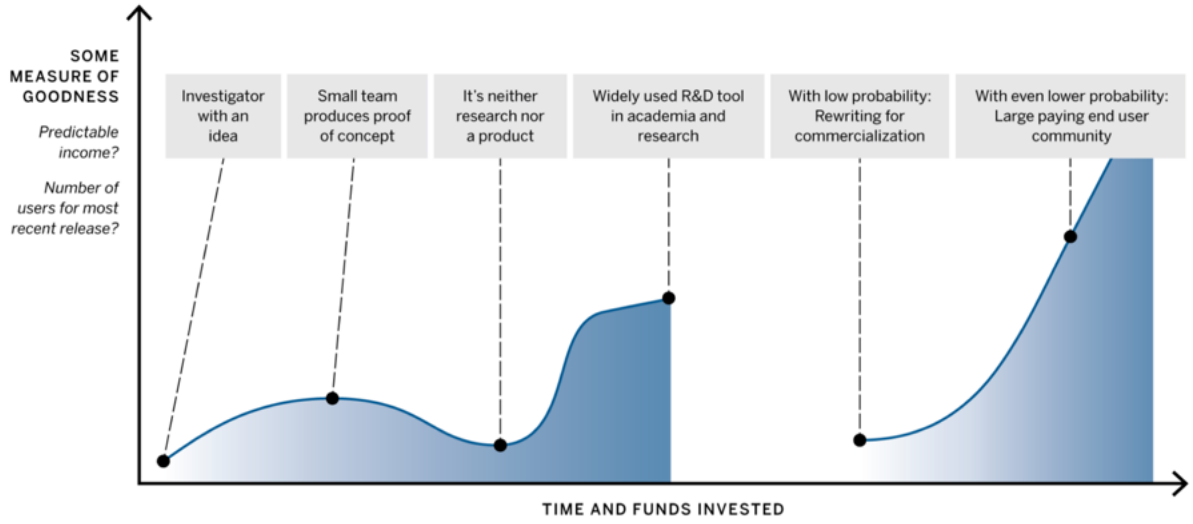



Figure 1. Two valleys of death in the life of a new technology innovation and maturation, based on a figure from a document written by the Royal Aeronautical Society.

Three of PTI's major functions relate to technology innovation and maturation and have to do with the evolution of technology along these valleys of death, as shown below in Figure 2. First, PTI creates new technologies and services. PTI spends much of its effort identifying new ideas—from Indiana University and elsewhere—and shepherding them through the first valley of death to convert them into widely-used tools and services within the academic research and development community. When appropriate, PTI also becomes directly involved in commercializing new technologies developed at Indiana University.

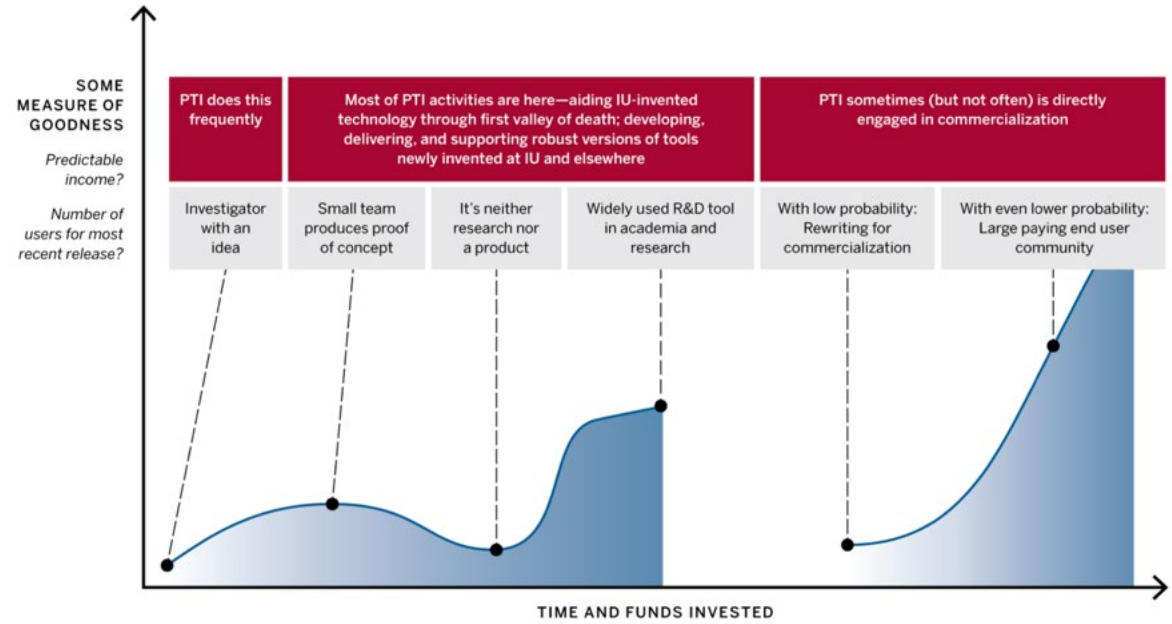



Figure 2. PTI's role in traversing the two valleys of death.

PTI's distinctive focus on transforming technology from "proof of concept" to "widely used tool" separates its mission from that of IU's academic subunits, which tend to focus on teaching or creating new discoveries. PTI's unusual blend of faculty, staff, and students, and its dependence upon external funding, guide it to identify societally important inventions within IU and to develop and harden them while promoting their adoption. This activity creates a competitive advantage for IU researchers in that innovations made here are used here first, before they are discovered by, and widely adopted at, other institutions. By supporting research interests in this way, PTI adds value to Indiana University, the state of Indiana, and the United States.
PTI is already a leader in a number of substantial national-scale efforts, including:

- Cybersecurity, through CACR's activities.
- Literary scholarship, through the research and analytics tools provided by the HathiTrust Research Center, enabling scholars to use 16 million volumes of text (11 million still protected by copyright) to do large-scale text analyses.
- Development and support of genome alignment and analysis through the National Center for Genome Analysis Support.
- Development of science gateways through CIRC's engagement in XSEDE and the NSF-funded ($5M) Science Gateway Cyberinfrastructure Center.
- NSF-funded cyberinfrastructure projects including the $13M Jetstream cloud system, and IU's leadership involvement in XSEDE ($110M total funding; $8M to IU), a national CI coordination and support organization.

This proposal will expand PTI's sustainability and scope in the following ways:

- Internally, status as a university-level institute will foster growing engagement with the Luddy School of Informatics, Computing, and Engineering, and the creation of formal ties with the IU School of Medicine, the Precision Health Initiative, and the Regenstrief Institute.
- Externally, such status will aid PTI as it expands involvement in IU's role in the state and nation, including the following endeavors:
    - Proposal preparation for operation of a Joint Hypersonics Technology Organization
    - Engagement in the private/public partnership V4I – the Virtual Verification, Validation, and Visualization Institute (V4I.us)
    - Engagement with Crane Naval Weapons Support Center (Crane NWSC) and the INdiana INovation INstitute (IN3[3])

## 3.4.5 Organizational Structure

The organizational structure of PTI has been described in general terms above; an organizational diagram is shown below:

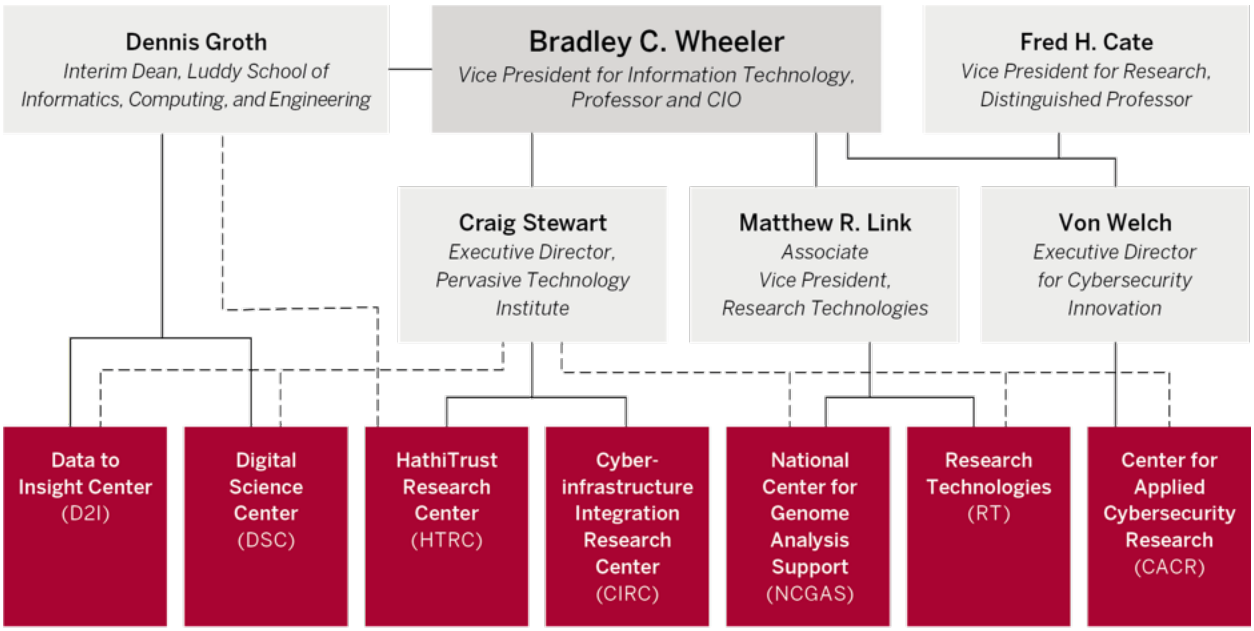


Figure 3. Organizational structure of PTI as of 1/1/2020

As PTI lacks an external advisory committee, we propose the following advisory committee with significant representation from within IU but a majority of members from outside IU:

- From outside IU, to provide objective and informed external perspectives:
  - Confirmed participants:
    - Lizanne DeStefano, Georgia Tech, https://www.ceismc.gatech.edu/about/staffdirectory/dr-lizanne-destefano
    - Ewa Deelman, Information Sciences Institute - https://deelman.isi.edu.
    - Bill Kramer, National Center for Supercomputer Applications - http://www.ncsa.illinois.edu/assets/php/directory/contact.php?contact=wkramer
    - Nancy Wilkins-Diehr - http://users.sdsc.edu/~wilkinsn/ (now retired from San Diego Supercomputer Center).
- From within IU, to promote collaborative relationships essential to PTI success:
  - Confirmed participants:
    - Jennifer Schopf, Director, International Networks, OVPIT
    - Scott Michaels, Professor and Associate Chair for Research, Department of Biology

Under current guidance from IU President McRobbie, we plan to hold this review in May via teleconference.

## 3.4.6 PTI Value Proposition and Potential for Revenue Generation

Within IU, PTI is uniquely flexible, which allows for a strategic focus on the pressing questions and issues of the moment in cyberinfrastructure and its applications. PTI's collaborative structure is also unique, spanning five responsibility centers in an environment where fiscal policies sometimes seem to present obstacles to inter-RC collaboration.

PTI is also unique nationally. Among cyberinfrastructure centers, IU ranks within the top six in the nation that receive most of their funds from the National Science Foundation. These six, in rank order, are:

1. Texas Advanced Computing Center (TACC), part of the University of Texas at Austin.
2. National Center for Supercomputer Applications (NCSA), part of the University of Illinois at Urbana-Champaign.
3. San Diego Supercomputer Center (SDSC), part of the University of California San Diego
4. Pittsburgh Supercomputing Center (PSC), now affiliated with Carnegie Mellon University and the University of Pittsburgh.
5. IU Pervasive Technology Institute.
6. The University of Southern California Information Sciences Institute (ISI).

The ranking above is based on a mix of annual budget, FTE count, grant totals, and national reputation. One could quibble about the ranking of PTI and PSC. PSC still has the more significant national reputation, but PTI has a larger overall budget, greater headcount, and more significant interaction with our home institution. Still, on the basis of reputation, in this ranking will give the nod to PSC with a note that in the coming years IU and PTI might aspire to overtake either or both of PSC or SDSC.

Of the above, the TACC, NCSA, SDSC, and PSC are viewed (and view themselves) as national supercomputing or cyberinfrastructure centers. ISI is a different sort of organization: a collection of computer science labs, each of which fends for itself in obtaining external funding.

PTI is unique in its dual focus on local service to its home university based on university funding combined with national service offered via federal funding. PTI is also unusual in having six centers that are each much like ISI's R&D units, while having a seventh (Research Technologies) that functions as a university CI center and a national CI center – like TACC, NCSA, SDSC, or PSC, but with a greater array of baseline services offered to its home institution than any of these other organizations.

### 3.4.7 Resources and Funding Requested

No new resources are requested. For reference, a summary of the budget for the past five years is included below, along with a budget projection for the next three years:

Table 2. Past and projected budgets for PTI

| Group | Average annual budget for last 5 years | | | Annual average budget projected for the next 3 years | | |
|---|---|---|---|---|---|---|
| | University support | Grants & Contracts | Total Budget Annual Average | University support | Grants & Contracts | Total Budget Annual Projected Average |

| | | | | | | |
|---|---|---|---|---|---|---|
| PTI-affiliated R&D Centers & Labs | | | | | | |
| CACR | $400,000 | $2,600,000 | $3,000,000 | $460,000 | $4,000,000 | $4,460,000 |
| CIRC | $240,000 | $1,313,098 | $1,553,098 | $340,000 | $1,400,000 | $1,740,000 |
| CTIL* | $64,216 | $120,000 | $184,216 | $67,000 | $200,000 | $267,000 |
| D2I** | $126,000 | $170,000 | $296,000 | $100,000 | $500,000 | $600,000 |
| DSC | $218,221 | $400,000 | $618,221 | $220,000 | $400,000 | $620,000 |
| eLearning Lab* | $200,586 | $91,000 | $285,586 | $210,000 | $105,000 | $315,000 |
| HTRC | $277,000 | $382,000 | $659,000 | $506,000 | $665,000 | $1,171,000 |
| NCGAS | $940,622 | $3,972,807 | $4,913,429 | $941,000 | $500,000 | $1,441,000 |
| Ex Dir | $345,000 | $1,119,365 | $1,464,365 | $350,000 | $1,500,000 | $1,850,000 |
| Subtotal of R&D Centers | $2,811,645 | $10,168,270 | $12,979,915 | $3,194,000 | $9,270,000 | $12,464,000 |
| | | | | | | |
| UITS Divisions (majority of funding overall for services to IU) | | | | | | |
| Research Technologies (exclusive of NCGAS)*** | $51,076,264 | $9,625,961 | $60,702,225 | $36,231,824 | $12,500,000 | $48,731,824 |
| Subtotal of UITS Divisions | $51,076,264 | $9,625,961 | $60,702,225 | $36,231,824 | $12,500,000 | $48,731,824 |
| | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total | $53,887,909 | $19,794,231 | $73,682,140 | $39,425,824 | $21,770,000 | $61,195,824 |

*Budget for FY20 only; D2I is currently at a purposefully low level of activity while Director Beth Plale has been on rotation at the National Science Foundation.
**Past 3 years under interim leadership as Dr. Plale has been on rotation at the National Science Foundation.
***RT grants include several for which Stewart is or was PI but the work was mostly done in RT (Wrangler, OSG subcontracts, Jetstream).

OVPIT will retain overall fiscal responsibility for PTI's central organizing functions, and administrative management of PTI (but not particular centers that may be part of another RC and affiliated with PTI).

Practices regarding distribution of Facilities and Administration returns will be handled per OVPIT existing policy, as set out in the document "F&A distribution between OVPIT and other IU Responsibility Centers" dated 20 April 2020, itself a subset of a policy that was approved within OVPIT prior to the end of FY2019, included in this document as Appendix 1. The summary of this policy and practice is that in general, distribution of F&A return follows the work done to generate the F&A return and such funds are handled within the Responsibility Center where the F&A return funds are generated. This policy also recognizes that this is an area in which flexibility is essential and exceptions are expected (but they are expected to be proposed and approved before enacted in the form of a budget behind a proposal that is submitted).

Appendix 2 summarizes existing understandings and practices regarding grant collaborations between OVPIT and the Luddy School of Informatics, particularly as regards selection of Principal Investigators, routing of proposals, and accounting of grant income for purposes of reporting accomplishments outside of IU.

## 3.4.8 Strategic Goals and Metrics of Success

To gain a sense of the IU faculty's general awareness of PTI, we are contracting with the IU Center for Survey Research to do a brief survey this spring. This survey will be done online, assessing awareness among faculty on the Bloomington and Indianapolis campuses, particularly those in the College of Arts and Sciences, the School of Informatics, Computing, and Engineering, and the School of Medicine. The aim of the assessment is to gauge awareness of the Pervasive Technology Institute and its associated centers, as well as to identify those faculty members with research, education, and/or outreach projects on which we may partner in the future. To protect confidentiality, the survey will be administered by the IU Center for Survey Research and conducted under the auspices of the Indiana University Institutional Review Board; collected data will be available to Advisory Board members in advance of its inaugural meeting in May.

### 3.4.9 Support from Relevant University Leaders

This proposal is endorsed by:

- Consensus support of PTI center directors
- Brad Wheeler, Vice President for Information Technology and CIO
- Kay Connelly, Associate Dean for Research, Luddy School of Informatics, Computing, and Engineering

### 3.4.10 Proposal by

This proposal is submitted by:

- Craig A. Stewart, Executive Director, Pervasive Technology Institute; Adjunct Professor, Department of Computer Science, Luddy School of Informatics, Computing, and Engineering, Department of Biology, College of Arts and Sciences, Department of Medical and Molecular Genetics, School of Medicine

### 3.4.11 Appendix 1: F&A distribution between OVPIT and other IU Responsibility Centers

Policy as previously approved, updated on 20 April 2020 by deleting references to issues specific to budget construction for FY 2019 and distribution of F&A within OVPIT
Problem Statement
At one point almost all distribution of Facilities and Administration monies that had something to do with PTI either went into a pooled RT and PTI joint account or a CACR account. Distribution between OVPIT and other RCs (Responsibility Centers) was generally limited to exchanges between OVPIT and the Luddy School of Informatics, Computing, and Engineering. These exchanges were governed by a memorandum of agreement between OVPIT and that School. These situations no longer hold:

- PTI-affiliated centers within OVPIT are involved with many collaborative grants and many RCs.
- A former Dean of what was then called SOIC terminated the MOU that once governed distribution of F&A between OVPIT and the Luddy School (using today's terminology).
- It is no longer organizationally appropriate to have F&A pooled across RT and other parts of PTI.

Practice as approved prior to the end of FY 2019 and beyond
F&A Distribution between OVPIT and other RCs:
When a grant award spans multiple subunits of OVPIT, or multiple RCs, then the following will hold true overall:

- ***Award management.*** The entire grant award budget will be managed by the OVPIT FO unless another arrangement is approved in advance via a preproposal to relevant to the FO and RT, PTI, or CACR leadership.
- ***Timing.*** Distribution will be made (or expected) once per quarter, and allocations of F&A to various recipients will be based on budgeted amounts rather than actuals.
- ***"Advances" on F&A return or exceptions to 50-50 distribution within OVPIT.*** There may be times when some variation of the standard algorithm is appropriate. For example, in large hardware acquisition proposals it may be essential for proposal

competitiveness to request that more than 50% of the F&A return to OVPIT be transferred to a PTI affiliated group. In the case of very large NSF system acquisition proposals, it may well be essential to competitiveness to devote all of the F&A return to OVPIT to the project budget. In this case, OVPIT benefits less financially but OVPIT benefits not at all from proposals that are submitted and not competitive and not funded. In addition, in some cases a PI or project team may want to "borrow against" F&A returns expected in the future. In all such cases an internal proposal must be submitted and approved by the relevant authorities within (and if appropriate beyond) OVPIT.

The policies and processes for management of grant accounts distribution of F&A return will be in general as follows:

- Management of F&A return funds when there is an OVPIT PI and "internal to IU subcontractors" in other RCs
    - When a staff member with an appointment in an RC and has their workspace and personal productivity equipment provided by that RC, then the F&A return forthcoming for the work of that staff member will be sent to that RC's Finance Office for distribution in compliance with that RC's policies and practices.
    - When a staff member has an appointment in one RC and space/personal equipment provided in another RC, the F&A associated with that staff member is divided equally between two such RCs. F&A accrual to RCs other than OVPIT will be distributed to the FOs of the relevant RCs to be distributed in accordance with the policies of that RC.
- Management of F&A return funds when there is a PI external to OVPIT and expenses that are F&A bearing within OVPIT (or expenses that would be F&A bearing if they were included in a grant award budget)
    - OVPIT will receive the F&A return generated from the work of staff with an OVPIT appointment and workspace / personal productivity tools provided by OVPIT.
    - If the lead RC places OVPIT expenses on some form of expense on a source of money other than the formal grant budget, then OVPIT will still receive funds equivalent to what OVPIT would receive were all expenses budgeted on a formal grant budget.[4]
    - If provision of workspace and appointments are not both held by OVPIT, then OVPIT receives half of the F&A return generated from the work of such staff. Examples would be a staff member in an OVPIT line but housed in space of another RC, or vice versa.
- *Distribution of F&A return is unaffected by the RC with which the PI is affiliated.* In other words, no venue shopping to maximize F&A return to a PI. This is a simple deduction from the above.

The above algorithm is designed to promote fairness to all parties involved in execution of grant funded activities and to provide individual and organizational rewards for successful acquisition of grants.

Those issues not addressed in this proposal

Those issues not addressed in this proposal are … simply not addressed here. In particular, distribution of F&A in partnerships within OVPIT subunits not affiliated with PTI are not constrained by this proposal. This proposal may serve as conceptual guidance but is not binding in terms of guiding such collaborations. Collaborations of this form are likely best handled by an internal proposal defining arrangements prior to submission of a proposal.

Similarly, this document sets out general policies and practices. When a particular task requires a different approach, it can be set out and approved by relevant authorities via an internal proposal.
Implementation Planning and Timelines
This policy took effect as of 7/1/2019
Policy proposed by
Craig A. Stewart
Matthew R. Link
Therese Miller

Endorsed by
Von Welch, CACR Director, and Leslee Bohland, CACR Administrative Director
Marlon Pierce, Director, Science Gateway Research Center

## 3.4.12 Appendix 2: A short summary of existing practices and understandings regarding grant collaborations between OVPIT and the Luddy School of Informatics, Computing, and Engineering

The below statements are drawn from earlier MOUs and agreements between OVPIT and the Luddy School of Informatics, Computing, and Engineering. These agreements were made formally at the time the latter school was known as the School of Informatics and Computing. While no longer embodied within up-to-date Memoranda of Understanding but the following remains practice as regards collaboration between OVPIT and Luddy from OVPIT's standpoint:

- PIs should be chosen in whatever fashion creates the strongest proposal. In cases where the PI has only one appointment (either Luddy or OVPIT) then the proposal is routed through the organization that constitutes the PI's organizational home. In cases of PIs with joint appointments the proposal will be routed in whatever way seems to make for the strongest possible overall proposal. For example, routing through Luddy will in general present the strongest overall proposal for basic computer science research. Routing a proposal through OVPIT may make for the stronger approach for a proposal for a widely used cyberinfrastructure facility.
- Current practice regarding reporting of grant income will remain as it is: ALL grant income to any PI, Co-PI, or SI in OVPIT with any sort of appointment in Luddy will be reported through DMAI (Digital Measures – Activity Insights) as a Luddy accomplishment. This will maximize Luddy's total grant income and expenditures and optimize these measures which are commonly used in ranking Schools. (Such measures are generally irrelevant to rankings of IT organizations).

## 3.4.13 Appendix 3: Proposal for external review of the Pervasive Technology Institute (pti.iu.edu)

Original Proposal 4 December 2019; Revised most recently 1 May 2020
Problem Statement
This proposal is one of two related to securing the future of PTI within IU and as an asset to the state of Indiana for the foreseeable future. The topics of these two proposals are as follows:

- **Bringing PTI into compliance with IU Policy RP-11-002** (Establishment of Centers and Institutes - https://policies.iu.edu/policies/rp-11-002-establishment-centers-institutes/index.html). This policy identifies a categorization of centers and institutes within IU, and was created after PTI was established. With a turnover in IU leadership expected, it seems prudent to take steps to bring PTI into compliance with this policy. We have thus drafted a proposal to establish PTI as a "university-level" institute with management, operations, and funding delegated to OVPIT.
- **Executing a five year review for PTI.** The IU policy on Centers and Institutes (Policy RP-11- https://policies.iu.edu/policies/rp-11-002-establishment-centers-institutes/index.html)

makes clear that such entities should be formally reviewed once every five years. Such an external review for the Pervasive Technology Institute the topic of this proposal.

IU Policy established in 2011 calls for all institutes to have an external review once every five years. PTI has never had a typical external review involving a group of faculty experts from outside Indiana University. One could, perhaps over generously, consider the proposal to the Lilly Endowment, Inc. that resulted in 2nd round funding from the Endowment to have consisted of some form of review. One could also consider the 2014 final report to the Lilly Endowment to constitute an external review of PTI (available online[5]). PTI is thus as of the revision of this proposal slightly overdue for an external review. Technically, we might be able to request a three-year window within which to do such a review, but PTI has existed now for over 20 years without ever having a formal external review or committee of visitors in the usual academic sense and it is past time so to do. We are also at a critical point in PTI's history, in that in the foreseeable future, and for the first time since the creation of the original Pervasive Technology Labs, IU will have a President who was not the Principal investigator on the two grant awards from the Lilly Endowment that initial created the Pervasive Technology Labs (1999) and then supported the evolution of those lags into the Pervasive Technology Institute in 2008. There is widespread agreement within the leadership of PTI that an external review is useful at this point, particularly to help suggest directions PTI should take to be viewed within and without IU as being effective and a benefit to the University.

A critical point is that the entity being reviewed is the Pervasive Technology Institute, not PTI plus each of the affiliated centers. The various centers have a variety of primary reporting lines (e.g., two report primarily to the Luddy School of Informatics, Computing, and Engineering). Therefore, independent of this proposal, each center will consider how best to proceed regarding its review process in the future. Of the centers and labs now affiliated with PTI, the following have a clear and established status:

- The Center for Applied Cybersecurity Research (CACR) is a VPR-approved university-level center, led by Von Welch.
- The Digital Science Center (DSC) is a school-level center within the Luddy School of Informatics, Computing, and Engineering, led by Distinguished Professor Geoffrey C. Fox.
- The National Center for Genome Analysis Support (NCGAS) is a management unit of the Research Technologies Division of UITS, which derives its "center" name from the name used in a now series of grant awards from the NSF that constitutes the core financial support for NCGAS longstanding (3 awards over 8 year). NCGAS is led by Dr. Thomas Doak, with a leadership team (Co-PIs). It has the unusual status of being

primarily funded by external (NSF) grants. It is the only management unit within RT that gets just a minority of its funding from IU sources.
- RT (Research Technologies) is a division of University Information Technology Services.

The following groups do not yet have a status clarified through VPR processes called for in IU Policy RP-11-002. A useful thing to do in the "three year window" after a review of PTI that is often afforded new institutes might be to specify this as a time for each of the following can clarify their status through VPR action on proposals as called for in this policy:

- CyberInfrastructure Research Center (CIRC). CIRC is led by Dr. Marlon Pierce, and it reports directly to PTI Executive Director Craig Stewart.
- Crisis Technologies Innovation Lab (CTIL). CTIL is a new lab, formally within OVPIT a lab affiliated with CIRC. It is led by Associate Professor David Wild of the Luddy School, and Robert Henschel and Matthew Link of OVPIT.
- Data to Insight (D2I) Center. This Center evolved out of other labs and was established as a Center as part of the 2008 round of funding from the Lilly Endowment. It is led by Luddy School Professor Beth Plale, the Michael A. and Laurie Burns McRobbie Bicentennial Professor of Computer Engineering. Professor Plale has been on rotation at the National Science Foundation for just under three years. She will return to full time activities within IU in summer of 2020.
- eLearning and Discovery Lab. eLearning is another new lab recently created within PTI, and it is formally a lab of D2I. It is led by Ben Motz, who has appointments within OVPIT and the Department of Psychology and Brain Sciences. Dr. Motz is NTT faculty (research scientist).
- Hathi Trust Research Center (HTRC). HTRC is led by Luddy School Associate Professor John Walsh. All of the staff of HTRC hold appointments within OVPIT. Matching monies in support of the primary grant funding for HTRC comes primarily from OVPIT, and secondarily from the Bloomington Libraries.

Recommendations

Objectives for an External Review

PTI does not greatly need an external review to confirm that it is producing excellent scientific results and software, graduating lots of students, and bringing in lots of money. We have plenty of metrics and reports to show that, but an external review to confirm that still has merit.

However, an external review would provide useful advice and expertise from outside IU on the following topics:

- Sustainability strategies, particularly related to how PTI is helping each center attain its respective mission and goals
- The amount of local support PTI-affiliated centers receive from IU (which, I think, many involved in PTI believe to be too low)
- PTI's strategies related to funding from
    - Private sector grants and contracts
    - Private sector philanthropy including foundations
    - Advice on DOD and DOE funding strategies
- AI integration
- New opportunities in areas other than AI
- Commentary on and critique of our written strategic plans

While PTI could perhaps request a time period of years in which to do an external review, the time is right. PTI is, after all, more than 20 years old and has never had a traditional academic external review. The status of three of the organizations affiliated with PTI is clear already. CACR is a university-wide center, as approved in 2019 by VPR. RT is, technically, a Division of UITS. NCGAS is organizationally a management unit within RT, although

It seems appropriate to have this initial external review performed by the PTI Advisory Board identified in the associated proposal to identify PTI as a university-level institute, supplemented by a minority of experts from within IU. The proposed members of this advisory board drawn from outside IU are as follows:

- Chair: Lizanne DeStefano, Georgia Tech (https://www.ceismc.gatech.edu/about/staffdirectory/dr-lizanne-destefano). Dr. DeStefano is Professor of Psychology, and the Executive Director of the Center for Education Integrating Science, Mathematics, & Computing (CEISMC) at Georgia Institute of Technology. She has done (and been funded to do) more evaluations of cyberinfrastructure organizations than any other person working in open (unclassified) research. She is funded to evaluate the following existing programs: the Georgia Tech Center for Brains, Minds, and Machines (CBMM), the NSF-funded Emergent Behaviors of Integrated Cellular Systems Science and Technology Center, Center for Sustainable Nanotechnology, XSEDE (Extreme Science and Engineering Discovery Environment), and the Blue Waters educational program.
- Ewa Deelman (https://deelman.isi.edu). Dr. Deelman is Research Professor and Research Director at the USC Information Sciences Institute (ISI) and a Fellow of AAAS and IEEE. She is an expert in distributed computing, and has sustained her own research group for now more than a decade at ISI. She has keen insight into ISI's sustainability strategies and regularly serves on NSF advisory committees and review panels.
- Bill Kramer (www.ncsa.illinois.edu/assets/php/directory/contact.php?contact=wkramer). Dr. Kramer is the Senior Associate Director for the Blue Waters Project Office at the National Center for Supercomputer Applications at the University of Illinois, Urbana-Champaign. He was the PI for the NSF grant to create Blue Waters, at one point the fastest unclassified supercomputer in the world. He has worked at NCSA for more than a decade, and recently turned down an offer to head up the Pittsburgh Supercomputer Center. As such, he has insights about the finances, operations, and sustainability of two of the most long standing supercomputer centers in the US.
- Nancy Wilkins-Diehr (http://users.sdsc.edu/~wilkinsn/). Dr. Diehr is now retired from decades of leadership at the San Diego Supercomputer Center. She was formerly the PI for the Science Gateways Community Institute and a co-PI for XSEDE. She has extensive knowledge of SDSC's sustainability strategies, and she is a leader nationally and internationally in the area of science gateways, where CIRC does most of its funded research.

Two members of the IU community (a minority of the committee as a whole) will be included in this review:

- Professor Scott Michaels (College / Department of Biology, https://biology.indiana.edu/about/faculty/michaels-scott.html). Professor Michaels is a former collaborator with NCGAS, and has himself led the Center for Genomics and Bioinformatics. He is extremely well positioned to speak to (and serve as a resource

for the review panel) on matters of successfully operating a sustained research center within IU.
- Jennifer Schopf (OVPIT, https://it.iu.edu/structure/bios/jmschopf). Dr. Schopf is the Director, International Networking within the Networks Division of UITS, and PI and Director of the NSF-funded Engagement and Performance Operations Center (EPOC). Dr. Schopf is also the PI of all of IU's current NSF grant awards to operate international networks. She was formerly on staff at the NSF. Dr. Schopf is one of the three people within OVPIT most successful in obtaining funding from the NSF, and has keen insight about NSF strategies. She is not formally affiliated with PTI, and never has been.

The review panel collectively is majority women, and the external reviewers are almost all women. Collectively they represent people with leadership knowledge of four of the nation's leading cyberinfrastructure and supercomputer centers: NCSA, PSC, SDSC, and ISI. They also have expertise in most of the areas of research in which PTI is involved. There are no cybersecurity experts involved in this panel, intentionally. With CACR already approved as a university-level Center, it has its own review processes established and among PTI-affiliated centers also has the best current sustainability plan.

Consistent with current guidance from IU President McRobbie, this review will be held by teleconference, and will be controlled by a moderator other than the review participants so that review participants can pay full attention to the day's activities.

We propose the preparation of four sets of briefing materials for the external review committee: one set of materials prepared collectively by the leadership of PTI, one report created by the Center for Survey Research, and one document written by PTI Executive Director

Materials to be prepared collectively by PTI leadership, or which already exist and are published:
- A charge document with agenda
- A revised version of The Pervasive Technology Institute at 20: Two decades of success and counting (http://hdl.handle.net/2022/22607)
- Application - IU PTI University Level Institute_2020_apr_20_FINAL_REV7 (Application for the IU Pervasive Technology Institute to be categorized as a "university level" institute with fiscal and management authority retained by OVPIT.) This document includes as an appendix the current policies for distribution of facilities & administration funds returns for OVPIT.
- The Pervasive Technology Institute at 20: Two decades of success and counting. Penultimate copy before posting final.
- *Final Report to Lilly Endowment Inc. Indiana University Pervasive Technology Institute.* 8/31/2014, Michael A. McRobbie (although actually mostly written by Beth Plale). Also available from http://hdl.handle.net/2022/19787

Materials to be prepared by Center for Survey Research:
- Survey of IU faculty to determine amount of awareness and utilization of PTI and PTI-affiliated centers

Materials to be prepared by each center and separately for the two newest labs:

- A PowerPoint deck consisting of three slides: one highlighting past successes, one highlighting current activities, and one highlighting future plans.

Schedule
The review has long been scheduled on May 13, 14, and 15. When guidance from President McRobbie and common sense both dictated that the review be held virtually, we based on experiences to date with teleconferencing decided to increase the amount of written materials provided in advance, and shorten the actual scheduled time for the review.

Please see section 3.2.1 above.

Implementation Planning and Timelines
Timeline:
- Stewart: Submit proposed names of external advisory board members to VP Wheeler. (done)
- VP Wheeler approves proposal (done)
- Stewart: Invite EAB members as soon as the invitee list is approved by VP Wheeler. Include individual targets for dates and draft charge statement for external review. (Done)
- Circulate "PTI as a University-level Institute" proposal for PTI to Luddy Associate Dean for Research Kay Connelly (done), VP Brad Wheeler (done), Luddy Dean Dennis Groth (in process).
- Turn over materials prepared in advance to the review panel (scheduled for 4 May).

Stakeholders, expected outcomes, Key Performance Indicators (KPI)
Stakeholders:
- PTI leadership
- OVPIT leadership
- Luddy School of Informatics, Computing, and Engineering leadership
- Luddy School faculty as a whole (in the sense that they might generally benefit from more information about what PTI is and what DSC, D2I, and HTRC are doing)
- Faculty of the College of Arts and Sciences
- Research faculty of the IU School of Medicine

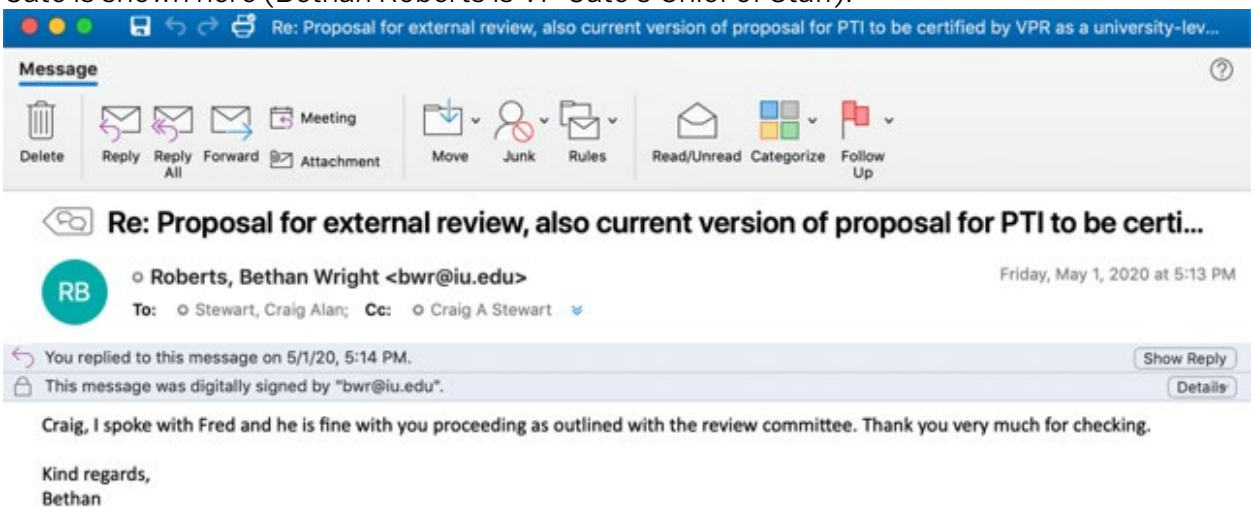
KPIs:
- Whether or not the PTI center directors find an external review useful
- Whether or not Luddy School and OVPIT leadership find the external review useful

Funding detail
We have the funding needed to support this activity.

Policy Implications
This proposal will enable PTI to stay compliant with IU policies regarding institutes.

Proposal by
Craig Stewart, Executive Director, Pervasive Technology Institute
Robert Ping, Manager, Education, Outreach, & Training; Research Technologies & Pervasive Technology Institute at Indiana University

Approval by Vice President for Research
Per IU Policy RP-11-002, approval of the makeup of a review committee by the Vice President for Research is required in advance of a review. Such approval by IU VP for Research Fred Cate is shown here (Bethan Roberts is VP Cate's Chief of Staff):




[1] https://policies.iu.edu/policies/rp-11-002-establishment-centers-institutes/index.html
[2] Royal Aeronautical Society. (2012). *Written evidence submitted by Royal Aeronautical Society*. https://publications.parliament.uk/pa/cm201213/cmselect/cmsctech/348/348we03.htm
[3] http://in3indiana.com
[4] In other words, an RC that subcontracts to OVPIT does not escape paying the equivalent of appropriate F&A funds to OVPIT by putting the expenses of OVPIT effort on internal matching funds or so other non-grant source, and saying "here, you get 100% of nothing because your expenses generated no F&A because they are not on the grant budget." This is a correction of a prior oversight, once exploited by an RC other than OVPIT.
[5] McRobbie, M.A. 2014. Final Report to Lilly Endowment Inc. Indiana University Pervasive Technology Institute. Indiana University. http://hdl.handle.net/2022/19787

## 3.5 The Indiana Pervasive Technology Institute at 20: Two decades of success and counting

Available from http://hdl.handle.net/2022/22607.

## 3.6 Data: Survey of IU faculty to determine amount of awareness and utilization of PTI and PTI-affiliated centers

Overall Awareness

| Are you aware of the Pervasive Technology Institute? | | |
|---|---|---|
| Response | Number of responses (N=146) | Percentage of N |
| Yes | 48 | 33% |
| No | 98 | 67% |
| Total | 146 | 1.00 |

Overall Impression

| What is your overall impression of the Indiana University Pervasive Technology Institute and its associated Centers and Labs? (N=47) | | |
|---|---|---|
| | Number of responses | Percentage of N (47) |
| Very Unfavorable | 1 | 0.02 |
| Somewhat Unfavorable | 2 | 0.04 |
| Indifferent | 5 | 0.11 |
| Somewhat Favorable | 13 | 0.28 |
| Very Favorable | 14 | 0.30 |
| No Impression | 12 | 0.26 |
| Not answered | 1 | 1.00 |
| Total | 48 | |

| Mean Impression | Very Unfavorable | Somewhat Unfavorable | Indifferent | Somewhat Favorable | Very Favorable | No Impression/Did not answer | Valid responses |
|---|---|---|---|---|---|---|---|
| 4.06 | 1 | 2 | 5 | 13 | 14 | 13 | 35 |
| | 0.03 | 0.06 | 0.14 | 0.37 | 0.40 | | |

Interest in Future Engagement

| Center Name | Interest in learning more/engaging further wi/ PTI Centers/Labs as either a client or research collaborator? |
|---|---|
| Center for Applied Cybersecurity Research (CACR) | 27 |
| Crisis Technology Innovation Lab (CTIL) | 31 |
| Cyberinfrastructure Integration Research Center (CIRC) | 37 |
| Data to Insight Center (D2I) | 39 |
| Digital Science Center (DSC) | 38 |
| E-Learning Lab | 52 |
| HathiTrust Research Center (HTRC) | 31 |
| National Center for Genome Analysis Support (NCGAS) | 28 |
| Research Technologies (part of UITS) | 76 |

Awareness by lab or center

| With which of PTI's Centers or Labs... (Select all that apply) | | | | | | |
|---|---|---|---|---|---|---|
| Center/Lab name | Are you familiar? (N= 48) | Percentage of N | have you collaborated as part of your research or teaching activities? (N=40) | Percentage of N | have you collaborated as part of your research or teaching activities? (N=40) | Percentage of N |
| Center for Applied Cybersecurity Research (CACR) | 18 | 0.38 | 5 | 0.13 | 2 | 0.050 |
| Crisis Technology Innovation Lab (CTIL) | 2 | 0.04 | 0 | 0.00 | 0 | 0.000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Cyberinfrastructure Integration Research Center (CIRC) | 5 | 0.10 | 0 | 0.00 | 0 | 0.000 |
| Data to Insight Center (D2I) | 8 | 0.17 | 3 | 0.08 | 0 | 0.000 |
| Digital Science Center (DSC) | 6 | 0.13 | 4 | 0.10 | 0 | 0.000 |
| E-Learning Lab | 6 | 0.13 | 1 | 0.03 | 0 | 0.000 |
| HathiTrust Research Center (HTRC) | 16 | 0.33 | 6 | 0.15 | 0 | 0.000 |
| National Center for Genome Analysis Support (NCGAS) | 4 | 0.08 | 0 | 0.00 | 0 | 0.000 |
| Research Technologies (part of UITS) | 26 | 0.54 | 15 | 0.38 | 14 | 0.350 |
| None of the above | 8 | 0.17 | 17 | 0.43 | 21 | 0.525 |
| No response | 0 | 0.00 | 1 | 0.03 | 3 | 0.075 |

Open-ended comments (unredacted)

| Please share any comments about your impressions, experiences, and/or potential opportunities for collaboration with the Pervasive Technology Institute. |
|---|
| At this point, I am not exactly sure how (or in what ways) I can benefit from working with the Pervasive Technology Institute. There are several areas of the institute that I am interested in learning more about, but I think I can do that (more or less) from spending some time online. After doing so, I will follow-up if I see a strategic opportunity to partner with the institution. |
| Do you think there are already too much informative technologies out there? |
| Even from the questions/statements, the lack of clarity and use of jargon makes it very difficult to identity what PTI is or does. I could not offer a "yes or no" response because the question was lacking substance. |

| |
|---|
| Frankly, I'm not sure of the potential opportunities. |
| Great resources that are truly unique to IU--we can truly argue that our work is not limited by our compute resources! This has been a strength for our research and our research proposals. We could use more software engineering help now and again (hire part time??) |
| Have not worked with PTI before. |
| Hope there would be more collaborations across campuses particularly between IUB and IUPUI. |
| I am excited to see what this offers to enhance my work. |
| I appreciate the support that the Pervasive Technology Institute offers faculty. Unfortunately, now is not a good time to schedule a consultation or even learn more about available services. |
| I don’t have any. |
| I don't know enough to have these comments. This is the first that I'm hearing about these groups. |
| I don't necessarily know when I have engaged with the Institute: I have occasionally asked questions within the domain of Research Technologies, but and have heard about some work, but personal interaction is very limited |
| I had no idea of the resources. Like most things at IU the communication is not at the level one needs to build a vibrant interactive faculty. I would take a hard look at the individuals who are in leadership positions at IU and question why they are no versed in what the faculty are working on and what the needs are of the faculty. |
| I have been a faculty member of the IU School of Medicine for over 30 years and never knew your institute existed. |
| I have been aware of some of the things that PTI is doing, just not aware of the name. I do not know what I would have to offer PTI, but I always enjoy working with computers and seeing what they can do for faculty/health and helping them do more or making life easier for them. |
| I have not heard of the Pervasive Technology Institute previously. From what I read in the short descriptions of the Institute's components, I see potential utility for collaborations. |

| |
|---|
| I have very limited impressions or potential opportunities as this is my initial introduction to the Institute. |
| I heard of the Pervasive Technology Institute but have no idea what it's about. Hopefully, following this assessment, more information can be distributed about the institute's mission and past accomplishments. |
| I know it exists, but I have had no formal interactions with the Institute. |
| I know nothing about this. |
| I never heard of it. My work must not overlap with the work of the institute |
| I really have no idea what this is. |
| I really seem to have no direct link with the work done in this Institute at this time. |
| I would be interested in collaborations across my field of education within and through creativity, imagination and play via the Arts especially as it would seek to explore notions of consciousness and learning. |
| I'd like to learn more about conjoining humanities studies (literary studies, cultural studies, philosophy, ethnomusicology, African and African American Studies) with digital learning, cyber-infrastructure, and the development of digital tools for environmental and medical crises. |
| in the face of the COVID19 pandemic, I would be interested to see if the institute could assist with secure online learning opportunities for instructors and students. |
| It is very exciting to learn about this Institute. The Technical Communication program would be well suited to collaborate. I look forward to learning more about these excellent opportunities. |
| It might be helpful if information about the PTI were more readily available, or even possibly advertised. |
| IU tech is failing utterly during the transition to online teaching. Every day I am getting another notification about a system that has failed due to "unprecedented demand." Seriously???? No one foresaw this? Isn't that your job? Money has been wasted, UITS has failed to prepare, even given two weeks and more of lead time. IU needs to seriously |

| |
|---|
| reconsider investments in tech, especially educational tech, because the technology is almost entirely useless at the time it is needed most. |
| My primary interest is in developing theory and practical tools to facilitate thinking about internet regulation and freedom in a global context, including human rights and security challenges. |
| My research is not that close to the focus of the Pervasive Technology Institute, but my general impression is that good work is done under the umbrella of the institute. I work on the transmission of narratives in the modern word, including on large scales via social media. So far, my work is mostly experimental (via surveys) and I have less experience with large data. It may be too early for a full collaboration. |
| none |
| None |
| potential collaborative efforts could include predictive models for patient outcomes in traumatic brain injury or cancer |
| Tends to focus a lot of resources on a very small percentage of the faculty. Does not actually try to address the more mundane needs, which affect many more people. Thus, we end up with overbuilt over-costly technology (think of a data storage system that costs 1000+ dollars/terabyte. |
| Thank you for realizing that wanting more information is not the same as planning to do research with any of these. I am a grad program director - I need to know about this stuff to do my job. But I need surface to mid-depth information only. I do not need to become an expert. |
| The take resources. The faculty and staff involved are not team players. Avoid at all costs. |
| This seems very high end, requiring considerable training, far beyond what I ordinarily have time for, and certainly now amid pandemic crisis and indefinite economic recession. |
| To the extent that PTI is centered on the IUB campus, I am less likely to think about it and to reach out looking for services and collaboration. In other words, I'm work likely to work with IUPUI people. |

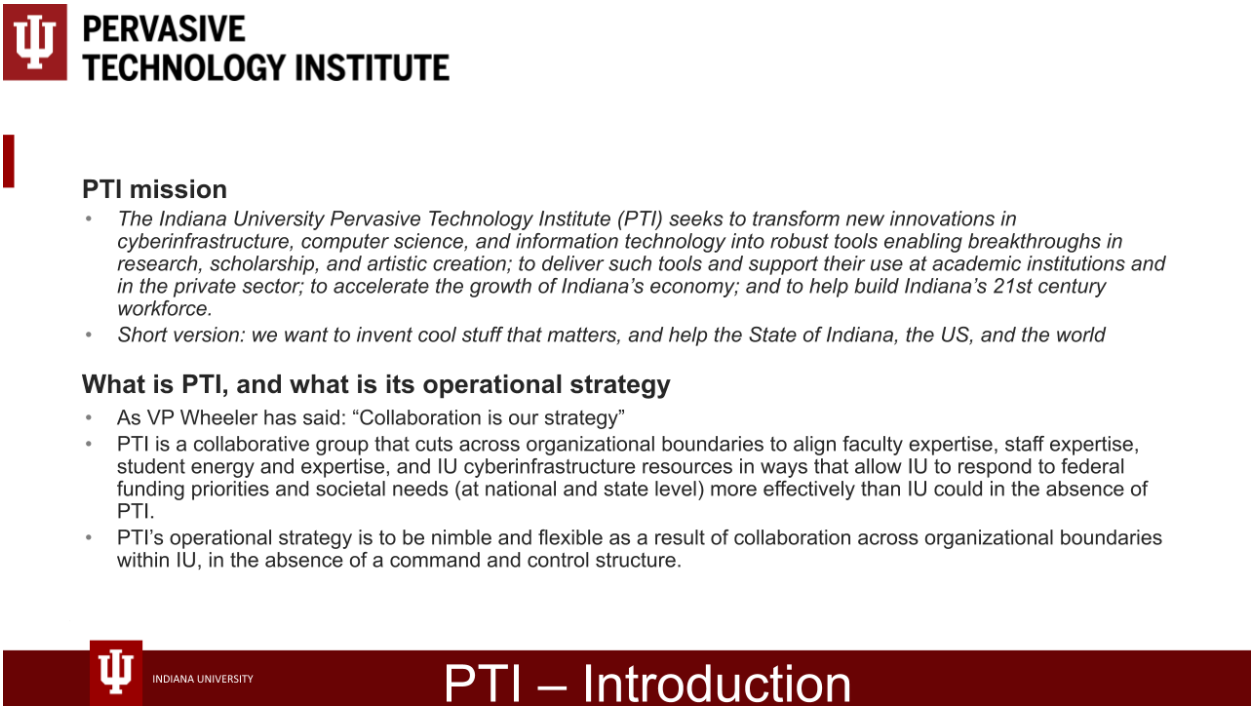
Response Rate by School

| School* | Number of responses | Response Rate (RR2) |
|---|---|---|

| | | |
|---|---|---|
| ARTS & SCIENCES (IUB) | 46 | 10.50% |
| IU SCHOOL OF MEDICINE (IUPUI) | 23 | 5.90% |
| LUDDY SCHOOL OF INFO COMP & EN (IUB) | 16 | 15.50% |
| IUPUI SCHOOL OF SCIENCE (IUPUI) | 10 | 8.40% |
| | | |
| *Response rates are calculated for schools with a least 10 responses | | |

# 4. Slides presented by PTI leaders during the review

## 4.1 Introduction



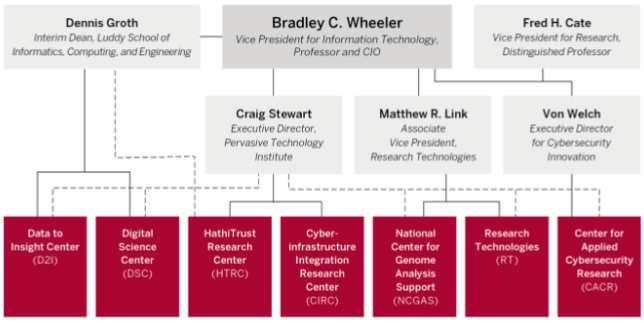
**PERVASIVE TECHNOLOGY INSTITUTE**

**Established:** 1999

**Executive Director**
Craig A. Stewart

## Leadership and key personnel:

- Fundamental organizational unit of PTI is the Center. Centers generally consist of multiple labs or subgroups
- Leaders:
  - 7 Center Directors (*and Associate Directors of PTI*)
  - 2 Directors of Labs intending toward Center Status
  - 1 Executive Director
- 6 R&D Centers, 1 Computing Center Division that does significant amounts of R&D




**Academic unit affiliations:**

- Luddy School of Informatics, Computing, and Engineering *(hereafter the Luddy School)*
- College of Arts and Sciences
- Maurer School of Law
- Kelley School of Business
- Office of the VP for IT (OVPIT)
- Office of the VP for Research (OVPR)

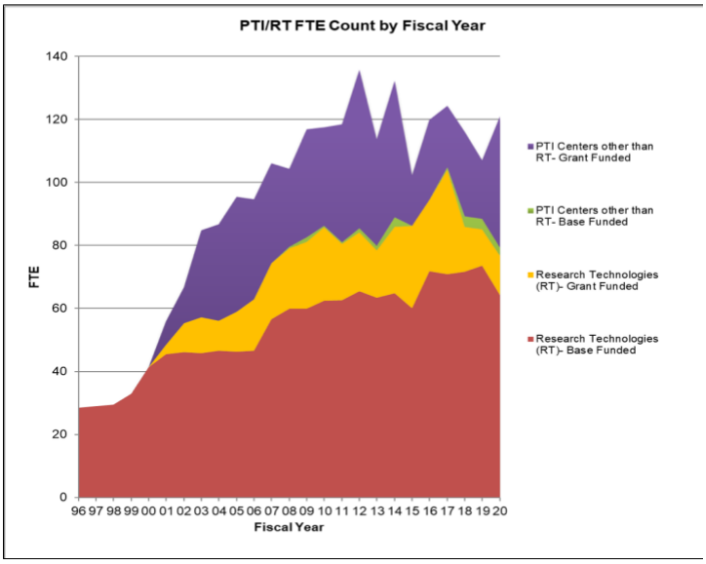
INDIANA UNIVERSITY

# PTI – Organization

**PERVASIVE TECHNOLOGY INSTITUTE**

## Key PTI stats over 20 years

- **1,287 peer-reviewed technical publications** (1,468 total technical reports)
- **$136,327,753 in extramural grant awardsand contracts received**
- 1,804 outreach events; **104,338 total attendees at outreach events** (since 2011-ish)
- **Extramural grants and contracts have funded 862 person-years of employment at IU**




INDIANA UNIVERSITY

# PTI – key metrics

PERVASIVE TECHNOLOGY INSTITUTE

### 1999-2008 - Pervasive Technology Labs

- $30M grant award to IU from the Lilly Endowment, Inc.: $15M to fund School of Informatics; $15M to create the Pervasive Technology Labs.
- Dennis Gannon initial Science Director, Brian Voss initial COO
- Community Grids Lab led by Geoffrey Fox the biggest early star
- 2005 Stewart promoted to AD of Research Technologies, COO of PTL

### 2008-2014 - Pervasive Technology Institute

- $15M second-round funding from Lilly Endowment; Center model of organization adopted
- Beth Plale becomes Science Director of PTI, Stewart becomes Executive Director
- CACR becomes affiliated with PTI
- Significant successes in grant-funded activities

### 2014 – Now: Sustained without Lilly funding

- CACR takes off under leadership of Von Welch
- 2015: Jetstream - one of the most significant things accomplished by PTI in terms of national cyberinfrastructure
- 2018: HTRC spun off as independent Center
- 2019: consensus on an operational governance process and basic concepts of what PTI is and does

INDIANA UNIVERSITY

## Concise history

PERVASIVE TECHNOLOGY INSTITUTE

### PTI and its collaborative structure have aided:

- Faculty recruitments to IU in the College and Luddy (including Fox, Plale, Lumsdaine, Baker, Sterling, Swany)
- Faculty promotions (most recently aiding tenure and promotion for Nicole Jacquard)
- Many students receiving graduate degrees
- Staff recruitment because we are perceived to (and actually do) enhance sustainability of staff funding through PTI
- IU success in obtaining a lot of grant and contract income that it might otherwise not have received:
  - Cross-center collaboration on major grant-funded activities (computational science environments, cybersecurity, cyberinfrastructure, digital humanities)
  - Value of PTI as a “brand name”
- Research and Development:
  - Incubation of new concepts into organizations and development of large centers from startup labs
  - Nimbleness in response to societal needs – most recently IU’s response to government calls for university leadership related to defense against hypersonic vehicle attacks and research to fight COVID-19
- People in Indiana and beyond appreciating the value of advanced computing to society

INDIANA UNIVERSITY

## PTI has aided IU

PERVASIVE TECHNOLOGY INSTITUTE

## Why a review now

- Sooner or later we will refer to IU President <*Someone*>, where <*Someone*> will not be the name of the PI on the two Lilly Endowment grant proposals that led to what we now know as PTI
- IU is engaged a number of organizational pivots
  - Grand Challenge research projects, increased focus on NIH-centric research within PTI
  - Increased engagement in defense-oriented research
  - New AI institute, new Dean at the Luddy School
  - And not part of the plan for the review but… response to COVID-19 pandemic
- Reviews are always helpful
  - The preparation has been useful to us. For example, we just completed a survey of faculty awareness and faculty opinions of PTI
  - Outside perspectives from knowledgeable colleagues are always helpful, and an external review corresponding roughly with the 20th anniversary of PTI just seemed like good timing
  - We are interested in outside perspectives on adjusting to changing roles and priorities of NSF, NIH, DOE, DOD

INDIANA UNIVERSITY

# PTI – Looking forward

PERVASIVE TECHNOLOGY INSTITUTE

## Logistics for today

- I am going to duck out now to facilitate open communication between Center Directors and the External Review Committee.
- Please turn your chat window on
  - Tony Walker and Robert Ping will keep track of time there
  - Lizanne DeStefano will gently reinforce timekeeping at 12 to 15 minutes of presentations if needed
- I'll pop back in when it is time for me to talk about my group's research activities
- PTI leaders: you will be sharing your own screens during presentations; please send copies of your slides to me via email when you are done and I will share them with the review committee.
- Review committee members: thank you for your time and for sharing your insights and judgments!

INDIANA UNIVERSITY

# 4.2 Office of the Executive Director: Research Program

PERVASIVE TECHNOLOGY INSTITUTE

**Research in the Office of the Executive Director**
Craig A. Stewart

**Established:** 2017

**Leadership and key personnel:**

- Julie Wernert: Evaluation, Research, and Assessment (ERA) – Dr. Claudia Costa and Tonya Miles report to Wernert
- Brian D. Voss: Humans Advancing Research in the Cloud (HARC)
- Drs. Shawn Slavin, D.F. "Rick" McMullen (50%): technical advisors
- Monica Shannon: Administrative assistant / boss

*HARC workshop, PEARC '19*

**Academic unit affiliations:**

Adjunct appointments in Computer Science (Luddy School), Biology (College of Arts and Science), Medical and Molecular Genetics (School of Medicine)

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## Basic Information

PERVASIVE TECHNOLOGY INSTITUTE

**Research in the Office of the Executive Director**

**Under what circumstances is the PTI Executive Director directly involved in research?**

- Work requires coordination across multiple PTI-affiliated Centers and the Executive Director is the PI. *Example: IU subcontract from XSEDE*
- The work fits with a personal research interest / strength of the Executive Director. *Example: Return on Investment (ROI)*
- A good idea, but not a fit for any of the existing PTI-affiliated Centers or Labs. *Example: Humans Advancing Research in the Cloud*

**Major accomplishments in past:**

- TeraGrid, XSEDE, OSG operations, Wrangler, Jetstream

INDIANA UNIVERSITY

## Center Purpose and Goals

**Humans Advancing Research in the Cloud:**

- Started with a $1,001,000 contract from Microsoft, Inc. (No shilling)
- First phase involved funding 8 Cloud Research Software Engineers (CRSEs). Culminated in a workshop co-located with PEARC19

- Phase 2 :
  - **IU:** repository of cloud images and tools
  - **Arizona State University:** materials design
  - **University of Pittsburgh:** augmenting on-premise resources with 'bursting' to commercial clouds
  - **Notre Dame:** student access to diverse computer architectures
  - **Georgia State University:** cybersecurity and privacy
  - Awardees receive funding in exchange for contributions to community knowledge and to the HARC community online tools and resources (https://github.com/HARC-PTI)
  - 2nd HARC workshop will be led jointly with NSF Strides program co-located with PEARC20

## One Current Example

PERVASIVE TECHNOLOGY INSTITUTE
Office of the Executive Director

**Funding sources and strategies focus on:**

- NSF
- NIH (particularly ITCR – Informatics Technology for Cancer Research)
- Private sector and DOD (V4I, hypersonics)
  - V4I = Virtual Validation, Verification, and Visualization Institute; part of our service to Indiana

**Help desired from PTI and IU to enhance sustainability:**

- Base funding for a larger piece of the assessment group (I am subsidizing PTI operations with my F&A return)

**Benefits - As a result of my ties with PTI and academic units at IU, I have helped IU:**

- Quickly respond to external requests related to grant award opportunities
- Bring together collaborators for successful proposals that might not have become connected without my assistance
- Aid in capability and capacity building in areas that are important but do not necessarily match up with the reward system as perceived by IU faculty members

## Sustainability and Value

# 4.3 Research Technologies (RT)

PERVASIVE TECHNOLOGY INSTITUTE

**Research Technologies**
Matt Link, Associate Vice President


**Established:** 1991

**Leadership and Key personnel:**

- David Hancock, ACI Director
- Robert Henschel, RSS Director
- Therese Miller, CEI Director
- Eric Wernert, VDS Director
- ~100 FTE, wide domain expertise
  - Deep Learning team supporting AI

**Academic unit affiliations:**

- Adjunct appointments in Astronomy (College), Biology (College), Computer Science (Luddy)

200 YEARS
INDIANA UNIVERSITY
1820–2020

## INDIANA UNIVERSITY Basic Information

PERVASIVE TECHNOLOGY INSTITUTE

**Research Technologies**

**Collaborate and Support the research mission of Indiana University**

- Provide CI , domain, workflow, and pipeline expertise (HIPAA/FISMA, etc)
- Partner with faculty or lead on grants and contracts where appropriate (last 15 years, ~$75M)
  - In the last five years, RT CI enabled IU researchers who ran jobs to secure ~$700M
- Support IU's Grand Challenges, Support faculty, students and staff (~350 academic disciplines and over 150 departments)

**Impacts**

- https://rt.iu.edu/impact/ (2018 & 2019 Annual reports - success stories and publications)

**Major accomplishments in past:**

- Teragrid, XSEDE, OSG Operations, Wrangler, Jetstream, Polar Grid, NASA Operation Ice Bridge

**Current and planned projects:**

- Collaboration with Luddy and AI (AI clusters as part of RT's CI), CTIL, HTRC, COVID-19

## INDIANA UNIVERSITY Center Purpose and Goals

PERVASIVE TECHNOLOGY INSTITUTE

Research Technologies

**Benefits of affiliation with the PTI:**

- Consistent International/National name recognition. Larger collaboration resource pool
- ED Stewart well known brings credibility to IU

**Suggested changes to PTI and services to improve center effectiveness:**

- Adding more depth and reducing some breadth
- Would improve/compliment strategic direction

**Benefit of interaction with other PTI centers and labs:**

- Increase opportunities to collaborate on grants and contracts
- Staff opportunities to learn

**• Benefit of PTI affiliation to on-campus collaborations:**

- See above

INDIANA UNIVERSITY

## Center Affiliation with PTI

PERVASIVE TECHNOLOGY INSTITUTE

Research Technologies

**Funding sources and strategies:**

- Focus on internal to IU contracts
- National Science Foundation, partner on NIH grants
- DOD,DOE, DHS, FEMA
- Private foundations, Industry

**Help desired from PTI and IU to enhance sustainability:**

- Continued collaboration with PTI centers with special focus on CTIL

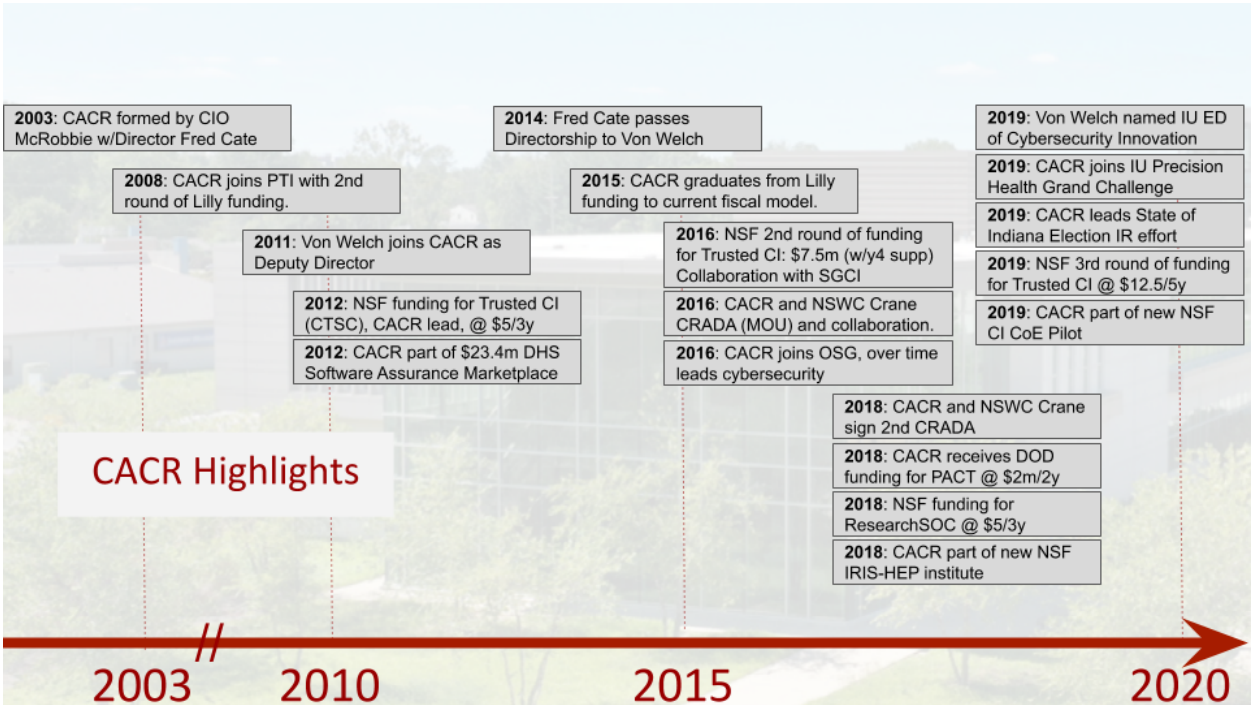
**Benefits of affiliation to agility in meeting new scientific challenges:**

- Contributions of CI and domain expertise with flexibility and speed resulting in agile support for novel opportunities

INDIANA UNIVERSITY

## Sustainability and Value

## 4.4 Center for Applied Cybersecurity Research (CACR)

## CACR In 2020

**Leadership**

Von Welch, Director
Leslee Bohland, Administrative Director
Craig Jackson
Mark Krenz
Anurag Shankar
Kelli Shute
Susan Sons

19 total staff
- Plus ~1 FTE of collaboratively funded staff within OVPIT and Maurer

Reports to VPIT, with dotted line to VPR.

Internal fiscal support agreement to FY23

**IU Impacts in addition to PTI**

- Compliance leadership (HIPAA, CUI, CMMC)
- Secure My Research
- "Cybersecurity catalyst"
- 13 Faculty Fellows with Kelley School of Business, Luddy School, Maurer School of Law, School of Ed.
- Speaker Series

**Funding: $5.5m/y**
- ~90% external (including F&A)
  - IU support agreement to FY23
- Major (~$3m/y): NSF
- Medium (~$1m/y): DoD
- Small: ~$1m/y in aggregate

3

## CACR and PTI

**PTI as an Incubator**

CACR Goal is to have one more major funding source for resilience.

Aggregate of small funding streams is a viable alternative, possibly more resilient.

Small projects often come to CACR in collaboration with other IU centers and projects.
- Easier w/o added subcontract
- E.g. OSG w/RT, SGCI & others w/CIRC

A stronger set of CI centers at IU → additional opportunities to CACR for collaborative funding roles.

**Policies for CI Centers**

IU is largely composed of educational, administrative, basic research, or small single investigator projects/sub-organizations → organizational misfit with CACR.

Aggregate policy and policy exception body is a useful function.

**Flexibility**

CACR operates as part of PTI, IU Cybersecurity, OVPIT, VPR, plus externally with Trusted CI, ResearchSOC, Alliance4CI, others. Flexible PTI participation in terms of branding, expectations, etc. allows CACR breadth of reach.

4

# 4.5 Cyberinfrastructure Integration Research Center (CIRC)

PERVASIVE TECHNOLOGY INSTITUTE

**Cyberinfrastructure Integration Research Center**
Marlon Pierce, Director

**Established:** 2016

**Leadership and Key personnel:**

- Suresh Marru
- Rob Quick
- Sudhakar Pamidighantam
- Eroma Abeysinghe
- Marcus Christie
- Jun Wang
- Eric Coulter
- Dimuthu Wannipurage
- Isuru Ranawaka
- Rick McMullen (with PTI Ex Dir)
- $1.5M budget (salary and benefits), 75-90% grants

SGCI Science Gateways Community Institute

APACHE AIRAVATA

XSEDE Extreme Science and Engineering Discovery Environment

RDA RESEARCH DATA ALLIANCE

**Academic unit affiliations:**

- Adjunct appointments in Luddy School of Informatics, Computing, and Engineering

INDIANA UNIVERSITY

## Basic Information

PERVASIVE TECHNOLOGY INSTITUTE

**Cyberinfrastructure Integration Research Center**

- **Purpose and Aims**
  - Research, implement, integrate, and operate full stack cyberinfrastructure software for scientists, from end user environments to innovative infrastructure
- **Goals**
  - Develop and release open community software through the Apache Software Foundation
  - Operate scientific cyberinfrastructure for collaborators and clients
  - Collaborate with scientific and research communities to deliver science-centric CI systems.
- **Major accomplishments in past**
  - 40+ Science Gateways using Apache Airavata/SciGaP Services
  - 15 Clusters and 27 Virtual Clusters built with XCRI
  - >$9.25M in grants since 2014
  - Leadership roles in XSEDE, SGCI, RDA
  - Apache Software Foundation elected membership (Marru, Pierce, and several alumni)
- **Current and planned projects**
  - Lead NSF-funded **Science Gateways Platform as a service** and **Custos** projects (M. Pierce, PI and Suresh Marru, Co-PI)
  - Lead **XSEDE science gateways program** (R. Quick)
  - Leadership Team, **Science Gateways Community Institute** (M. Pierce is Co-PI)
  - Leadership Team, **XSEDE Campus Research Integration**

INDIANA UNIVERSITY

## Center Purpose and Goals

PERVASIVE TECHNOLOGY INSTITUTE

Cyberinfrastructure Integration Research Center

**Benefits of affiliation with the PTI:**

- PTI Executive Director's connections within IU and within nationally prominent projects like XSEDE
- Grant and editing support
- Connections to other PTI centers
- Private sector partnerships (V4I.us, IN3)

**Suggested changes to PTI and services to improve center effectiveness:**

- Foster greater center-center and center-lab collaboration for grant competitiveness
- Identify scientific, technical cross-cutting areas

**Benefits of interaction with other PTI centers and labs:**

- RT, NCGAS collaborations on campus bridging, virtual cluster technology, science app containerization
- Collaborating with CACR is a competitive advantage for grants
- Emerging collaborations with HTRC on middleware

**Benefits of PTI affiliation to on-campus collaborations:**

- Provide a unified face for OVPR/VPR interactions

INDIANA UNIVERSITY

# Center Affiliation with PTI

PERVASIVE TECHNOLOGY INSTITUTE

Cyberinfrastructure Integration Research Center

**Funding sources and strategies:**

- Primary sources: NSF, NIH, NASA
- Strategies
  - Participate in national level cyberinfrastructure projects
  - Provide supporting services and expertise valuable to collaborators leading grants
  - Lead grants

**Help desired from PTI and IU to enhance sustainability:**

- Greater connection to IU research community
- Be "in the room" in future national-scale CI activities
- Diversify funding sources

**Benefits to sustainability from affiliation with PTI:**

- PTI is a champion for and single point of contact for its affiliated centers and labs
- Access to centralized PTI services

**Benefits of affiliation to agility in meeting new scientific challenges:**

- Connections with complementary centers and labs, including new ones that get created

INDIANA UNIVERSITY

# Sustainability and Value

# 4.6 National Center for Genome Analysis Support (NCGAS)

PERVASIVE TECHNOLOGY INSTITUTE

**Established:** 2012

**Leadership and Key personnel:**

- Co-PIs: Matt Hahn (Biology), Sheri A. Sanders, Craig Stewart, Yuzhen Ye (Luddy School)
- Collaborative award PI Phil Blood (PSC)
- NCGAS Bioinformaticians: Carrie Ganote, Bhavya Papudeshi, Sheri A. Sanders

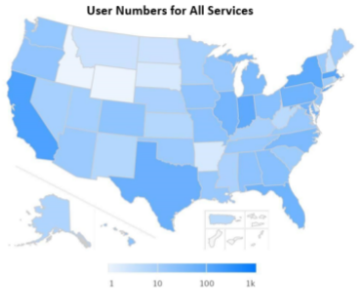
**Academic unit affiliations**: Biology and Luddy School

**Past accomplishments**: NCGAS is now on its third ABI NSF award, >$3M

**Most important current projects**: an epigenetics-support proposal (SABI 19-569) is submitted, and the fourth NCGAS-supporting proposal will go in momentarily—also SABI 19-569 [yearly reports are available]

NATIONAL CENTER FOR GENOME ANALYSIS SUPPORT

Dr. Thomas G. Doak, Director
Sn. Research Sci. in UITS
Adjunct in Biology




## Basic Information

PERVASIVE TECHNOLOGY INSTITUTE

NATIONAL CENTER FOR GENOME ANALYSIS SUPPORT

- **NCGAS' Purpose:** To aid biologists doing genomics to access national CI, curated tool set, and training in genomic bioinformatics (mostly for free)

1. Facilitate access to IU and XSEDE computational resources as appropriate
2. Provide curated genomics software—both preinstalled on "our" clusters, and in formats suitable for installation on researchers' local clusters.
3. Provide training and consultation to biologists undertaking genomics research: workshops, blogs, 1-to-1 consultation, *etc.*

- **Goals:**, expand users, adapt to changing technology.

1. Continue current services and expand into other areas of biology (*e.g.* epigenetics, field stations, *etc.*)
2. Expand user base—more underserved populations and their institutions
3. Adapt to changing technology, both in sequencing methods and CI delivery (containers, cloud, *etc.*)

- **Major accomplishments:**

1. NCGAS has excellent user satisfaction, and our trainings are wildly successful

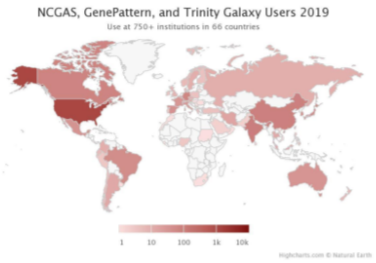
- **Current and planned projects:**

1. Expand course offerings and continue to convert trainings to virtual
2. Find additional funds for training development
3. Just opened our services to all virology researchers

## Center Purpose and Goals

## Stats:

- NCGAS has users in all 50 states and Porto Rica—i.e. all EPSCoR states
- Via a non-NSF project, we have a global reach 65 countries
- Grant monies associated with NCGAS allocations~ ~$430M
- Current users 370
- Bioinformatics software packages maintained 430
- Jetstream Bioinformatics VMs 19
- Our approval rating are 88%
- NCGAS consulting 4.3/5 stars
- Say we're essential to their research 50%
- Our last virtual workshop—R for Biologists on Jetstream≥400 attendees
- NCGAS has trained ~8000 people




INDIANA UNIVERSITY

# Stats

PERVASIVE TECHNOLOGY INSTITUTE

### Benefits of affiliation with the PTI:

1. The original NSF grant was a collaboration between PTI and Biology professors, and "incubated" in PTI
2. Overall, NCGAS is quite satisfied with PTI services: financial and grantsmanship support is strong.
3. Support for workshop logistics and surveys are essential!

### Suggested changes to PTI and services to improve center effectiveness:

1. Additional help with identifying further funding sources—compatible with the NCGAS' mission—would be helpful.

### Benefit of PTI affiliation to on-campus collaborations:

2. NCGAS is sited in RT and interacts with several management units. CIRC and CACR are the PTI centers NCGAS interacts the most with.
3. Our placement within RT is particularly important to our functions on campus.

INDIANA UNIVERSITY

# Center Affiliation with PTI

## Funding sources and strategies:

1. NSF sustaining funding for genomics is our bread and butter
2. We have a small amount of NIH funding—Information Technologies in Cancer Research—which we've had a hard time enlarging on
3. IU base funding for IU-centric support could be bumped up

## Help desired from PTI and IU to enhance sustainability:

1. [Distinguish NCGAS national center and RT management unit]
2. Locate and win funding compatible with NCGAS Mission: NIH, USDA, fisheries, etc.
3. NSF support is problematic.
    1. For how long will NSF support NCGAS as a free service?
    2. How would—or should—NCGAS transition from a free service to a pay-per service.

## Benefits to sustainability from affiliation with PTI:

4. Continued support of proposal preparation

## Benefits of affiliation to agility in meeting new scientific challenges:

5. I consider the placement of NCGAS within RT to be crucial to our mission
6. Our relationship with Jetstream is particularly close

INDIANA UNIVERSITY

# Sustainability and Value

# 4.7 HathiTrust Research Center (HTRC)

PERVASIVE TECHNOLOGY INSTITUTE

**HathiTrust Research Center**
John A. Walsh, Director

**HathiTrust Digital Library**
**Established:** 2008

HT is a not-for-profit collaborative of academic and research libraries that provides a digital preservation repository and highly functional access platform for over 17 million volumes of digitized library content from a variety of sources, including Google, the Internet Archive, Microsoft, and in-house member institution initiatives.

**Membership organization:** over 160 consortia and individual institutional members.

**Executive Director:** Mike Furlough

- 17,383,358 total volumes
- 8,399,497 book titles
- 469,549 serial titles
- 6,084,175,300 pages
- 779 terabytes
- 6,733,531 volumes(~39% of total) in the public domain

INDIANA UNIVERSITY

## Basic Information

PERVASIVE TECHNOLOGY INSTITUTE

**HathiTrust Research Center**
John A. Walsh, Director

**Established:** 2011

**Leadership and Key personnel:**

- J. Stephen Downie, Co-Director (U of Illinois)
- Marie Ma, Associate Director for *Cyberinfrastructure and Operations* (IU)
- Eleanor Dickson Koehl, Associate Director for *Outreach and Education Services* (HathiTrust/U of Michigan)
- Glen Worthey, Associate Director for *Research Support Services* (U of Illinois)

**Academic unit affiliations:**

- Luddy School of Informatics, Computing, and Engineering (IU)
- School of Information Sciences (U of Illinois)

INDIANA UNIVERSITY

## Basic Information

PERVASIVE TECHNOLOGY INSTITUTE

HathiTrust Research Center

**Purpose**

- to enable "non-consumptive research" and computational analysis of the HathiTrust corpus (currently 17 million volumes of digitized library content)
  - Infrastructure, secure compute environments, text analysis tools, derived data sets;
  - Related research support, outreach, and education services.

**Major accomplishments**

- HTRC Data Capsule
- HTRC Analytics Web Portal
- HTRC Extracted Features data set
- Advanced Collaborative Support Program
- HTRC "Phase 2" funding secured for 2019-2023.

**Current and planned projects**

- Scholar Curated Worksets for Analysis, Reuse, and Dissemination (SCWAReD)
- Book Traces, with University of Virginia

INDIANA UNIVERSITY

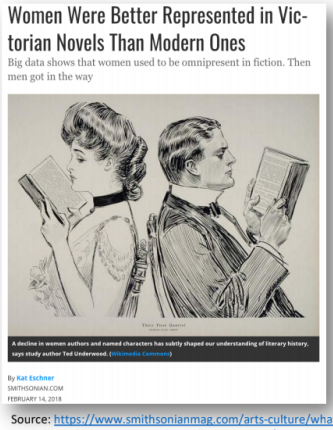
# Center Purpose and Goals

PERVASIVE TECHNOLOGY INSTITUTE

HathiTrust Research Center

- Nicole M. Brown, Ruby Mendenhall, Michael Black, Mark Van Moer, Karen Flynn, Malaika McKee, Assata Zerai, Ismini Lourentzou & ChengXiang Zhai (2019). **In Search of Zora / When Metadata Isn't Enough: Rescuing the Experiences of Black Women Through Statistical Modeling**. Journal of Library Metadata, 19:3-4, 141-162, DOI: 10.1080/19386389.2019.1652967

- William E. Underwood, David Bamman, & Sabrina Lee (2018). **The Transformation of Gender in English Language Fiction**. Cultural Analytics. DOI:10.22148/16.019




Source: https://www.smithsonianmag.com/arts-culture/what-big-data-can-tell-us-about-women-and-novels-180968153/

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# Supported Research Examples

- **total active users:** 864 (149 new in 2020 Q1)
- **active data capsule users:** 257
- **distinct institutions (domains) with active users:** 254
- **volumes analyzed:** 173,597
  - **in Web algorithms:** 39,185
  - **In Data Capsules with in-copyright access:** 130,848
  - **In Data Capsules with public-domain only access:** 3,564

## Usage stats: Q1 2020, January-March

PERVASIVE TECHNOLOGY INSTITUTE
HathiTrust Research Center

**Benefits of affiliation with the PTI:**

- Collaboration with other PTI centers and OVPIT groups
  - CIRC: next generation user authentication and identity management system utilizing their Apache Custos framework;
  - CACR: HTRC security policies, implementation, and review;
  - D2I: Data capsule; HTRC Community Advisory Board;
  - RT: HTRC infrastructure; shared system administrator; collaborations with digital humanities support team
- Grant proposal development support.

## Center Affiliation with PTI

**Funding sources:**

- *HathiTrust Digital Library*
- *Indiana University*
- *University of Illinois*
- Andrew W. Mellon Foundation
- Institute for Museum and Library Services
- National Endowment for the Humanities

**Benefits to sustainability from affiliation with PTI:**

- Institutional home
- Financial support
- Outreach to science community
- Leadership

INDIANA UNIVERSITY

# Sustainability and Value

# 4.8 Data to Insight Center (D2I)

PERVASIVE TECHNOLOGY INSTITUTE

## Data To Insight Center (D2I)

**Established:** 1999; refreshed 2020

**Leadership and Key personnel:**

- Beth Plale @bplale
- Benjamin Motz
- Martin Swany

***Societally-relevant research and scholarship in data science***

**Academic unit affiliations:**

- Luddy School of Informatics, Computing and Engineering
- Dept. of Psychology and Brain Sciences



INDIANA UNIVERSITY

**Basic Information**

PERVASIVE TECHNOLOGY INSTITUTE

## Data To Insight Center (D2I)

Strategic research areas for 2020+

1. *Smart and Connected Communities:* Selective application of new technologies and services in local communities can enhance service and reduce overall cost. D2I researches new tools, frameworks, and organizational approaches for ***societally-responsible application of new technology in smart and connected communities***.
2. *eLearning:* Students engage with technologies regularly in the course of their learning. This area is driven by affiliated lab, the ***eLearning Lab for Research and Practice***, which investigates data-driven approaches for more effective learning.
3. *Transparent HPC:* ***AI is increasingly driving new data and compute intense science.*** D2I researches new socio- and technical- approaches to AI in HPC for rigorous science.
4. *Open Science:* Open Science facilitates the sharing and use of the varied products of research. D2I contributes to ***better science practice through FAIR principles***, persistent IDs, and broader engagement in open science.

INDIANA UNIVERSITY

**Center Purpose and Goals**

PERVASIVE TECHNOLOGY INSTITUTE

# Data To Insight Center (D2I)

Plan for D2I under 2020+

1. Invite faculty/research faculty/staff affiliates as is strategic for research and educational initiatives in the 4 strategic areas
2. Organizationally, develop
   - Policies for faculty affiliation
   - Communication strategy
   - Staffing needs
3. Align center with campus AI activities (AI Institute)
4. Explore collaborations with UITS in AI in cyberinfrastructure

INDIANA UNIVERSITY

## Center Purpose and Goals

PERVASIVE TECHNOLOGY INSTITUTE

# Data To Insight Center (D2I)

Benefits of affiliation with PTI

- Strength of Indiana University is its research cyberinfrastructure (CI).
- PTI is catalyst for partnership formation needed for CI heavy opportunities (e.g., HTRC)
- Partnership enabled by PTI affiliation establishes good working relationships between faculty and research computing staff for when partnership is advantageous
- PTI as an entity to which both faculty and research staff belong reduces friction as both research staff and faculty on equal footing

Missed opportunity in workforce hiring and retention:

- Retention of technical research staff is a challenge for centers. Staff are isolated in centers, on soft funding basis. Modest steps would provide sense of belonging to these people and show them that they are valued:
  - Develop PTI identity amongst technical research staff (community of practice)
  - Fund 10% of salary of technical research staff.

INDIANA UNIVERSITY

## Center Affiliation with PTI

**Sustainability and the Future:**

- Center members seek extramural funding to carry out research and educational activities based on a personal need to drive science, research, and innovation both nationally and internationally.
  - Core mission of centers is to host shared services in support of research or other center mission. Should be fluidity in center makeup (and existence) as times change. But staff are essential part of shared services that keep centers effective, and staff hinder fluidity (because their livelihoods are at stake). Detangling a failed center and giving soft landings to staff is big, painful job. Better approach is cooperative one to staffing (within PTI).
- Executive director is a model of a visionary operations guy. These skills are hard to find in same person. PTI (and UITS) can't afford to not have visionary operations people on staff to help make PTI and all of IU CI work. Succession plan is important.

## Sustainability and Value

# 4.9 Crisis Technologies Innovation Lab (CTIL)

PERVASIVE TECHNOLOGY INSTITUTE

**Crisis Technologies Innovation Lab**
David Wild, Robert Henschel, Matt Link

**https://ctil.iu.edu/**

**Established:** June 2019

**Key personnel:**

- 3 Directors, 4 Associate Directors
- 8 Affiliated Faculty
- 8 Research staff, students, volunteers

**Benefits expected from association with the PTI:**

- Integrated process from basic research through to real-world deployment
- Access to expertise, staff and resources from Luddy and UITS including grant support
- Structure to grow into (lab -> center)

INDIANA UNIVERSITY

## Basic Information

PERVASIVE TECHNOLOGY INSTITUTE

**Crisis Technologies Innovation Lab**

**Purpose: we aim to be the nationally leading research center at the intersection of technology/data science, and emergency management and response**

**Goals**

- Establish visibility and credibility in emergency management through thought leadership, keynote presentations, practically useful research, and collaboration
- Sustainable grant funding to enable growth into a full center
- Diversity on all axes (gender, cultural, intellectual, etc)

INDIANA UNIVERSITY

## Lab Purpose and Goals

PERVASIVE TECHNOLOGY INSTITUTE

## Crisis Technologies Innovation Lab

**Early successes:**

- $652,347 grant from federal Economic Development Administration to create Analysis Platform for Risk, Resilience and Expenditure in Disasters (APRED)
- High impact collaboration with Bloomington Fire Department to develop situational awareness displays for fire stations (Project Innovation)
- $30,000 award from IU to develop COVID19 situational awareness tools for University, local and state responders
- Partnerships: IBRC, City of Bloomington, Disaster Tech Inc, GoTenna
- Wild has given invited keynote talks at FEMA

**Lessons learned:**

- Needs in this area so extensive, balance of focus and breadth is important
- Diversity does not occur naturally through good intentions

**Assistance received through association with the PTI:**

- Access to grants, marketing, communications support, full stack developers, technical and infrastructure support

INDIANA UNIVERSITY

# Current Projects

PERVASIVE TECHNOLOGY INSTITUTE

## Crisis Technologies Innovation Lab

**Growth plans:**

- Additional grants: currently working on
  - $8m NIST PSCR First Responder 3D Tracking Competition
  - Multiple NSF proposals in partnership with faculty at IU
  - Non-traditional center funding opportunities through federal government
- Additional partnerships and projects

**Assistance desired through PTI affiliation to enable these plans:**

- Continuation and increase of grant support

INDIANA UNIVERSITY

# Future Plans

# 4.10 eLearning Research and Practice Lab

PERVASIVE TECHNOLOGY INSTITUTE

**eLearning Research and Practice Lab**

Benjamin Motz, Director

**Established:** November 2019

**Key personnel:**

- Benjamin Motz, Director
- Joshua Quick, Principal Learning Data Analyst
- Stacy Morrone, AVP for Learning Technologies, Senior Advisor

**Benefits expected from association with the PTI:**

- Insulation from IT service/support workflow; Room to innovate, grow capacity, and leverage institutional strengths in an area that does not [yet] fit within traditional academic boundaries or IT.
- Support for grant writing; Resource sharing

INDIANA UNIVERSITY

## Basic Information

PERVASIVE TECHNOLOGY INSTITUTE

**eLearning Research & Practice Lab**

**Mission Statement**

The eLearning Research and Practice Lab leads advances in understanding of students' elearning behaviors, performance, and outcomes, and their associated social contexts, through cutting-edge research that addresses practical and theoretical questions at the intersection of learning, education, and technology. Our research is collaborative — we empower faculty affiliates to rigorously and responsibly examine student elearning, and to contribute their insights and expertise to an interdisciplinary research community. Through this work, we develop new evidence-based practices, interventions, and tools that advance student learning at Indiana University and beyond.

https://docs.udp.unizin.org/ Unizin

INDIANA UNIVERSITY

## Lab Purpose and Goals

PERVASIVE TECHNOLOGY INSTITUTE

eLearning Research and Practice Lab

**Early successes:**

- Hosted first research-track workshop at the 2019 Unizin hackathon
- ManyClasses (https://manyclasses.org/, https://osf.io/sdqwm)
- Major multi-disciplinary COVID-19 research study in higher education
- Collected $110,000 in research funding during first 6 months

**Lessons learned:**

- We cannot rely on peers to lead collaborations or large scale initiatives

**Assistance received through association with the PTI:**

- Grant review and mentorship
- Credibility when interacting with Data Stewards, Academic Leadership
- (*D2I, particularly*) Insights into similar processes for secure sharing of restricted research data, expertise on evaluation design and project management.

INDIANA UNIVERSITY

# Current Projects

PERVASIVE TECHNOLOGY INSTITUTE

eLearning Research and Practice Lab

**Growth plans:**

- Develop a community of academic researchers across Unizin institutions, who share common interests in utilizing elearning data.
- Expand utilization of elearning data among IU faculty, by receiving and fulfilling data requests, partnering on research grants, and supporting research design and analysis.
- Seek grant funding to grow/develop/sustain new scalable technologies for further enabling elearning research:
  - **Boost** – Personal elearning assistant
  - **Terracotta** – Canvas add-in for conducting RCTs in live classrooms

**Assistance desired through PTI affiliation to enable these plans:**

- Continued grant mentorship, review, and support
- Sharing of developer, project management, and writer time
- Faculty engagement networks and partnerships through D2I

INDIANA UNIVERSITY

# Future Plans

# 4.11 Center for Connected (C3)

PERVASIVE TECHNOLOGY INSTITUTE

**Center For Connected Computing ($C^3$)**
Martin Swany

**Established:** Proposed / in progress

**Key personnel:**

- Clint Whaley (faculty)
- Luke D'Alessandro (sci)
- Laura Pettit (Associate Director)
- FPGA Dev/Potential new TT hire in ISE

**Benefits expected from association with the PTI:**

- Center infrastructure for larger efforts (leadership agrees that you can't attempt a certain class of project without e.g. staff scientists)
- Collaboration opportunities across OVPIT units - RT, GlobalNOC and International Networking
- Proposal and grant support
- PTI visibility

INDIANA UNIVERSITY **Basic Information**

PERVASIVE TECHNOLOGY INSTITUTE

**Center For Connected Computing ($C^3$)**

- **The unifying theme of this proposed center is advanced computing and computation, and efficient implementations with e.g. accelerators**
  - ***Three main interwoven threads around networking - hardware and software***

**Purpose:**

- To engage in impactful systems work with an emphasis on communication – from switches to network interfaces to the operating system to the application

**Goals:**

- Maximize research output and impact  Increase external funding
- Responsive to DoD topic areas with an emphasis on NSWC Crane collaborations
- Re-engage with NSF OAC and CNS
- Reengage with DOE ASCR with Argonne as part of IU/ANL collaborative plan

INDIANA UNIVERSITY **Lab Purpose and Goals**

PERVASIVE TECHNOLOGY INSTITUTE

Center For Connected Computing($C^3$)

## Early successes:

- **INDIANA – In-Network Distributed Infrastructure for Advanced Network Apps**
  - Ecosystem for “Smart” networks, developed over the last 17 years with NSF and DOE $$
- **High-Performance Computing with Photon and GRyPHON**
  - Photon RDMA library most recently funded by DOE (ending now) - perfectly poised to transition into Hypersonic simulation
  - GRyPHON – FPGA support for distributed memory graph processing (IARPA $ ended)
- **5G / Mobile Edge Cloud (MEC)**
  - Building an SDR testbed; InLocus for efficient stream processing at the edge

## Lessons learned:

- Do the best you can with what you have - be lean

INDIANA UNIVERSITY

# Current Projects

PERVASIVE TECHNOLOGY INSTITUTE

Center For Connected Computing ($C^3$)

**Growth plans:**

- More affiliated faculty!
  - HPC hire still waiting in the wings!
  - We missed a really good radio researcher…
- Staff Scientists / Developers
  - I just lost my staff scientist of ~10 years when he and his wife started a family.

**Short-term plans:**

- A major Luddy donor is very interested in the 5G / MEC work
- The University Hypersonics Consortium is likely to spin up soon
- Crane micro-grant coming soon

INDIANA UNIVERSITY

# Future Plans

# 5. Supplemental Information

## 5.1 PTI Executive Director Narrative on self-analysis questions posed by PTI Center Directors / PTI Associate Directors

13 May 2020 DRAFT 4. This narrative was prepared by the Executive Director with input and suggestions from PTI Center and Lab leaders, but at this point it does not have the status of approved by consensus of the PTI Center Directors.

- What is PTI?

Covered in slides

- Is there a better name for the "Pervasive Technology Institute"?

The "Institute" part is fixed, since that has a specific meaning within IU, and has a specific meaning in relation to the word "Center" as we have developed our organizational model. As regards the words "Pervasive Technology," many alternatives might be better if we could start from scratch today, but we can't. A concerted attempt to change the name was put forth in 2008, as part of the preparation of the proposal for 2nd round funding from the Lilly Endowment, Inc. That attempt to change the name did not succeed. The "pervasive technology" part of the name originally had to do with the idea that the Pervasive Technology Labs (PTL) would recruit several faculty working in sensors, sensor nets, cell phone technology, that which we now call Internet of things, etc., and that this would be the focus of PTL. That is, the Pervasive Technology Labs would focus on technology that was indeed pervasive in our environments. IU did not end up recruiting even a single faculty member working in these areas.

We have a retroactively constructed explanation of why Pervasive Technology Institute makes sense as a name. It is as follows:

"Information technology today pervades scholarly discovery in the humanities, research in all areas of the sciences, and the processes of artistic creation. The 'pervasive' in the name IU Pervasive Technology Institute reflects the foundational importance of computer science, informatics, cyberinfrastructure, and information technology research to most of what is done in academia and industry today."

This admittedly reads as a bit contrived. That it seems only somewhat contrived is a success. As a result, we just use "IU PTI" or "PTI" whenever one of those is clear enough to identify who we are.

- What would not have happened if PTI had never existed? What has PTI aided because it exists?

Covered in slides.

- What if the centers operated independently with no overarching organization/ communication (i.e., if PTI went away)? How would things be worse off? Conversely, how does PTI create something that is more than the sum of its parts? If you were to create PTI from scratch in 2020, how might it be different?

If the Centers operated independently, our collective losses would include:

- The synergies of cross-center and cross-lab collaborations that have been critically important to some of the biggest grant wins – Center for Applied Cybersecurity Research (CACR), Research Technologies (RT), and the CyberInfrastructure Research Center (CIRC) engagement in the Open Science Grid and XSEDE are good examples. The emergence of the HathiTrust Research Center (HTRC) as an independent center spun off from the Data to Insight Center (D2I), and HTRC's collaboration with RT, is another example.
- The success of many of the outreach activities in which coordination, scale, and collectively funded outreach staff enable a scale of impact that would otherwise be impossible to achieve. This in turn aids grant competitiveness as regards outreach, dissemination plans, and broader impacts.
- The ability to serve as a "point of collaboration coordination" within and beyond PTI, which has proved valuable to IU's engagement in hypersonics research and responses to the COVID-19 pandemic.
- The ability for PTI to lead institutional responses to state and federal needs and requests. First, cross-center coordination is essential for pursuing both larger opportunities. Less importantly but still of significance: staff research leaders with critical mass of collaborators and faculty collaborators are often willing to pursue research and development agendas that are important as part of university strategy when the reward system is such that individual faculty members may not be willing to invest their efforts in such activities. IU's response to RFIs regarding hypersonics research is the best recent example.
- Shared supporting services, particularly grant support, editorial support, and outreach support has been critical to center success.

- What is the balance between "a house of brands" and "a branded house" in publicizing PTI and its affiliated centers within and beyond IU?

This is not a trivial question. We're not a command and control organization, like TACC or NCSA, and don't aspire to be. We have a different model on which our effectiveness and nimbleness depends, and this model works within the organizational and financial models of Indiana University, whereas the financial and organizational models of leaders such as NCSA and TACC are not feasible at IU.

What would seem to be ideal would be as follows:

1) PTI is a strong recognized brand, and thus able to have the PTI brand aid newer labs and developing centers.
2) Ideally accompanied by the really well-established centers continuing to acknowledge their affiliation with PTI to continue strengthening the PTI brand. CACR is a good example of this happening now. CACR is a bigger "brand name" nationally than PTI is. CACR has been very considerate in continuing to maintain an affiliation with PTI and advertise that affiliation. Likewise, on campus RT is a bigger brand than PTI and has been very considerate in advertising its PTI affiliation.
3) We are actually fairly close to this now with the caveat that PTI is not as well-known on campus as it might be because we have so little funding from IU to serve IU (excepting RT).

Within the computing community, the Apache Software Foundation (ASF) is a relevant model. ASF is a brand, it possesses a certain culture, and it exists in large part to incubate new organizations that want to adopt and promulgate this culture. It also helps manage the

lifecycle of its member projects, ensuring the integrity of the brand. Some of these projects are extremely well known in their own right (HTTPD, Hadoop, etc.). It also provides infrastructure services (many donated pro bono and including legal services as well as IT infrastructure) that it attracts through its prominence. It helps smaller projects learn from larger projects, and smaller projects have an opportunity to connect with prominent outside entities by participating in ASF-organized activities.

- Managing a non-static collection of centers is a major goal for the period 2020-2025. If PTI is to be measured as healthy, new centers will be coming in and existing ones will be transitioning, one way or another. What is the lifecycle of a PTI center, particularly:
    - Incubation as a lab and promotion to a Center?

We switched from a "lab-centric" approach to a "center-centric" approach when we realized how much "organizational thrash" came with the turnover associated with individual faculty members coming and going (and/or changing in their levels of productivity). The creation and incubation process is as follows: a lab may be created by a single faculty member or a single staff member, but should grow to have multiple leaders and multiple labs or organizational subunits working on a related set of themes before it becomes a center. Center designations in PTI affiliates depend on approval of the VP for IT (for centers within OVPIT) or the Luddy School of Informatics, Computing, and Engineering Dean (for Centers administratively housed in the Luddy School) and approval of the VP for Research per IU policy RP-11-02 (https://policies.iu.edu/policies/rp-11-002-establishment-centers-institutes/index.html). Some of the current centers and labs came about because the Executive Director was approached by faculty about joining PTI, or the ED saw a strategic opportunity to engage with a faculty member via a lab, or a center and the ED worked together on a strategic opportunity to recruit a faculty member to join PTI as a lab within a center.

    - What is the proper scope and mission of a PTI center?

The proper mission of a center is something that is related to computer science or cyberinfrastructure and which combines significant original research with more applied work and / or a more service/facilities role than is typical of a traditional research group within an academic unit. Centers often have a role that extends beyond the boundaries of IU serving the state of Indiana, the US, and the international research community. As mentioned earlier, the scope of a center in general is designed ideally to be multi-lab, multi-leader organization. CIRC is led by a staff person with a Ph.D. – Marlon Pierce, who has a significant national reputation. CIRC also includes two associate directors who are well established leaders in the computing community in their own right. NCGAS is led by a staff member with a Ph.D., but the underlying main grant support from the NSF includes as Co-PIs faculty from the Luddy School and the department of Biology in the College of Arts and Sciences. The Digital Science Center and Data to Insight Center each include multiple faculty members. The scope of a center should be broad enough such that it can sustain the loss of any one faculty member and still have a clear and discernable mission. RT is a different organization because it delivers significant operational services to the university as a whole, and thus has a very large staff and base budget supporting these activities.

    - When do you close a center?

There is no fixed policy, but empirical history is this: a center is typically closed when it is unable to balance its own budget without an emergency subsidy for more than 1 year. When a

center (or a lab) is closed, we work very hard to relocate staff to other jobs within PTI or within IU. (Note that each center has at some level a certain amount of ongoing subsidy from OVPIT or the Luddy School. This is different from "we need an extra million dollars from someone to make payroll for the next year."). Labs within centers come and go primarily at the behest of the Center Director. The two labs created within the last calendar year were affiliated with particular centers at the request of the Executive Director with the agreement of the relevant Center Directors.

- How do you distinguish between PTI and its member centers and other (OVPR) university centers and institutes?

First, OVPR does not maintain a distinction between the use of the word center and institutes the way that PTI does. More tangibly, other OVPR centers and institutes tend to be more rigid and monolithic in their focus – a center on instrumentation, an institute on philanthropy, etc.

PTI's structure is intentional in encompassing multiple centers and in being designed to evolve over time – which it has. We have closed down 4 labs and 1 center so far in our existence, and PTI is still here. OVPR centers and Institutes tend to be formed or go out of business wholesale. For that reason, the elimination of an OVPR center or institute tends to be accompanied with a great deal of emotional distress and disruption and loss of jobs for employees.

To emphasize the extent of PTI's evolution over time: The 2008 Lilly Endowment grant award created two centers - the Digital Science Center (DSC) and the Data to Insight Center (D2I). This grant award also engaged two pre-existing centers in formal affiliation with PTI – the Center for Applied Cybersecurity Research (CACR) and the Research Technologies Division of UITS (RT). Since 2008 we have created three new centers – the National Center for Genome Analysis Support (NCGA), the HathiTrust Research Center (HTRC), and the Center for Research in Extreme Scale Technologies (CREST) and closed down one Center (CREST). Within the past calendar year we have created two new labs, both in affiliation with existing centers, and both intending someday to be elevated to being a center. Discussion of creation of one other center is ongoing. PTI is designed to evolve over time in response to federal priorities and societal needs, and so far has succeeded in doing so quite well. This is not to say that there have not been job losses at some points in PTI's history, but in general PTI has moved individuals from one role to another within PTI far more often than it has terminated employment as centers and labs come and go.

One other difference: most other OVPR centers and institutes operate with VPR as the fiscal agent. For PTI, OVPIT remains the primary fiscal agent. Luddy is the fiscal agent for DSC. OVPIT and Luddy have joint responsibility for D2I and HTRC.

- Do all centers operate under the same rules?

No, in the sense that PTI centers span administrative domains within the university. IU is structured as an organization of multiple Responsibility Centers (RCs). This structure was instituted in the 1980s and is the topic of a book by a former IU VP for Finance.[1] Each RC is

[1] E.L. Whalen. 1991. Responsibility Centered Budgeting: Responsibility Center Budgeting: An Approach to Decentralized Management for Institutions of Higher Education. ISBN-13: 978-

responsible for balancing its own budget based on tuition, research dollars, F&A returns, and support from the state of Indiana. RCs are typical academic units – Schools – headed by deans, or large administrative units such as the Office of the VP for Information Technology. "Rules" for any given center or lab are determined by the RC to which it reports (e.g. Luddy for DSC, OVPIT for NCGAS). Thus, some labs and centers have certain financial and human resource rules that are different from others, because of the organization to which a laboratory or center reports. That is the better of the alternatives, because it's the only practical way to manage cross –RC collaborations. There have been two attempts in the past to unify HR policies across two different RCs. Both attempts created friction that was ultimately more counterproductive than helpful.

There are two policies that are very helpful that deal with cross-RC issues:

1) Distribution of F&A returns follow the expenditures that generate the F&A, and are transferred to the Finance Office of the relevant RC to be disbursed within that RC by its Finance Office within the policies of that RC.
2) Reporting of grant successes when there is a Luddy / OVPIT collaboration: grant awards and expenditures are reported externally as Luddy accomplishments whenever a grant is organizationally affiliated with OVPIT and the OVPIT leadership includes someone with a formal affiliation with Luddy. For example, the Jetstream award amount and annual expenditures are reported externally as part of the Luddy School of Informatics, Computing, and Engineering.

- How many centers should PTI have at any given time? What would too many centers be under the current structure? How much should PTI scale up?

Given the current size of the central organizing structure supporting PTI-affiliated centers, ten to twelve centers (and labs intending to be centers) seems to be a rough practical limit of the number of organizations that can be effectively affiliated with PTI. In other words, we can see incremental growth in the number of centers, but doubling the number of centers without significant investment in the central support functions seems untenable.

- What defines a PTI center? Can anyone with a grant who would like a big chunk of F&A get more of their F&A by creating a center?

A center has the following characteristics:

1) The head of the RC to which the center reports agrees that such a center should exist.
2) A PTI center generally includes multiple leaders and possibly affiliated labs. Centers often include faculty leaders, faculty affiliates, staff, and students. PTI is providing a solution to the "CI Research Engineer" problem and also providing a track for professional development into management, CI architect, and related roles.
3) A center complies with the relevant IU policy on use of the word "center," and if a university-level center is approved as such by the VP for Research.
4) A center can generate enough income through grants and contracts to pay the lion's share of the costs associated with being a center.

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0253364807. Amusingly, perhaps, Ed Whalen as VP for Finance gave Fred Luddy his first programming job, while Luddy was early on in his brief career as an IU student.

5) Skirting F&A policies of your own home Responsibility Center is not a reason to create a center. Our financial policies make "gaming the system" related to F&A essentially impossible.

- What are PTI's governance (decision making) structure and mechanisms?

First and most importantly, research ideas within the faculty-led centers are governed the way that faculty research is traditionally governed: research ideas may come from faculty members, students, or staff. Faculty members set the research agendas for their centers and labs.

Centers and labs led by professional staff tend to be somewhat more influenced by the faculty members of administrators to whom centers report. For example, VP for IT and CIO Brad Wheeler has suggested research priorities for certain portions of PTI that are led by staff and report up to him, and most of his suggestions are innovative and fruitful.

Decisions regarding PTI operational activities – in terms of services that "PTI central" focuses on and provides to affiliated centers and labs - are generally made by consensus of the Executive Director and the Center Directors. Center Directors also carry the title, and the role in practice, of Associate Director of PTI. This review process and the Application for PTI to be a VPR-designated University-level Institute are examples of joint decision making by the Executive Director and Center Directors.

Operational leadership within a Center is by the Center Directors lead, under whatever governance process is relevant to their own RC's hierarchy. For example, DSC is a "School-level" Center within the Luddy School of Informatics, Computing, and Engineering. NCGAS is a management unit of RT with a dotted line report to the PTI Executive Director. The VP for IT and the Dean of the Luddy School of Informatics, Computing, and Engineering have of course large scale decision making authority, and use this authority with care. One recent example of this authority being used is in official designations and reporting lines of CACR. CACR's status as a university-wide entity, long recognized in practice, has now been codified in the official designation of CACR as a university-level Center and joint reporting lines to VPR and OVPIT. (At the same time Von Welch was promoted to Executive Director for cybersecurity innovation at Indiana University. reporting jointly to the VP for IT and the VP for Research).

- What services does PTI offer to its centers and why (that is, are these aligned with our mission and vision)? Are these the right ones, and do we have the right organizational mechanisms to execute them?
    - What does "PTI Central" provide as services to Centers?
        - **Grant proposal creation and submission:** A lot (this is something we do very well). Competing for very large NSF awards, such as HPC system acquisition and CICI awards, requires a great deal of staff work.
        - **Execution of grant awards:** To a certain extent. We offer an effort reporting system that is particularly helpful in managing A21 reporting processes. We also offer some level of assistance with expenditure forecasting.
        - **Outreach, dissemination, and engagement in community:** We do this quite a bit. PTI and the IT Communications Office coordinate IU's display at the international IEEE/ACM SCxy conference. PTI often plays a strong role in organizing IU's activities at the International

Supercomputing Conference held in Germany. We often assist in leading or hosting conferences, workshops, hackathons, and outreach events. PTI also coordinates fundraising for Science Node, an electronic publication that is read by more than 140,000 people worldwide. This engagement is very helpful in writing compelling engagement and outreach plans as part of the "Broader Impacts" sections of NSF proposals. By being affiliated with PTI, a researcher, lab, or center has the advantage of being able to use (and in grant proposal writing claim use of) PTI's extensive outreach activities.

- Are these the right services?

They seem to be the most essential services, as indicated by the fact that many of them are funded in whole or in part by PTI-affiliated centers. Centers have shown a willingness to help fund the services we offer. There are other services we would like to have, but more "passing of the hat" simply seems impractical.

- Do we have the right mechanisms for providing such services?

Financially, at least, probably not. Central funding (from OVPIT or the Luddy School) is not sufficient to meet the preferences of many center directors and our perceived needs to be competitive for major federal grants. We have central funding support for some shared central services but not others. For editorial and grant preparation services, for example, funding comes largely from "passing the hat" among PTI Center Directors, and in some cases is subsidized by F&A returns on grant awards to the Executive Director. Lack of funding for central services has been a challenge within PTI and PTL from the start. Current fiscal conditions are unlikely to make it better anytime soon. PTI is distinctively successful within IU Bloomington in getting large federal grant awards ($10M or more). PTI is responsible for two such grants to IU Bloomington to date, when there are a total of five such awards to IU Bloomington from federal sources. We face an unprecedented set of challenges within the university financial system. In an odd way, in the face of potential across-the-board cuts in funding to RCs from the University, since PTI has less such funding, we face smaller cuts than some other units within IU.

The one real challenge facing us in the coming year is funding for Science Node. On the one hand, readership of Science Node is growing by leaps and bounds. Readership has grown from 123,000 to 143,000 people worldwide since the beginning of the COVID-19 pandemic. This is fueled by coverage of COVID-19 and how advanced computing technologies have helped in the fight against COVID-19. On the other hand, Science Node is supported roughly 1/3 by IU and 2/3 by underwriting from other universities. From the standpoint of fiscal officers at other universities, this support looks a lot like a "donation" – one of the first categories of expenditure to be banned by fiscal officers at universities in financial distress it seems. Science Node is unusual in reaching many students and lay people – far more people outside HPC professionals read Science Node than HPCWire. And Science Node is more oriented on computing technology that enables discovery than "I f*cking love science." Science Node is a great help in writing (and executing) broader impacts statements in grant proposals, so we are particularly watchful that we maintain funding continuity for the staff of Science Node. (The annual budget for Science Node is $145,000).

Note that by Indiana State Law, debt service on the bond that funded the building of the CyberInfrastructure Building (CIB) – the primary building housing OVPIT staff – is funded by

F&A return on grant awards. In other words, the portions of PTI that report administratively up through OVPIT help pay for the roof over everyone's heads. These payments are made from the 50% of OVPIT's F&A return that is retained by the OVPIT FO. Within OVPIT, PTI is one of the two major contributors to debt services on the CIB – the other major contributor being the Networks Division, particularly the international networking group led by Jennifer Schopf.

- What were PTI's lessons-learned over the previous five years?
    - Mixing faculty intellectual leadership and combining that with staff excellence in implementation can be extremely successful in implementing CI facilities and services. IT is the fundamental collaboration that has elevated IU from "why do you have a display at the Supercomputing Conference?" in 1997 to being one of the top ten academic HPC centers in the US in 2020.
    - PTI is a place where those who excel are likely to be those who want to look beyond basic research and be directly involved in the application of basic research to applied and useful purposes.
    - Collaborations among faculty with a shared interest in delivering benefits of new technology to the research community and the public as a whole can really make a difference. Persistent organizational ties among such faculty members facilitate collaboration.
    - The ability to collaborate effectively is essential to being effective in PTI (which is an unusual and sometimes ambiguous organizational environment).

- What should PTI's 2025 vision of itself be?
    - A meta-answer to the question is that PTI should evolve in response to evolving academic needs within IU and the US and international intellectual communities, and in response to evolving societal needs in the state of Indiana, the US, and the world.
    - Specific answers within the scope of current plans include:
        - A secure and pleasant place for faculty, students, and staff to work together to create new and important innovations in cyberinfrastructure, computer science, informatics, information technology, and engineering
        - A leader in IU successfully getting funding from the DOD for research related to hypersonics
        - A leader more generally in contributing to increased grant income to IU from the DOE and DOD
        - A significant help to IU's grand challenge projects (primarily precision health and preparing for/adapting to global climate change).
        - A leader specifically in correcting IU's underrepresentation among institutions with NIH ITCR grant awards (Informatics Technology for Cancer Research). IU currently has no current awards from this program. Institutions that we don't even acknowledge as peers do better in this program than IU does, and we are supposedly leaders in both cancer research and informatics/CS research. This is a matter of inattention to this program, which PTI is working now to correct.

- What is PTI's plan for its own continuity beyond 2025?

    - The same as it has been since the end of the second round: continuing to be responsible for the large majority of what it costs to operate PTI through direct expenses on grant award budgets and our portion of F&A returns to OVPIT and Luddy. In practice, we tend to think and plan in multi-year arcs: CACR's large multi-year grant awards; CIRC's multi-year engagement in the Science Gateways Institute and XSEDE; IU's engagement in TeraGrid and XSEDE; large NSF grants for facilities such as Jetstream; sequences of sustaining awards for NCGAS from the NSF; 3 to 5 year funding plans for HTRC from the Hathi Trust itself. When times are tough, we may be focused on getting through a year; we did that for example for three years in a row from 2005 to 2008. But in general, we plan to plan and work toward funding arcs for major projects that last between 3 and 10 years.

- Based on goals for 2025 and beyond, what are the right metrics for PTI?
    - The best metrics include some of the key metrics we have presented already in our self-reporting:
        - Do we continue to bring in enough funds to continue existing?
        - Total grant awards received, total awards per year, total grant expenditures per year
        - Peer-reviewed publications per year. We would like to add to this some measures of the importance of our published works (e.g., citation counts).
        - Student metric:
            - Continue measuring: number of students receiving an MA or Ph.D. while working somehow in a PTI-affiliated center
            - New metric to add in future: the extent to which PTI serves to help attract students to IU
        - Economic metrics:
            - Continue: Job-years of employment provided within IU; IMPLAN estimates of total economic impact; successful startups; licensing income to IU
            - New metric to consider adding in future: Effect of PTI in aiding IU's reputational advantage in terms of attracting VC funds and startup monies to south-central Indiana

New points of attention and consideration that have arisen since the emergence of the current COVID-19 pandemic as a national threat:

- What will PTI's role become as we settle someday into a new normal - whatever that is?

Hopefully we will have a strong role in aiding IU in R&D related to COVID-19, other zoonotic diseases, and the root cause of the increase in incidence we have seen worldwide in outbreaks of zoonotic diseases.

- How does PTI engage with AI initiatives locally and nationally?

IU's AI initiative is set up administratively and operationally independent of PTI, which makes sense given its narrower and deeper focus on AI and tight ties to the Luddy School. PTI is well positioned to carry out research that explores AI as applied to cyberinfrastructure because of the close relationship between the Luddy School and OVPIT, facilitated by PTI.

- What are the implications of the continued slippage of NSF compared to DoE and Industry in computer science and cyberinfrastructure? What are the implications of continued decrease of attention to HPC and Cyberinfrastructure as research areas with attention focused on AI, in spite of AI's dependence on HPC?

As regards the first question: the clear implication is that we need to put more focus on obtaining grant funding from the DOE and DOD. IU's current work in pursuit of funding in hypersonics is, for example, led by PTI. We are also engaging more with computational science leaders within the DOE, most notably Argonne National Labs. To keep doing what we are doing, we simply have to be successful in pursuing funding from the federal agencies that are making grant awards. Changes in IU policies relevant to our chances of success related to DOE and DOD grant awards are likely to be a significant help in the future.

- How do we factor in the growing importance of open-source GitHub as a publication mechanism in our outreach and dissemination plans in an environment where more and more dissemination of research results and research products will be rapid and virtual rather than metered by conferences and appearance of new issues of scientific and technical journals?

This is an important trend and we simply have to take advantage of it. At least two groups within PTI are already experimenting with GitHub (the Digital Science Center and the Office of the Executive Director). It seems likely that, if IU is going to be effective in leveraging GitHub, a strong institutional effort led at higher levels of organization within IU than PTI will be necessary.

- What is PTI's role locally and nationally in educating people about the importance of science and scientific research?

It is important for PTI to be respectful of the educational mandate that, for example, the Luddy School of Informatics, Computing, and Engineering has, and which PTI itself does not have within IU. PTI as an entity thus focuses primarily on education and training activities that do not bear university credit hours, including:

  - **Outreach education and training activities.** These include "Ready, Set, Robots!" camp, which provides fun education in computer programming since 2003, and Cybersecurity Camp, started by CACR in 2006.
  - **Noncredit training locally and nationally.** Within IU, the "Supercomputing for Everyone" training series headed up by RT is a popular and well-recognized name. This is a series of short courses about using IU HPC, cloud, storage, and visualization facilities. Nationally, NCGAS in particular offers short, non-credit, web-based courses that have proved tremendously popular. "R for bioinformaticians" in its most recent offering included 400 attendees and received very high ratings after the fact by course participants.
  - **Statewide outreach events.** While these are largely on hold at the moment, historically PTI has offered many in-person outreach events within the state of Indiana. This includes tours of IU visualization and computing facilities, with our "Science on a Sphere" and IU Data Center being particularly popular. We have participated in outreach events at state facilities such as the Grissom Center and displays at the Indiana State Fair. We also often participate in outreach events to business and professional communities, such as biotech-oriented, semi-scientific, semi-business events in Indianapolis.
  - **Nationally and internationally we produce the e-publication Science Node (sciencenode.org).** We fell into this by happenstance more than plan. While

deeply involved in the Open Science Grid, IU received funding to operate the US desk of what was then called "International Science Grid this Week." Originally led out of the EU, we woke up one day and discovered that the original EU leadership had quit, and we had inherited the sole leadership of this publication. We adapted the publication to one focusing more generally on technology and science, renamed it Science Node, and took it from a few thousand readers to the current 143,000 readers. Of that, 43%, or more than 60,000 readers, reside in the US. The second largest block of readers is from the EU, at 32% of the total readership. There is nothing else quite like Science Node, and it makes a very strong statement in a dissemination plan to say that as an underwriter of Science Node we will contribute content to it about a particular grant-funded activity, and that information will be read by more than 60,000 people inside the US.

# 5.2 Science Node

SCIENCE NODE™

## Each issue reaches over **143,773** people

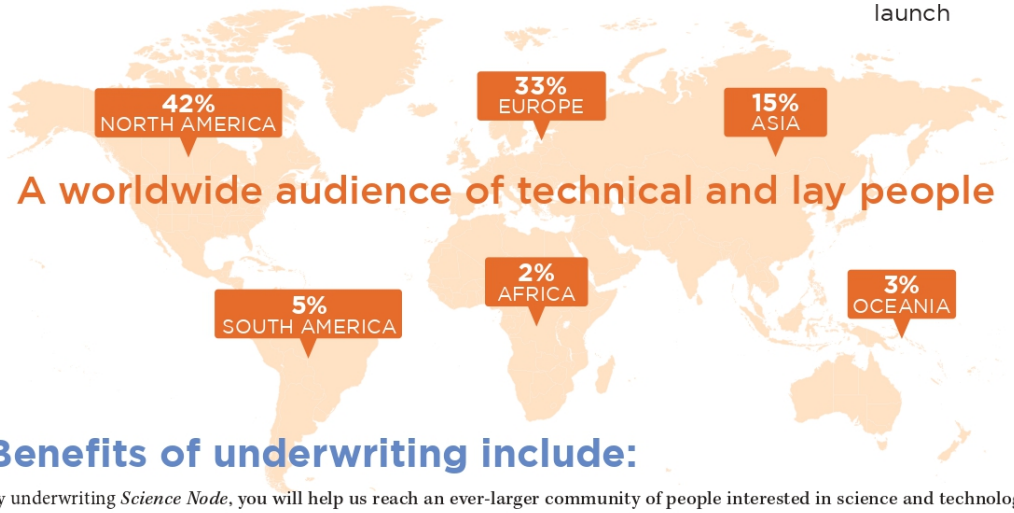
More than 100,000 readers see the content of each *Science Node* issue via email newsletters and social media. *Science Node* delivers timely, relevant content about scientific advances enabled by cyberinfrastructure, advances in cyberinfrastructure that will enable new insights, and the scientific workforce of today and tomorrow.

**48,603** Newsletter subscribers

**51,809** Twitter engagement

**43,361** Facebook and LinkedIn reach

**Over 100%** annual readership growth since 2015 launch




## A worldwide audience of technical and lay people

## Benefits of underwriting include:

By underwriting *Science Node*, you will help us reach an ever-larger community of people interested in science and technology, and build public understanding of scientific research and the cyberinfrastructure that enables new research breakthroughs.

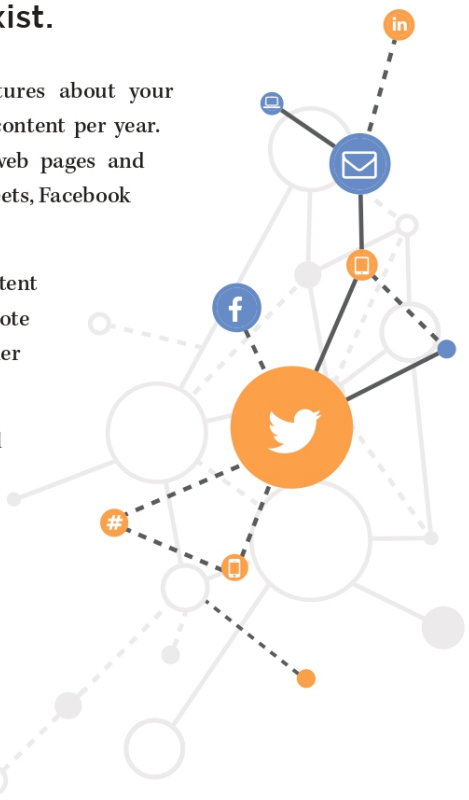
Publicize your organization's accomplishments! A key benefi t of supporting *Science Node* is that we'll share your content. Quantities vary with support level (detailed on back), and you can pick the type of content you want to contribute:

- News and information about your organization from your staff and faculty. This is your opportunity to send your message, in your organization's words, to the readers of *Science Node*. This sort of material is identified as "contributed content."
- Student writing! This new option is specifically designed to support students interested in science writing by getting them a byline in *Science Node*. Articles must be eight hundred words or fewer about some aspect of science or cyberinfrastructure, which you select. All articles are then edited by Science Node staff. It's a great way to help your students and *Science Node* at the same time!

## Be part of the story–support Science Node today!

# BECOME A *SCIENCE NODE* UNDERWRITER

## Boost your institution's outreach, publicize your accomplishments, and help *Science Node* continue to exist.



- ☐ **Platinum ($10,000 per year)** Two original features about your organization's activities, plus four pieces of contributed content per year. Logo on *Science Node* event materials in addition to web pages and newsletter. *Science Node* will promote your content with tweets, Facebook postings, and in other social media outlets.
- ☐ **Gold ($5,000 per year)** Four pieces of contributed content carried in *Science Node* per year. *Science Node* will promote your content with tweets, Facebook postings, and in other social media outlets.
- ☐ **Silver ($2,500 per year)** Two pieces of contributed content carried in *Science Node* per year. *Science Node* will promote your content with tweets, Facebook postings, and in other social media outlets.
- ☐ **Bronze ($1,000 per year)** One piece of contributed content carried in *Science Node* per year. *Science Node* will promote your content with tweets, Facebook postings, and in other social media outlets.

Return this form to *editors@sciencenode.org* or postal mail to the address below. We will contact you if you'd like more information or send an invoice if you are ready to make a financial committment.

*Science Node*
Cyberinfrastructure Building
2709 E. Tenth Street
Indiana University
Bloomington, IN 47408-2671

**Organization Name:** _____

**Address:** _____

**City:** _____ **State:** _____ **ZIP code:** _____

**Primary institutional representative:** _____ **(Name)**

_____ **(Email)** _____ **(Phone)**

**Billing contact:** _____ **(Name)**

_____ **(Email)** _____ **(Phone)**