



# **Center for Applied Cybersecurity Research**

A PERVERSIVE TECHNOLOGY  
RESEARCH CENTER

**July 2016 – June 2017 Annual Report**



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## Dear friends of the Center for Applied Cybersecurity Research,

Cybersecurity was constantly in the news this last year, touching on elections, medical devices, smartphones, critical infrastructure, and our day-to-day privacy. CACR is tackling this challenge both directly, working with organizations across the Nation to improve their cybersecurity posture, and broadly through applied research and outreach. Highlights of our impacts from the past year are:

- Continuing its leadership role in the **National Science Foundation's Cybersecurity Center of Excellence**, helping secure more than \$7 billion dollars of research funded by the NSF.
- Ongoing collaboration with **Naval Surface Warfare Center Crane**: As two of Indiana's leading institutions addressing cybersecurity, we exchange personnel and collaborate, bringing both organizations' strengths to bear on some of the nation's toughest cybersecurity challenges.
- As one of the lead institutions in the **Department of Homeland Security Software Assurance Marketplace (SWAMP)**, we are working to improve the software that serves as the foundation of our phones, medical devices, and cars. In late 2016, the SWAMP launched a new version of its continuous assurance technologies, called "SWAMP-in-a-Box," for the software assurance community to deploy on premise instances of the SWAMP.
- Leading a new \$1 million award from the **National Science Foundation** to assure scientific workflows and data.
- Supporting colleagues at Indiana University's School of Informatics, Computing, and Engineering, Kelley School of Business, and Maurer School of Law in launching **IU's Cybersecurity Master's program**.
- Welcoming three new Fellows: **Robert Cowles**, principal in BrightLite Information Security; **Rachel Dockery**, Research Fellow at the Indiana University Maurer School of Law; and **Robert Templeman**, Chief Engineer for Cybersecurity from NSWC Crane.
- Providing education and workforce development through training, talks, and workshops in Indiana and throughout the nation, demonstrating CACR's continued progress in tackling real-world cybersecurity.
- Collaborating with the Internet Civil Engineering Institute to secure the software on which the Internet relies.

These examples, along with with other activities described in this report, are the foundation of the pride CACR has in holistically tackling our nation's cybersecurity challenges.

Von Welch

# About CACR

CACR is distinctive in addressing cybersecurity from a comprehensive, multi-disciplinary perspective, by drawing on Indiana University's wide range of scholarly expertise in computer science, informatics, accounting and information systems, criminal justice, law, organizational behavior, and public policy, as well as the extensive practical cybersecurity experience of its operational units. Founded in 2003, CACR is a research center affiliated with the Pervasive Technology Institute at Indiana University and a member of the Indiana University cybersecurity community, which includes the Maurer School of Law, the Kelley School of Business, the School of Informatics, Computing, and Engineering, REN-ISAC, the University Information Policy Office, and the University Information Security Office.



# Mission of CACR

CACR is Indiana University's flagship center for cybersecurity, serving as an integrator for research across IT's different schools and organizations. Its mission is to empower people with the knowledge and skills they need to manage cybersecurity risks. It does this through an applied research cycle of undertaking cybersecurity operations, particularly in unconventional settings, and learning from those endeavors as well as the research and lessons of others. It then applies those improved outcomes in its own work and disseminates them broadly through education, training, and engagement. CACR is devoted to interdisciplinary cybersecurity and tackling challenges holistically across technical, policy, and social factors.





# Major

## INITIATIVES (2016–17)

CACR is proud of the following impacts its initiatives had for the nation.

### **CACR Collaborates with NSWC Crane on Cybersecurity**

In July 2016, CACR, represented by Vice President for IT and CIO Brad Wheeler, and Naval Surface Warfare Center Crane (NSWC Crane), represented by then-Crane Commanding Officer Captain JT Elder, signed a two-year Cooperative Research and Development Agreement (CRADA) to collaborate on cybersecurity as it applies to some of our nation's most critical challenges. Over the year since the start of the collaboration, the collaborative work has been presented over a dozen times to DoD senior leadership, including at the Pentagon. NSWC Crane's lead for the collaboration, Rob Templeman, was promoted to Chief Engineer for Cybersecurity and designated a CACR Senior Fellow. CACR staff Craig Jackson and Scott Russell have been invited to apply for prestigious temporary faculty positions at NSWC Crane.



## Array of Things

[arrayofthings.github.io](http://arrayofthings.github.io)

The Array of Things (AoT) is an urban sensing project, a network of interactive, modular sensor boxes that will be installed around Chicago to collect real-time data on the city's environment, infrastructure, and activity for research and public use. AoT will essentially serve as a "fitness tracker" for the city, measuring factors that impact livability in Chicago such as climate, air quality, and noise. CACR is collaborating with the AoT team to lead their efforts related to cybersecurity and privacy.

## CACR Provides Cybersecurity Expertise to Open Science Grid

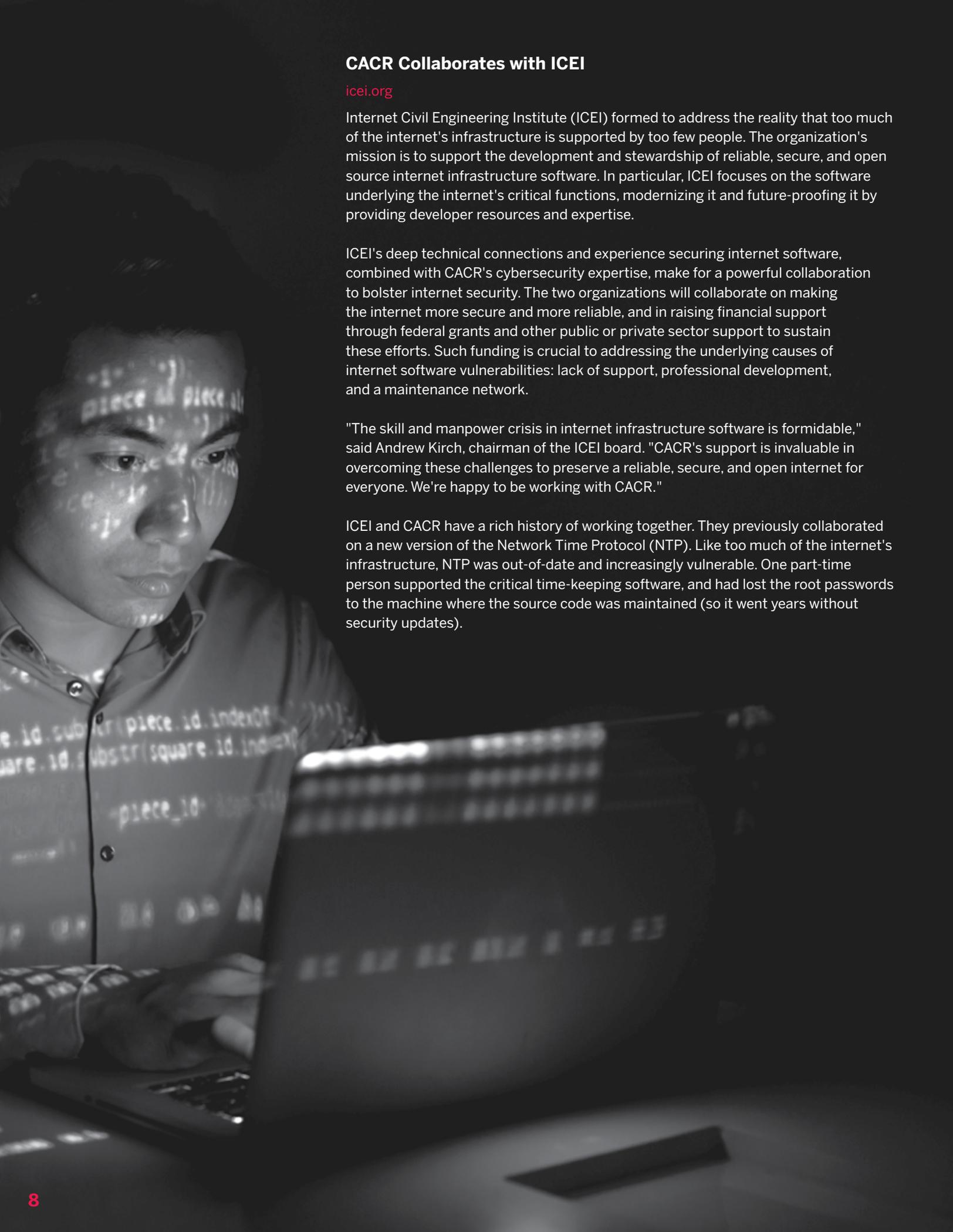
[opensciencegrid.org](http://opensciencegrid.org)

The Open Science Grid (OSG) is a nationwide facility and infrastructure enabling large-scale high-throughput computing for science. In FY16, CACR joined the collaboration, working alongside IU's Grid Operations Center to provide cybersecurity leadership for OSG. In FY16, CACR's focus was improving security services through increased automation, fixing weaknesses in traceability for certificate-free jobs, beginning deployment of secure hardware tokens for cryptographic keys needed to automate host certificate signing and deployment, and growing areas such as software assurance and security program management.

## Scientific Workflow Integrity with Pegasus

[cacr.iu.edu/projects/swip](http://cacr.iu.edu/projects/swip)

CACR is leading a new three-year project funded by a \$1 million grant from the National Science Foundation. The Scientific Workflow Integrity with Pegasus (SWIP) project, in collaboration with Dr. Steven Myers at the Indiana University School of Informatics, Computing, and Engineering, the Renaissance Computing Institute, and the University of Southern California Information Sciences Institute, will improve the security and integrity of scientific data by integrating cryptographic integrity checking and provenance information into the Pegasus workflow management system.



## CACR Collaborates with ICEI

[icei.org](http://icei.org)

Internet Civil Engineering Institute (ICEI) formed to address the reality that too much of the internet's infrastructure is supported by too few people. The organization's mission is to support the development and stewardship of reliable, secure, and open source internet infrastructure software. In particular, ICEI focuses on the software underlying the internet's critical functions, modernizing it and future-proofing it by providing developer resources and expertise.

ICEI's deep technical connections and experience securing internet software, combined with CACR's cybersecurity expertise, make for a powerful collaboration to bolster internet security. The two organizations will collaborate on making the internet more secure and more reliable, and in raising financial support through federal grants and other public or private sector support to sustain these efforts. Such funding is crucial to addressing the underlying causes of internet software vulnerabilities: lack of support, professional development, and a maintenance network.

"The skill and manpower crisis in internet infrastructure software is formidable," said Andrew Kirch, chairman of the ICEI board. "CACR's support is invaluable in overcoming these challenges to preserve a reliable, secure, and open internet for everyone. We're happy to be working with CACR."

ICEI and CACR have a rich history of working together. They previously collaborated on a new version of the Network Time Protocol (NTP). Like too much of the internet's infrastructure, NTP was out-of-date and increasingly vulnerable. One part-time person supported the critical time-keeping software, and had lost the root passwords to the machine where the source code was maintained (so it went years without security updates).

```
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## Software Assurance Marketplace (SWAMP)

[continuousassurance.org](http://continuousassurance.org)

CACR is one of four institutions leading the SWAMP project, launched in 2012 by the Department of Homeland Security Science & Technology Directorate to advance the effectiveness of software assurance technologies and to expand their adoption by software developers. The SWAMP provides an integrated, one-stop environment for developers to analyze their code with multiple tools and offers a unified assessment results viewer.

In late 2016, the SWAMP launched a new version of its continuous assurance technologies that allows the software assurance community to deploy on premise instances of the SWAMP. This version, called "SWAMP-in-a-Box," augments the services provided by the public SWAMP facility that has been in operation for the past three years. It is a free, self-contained version, including 15 open source tools that can be installed on local servers or individual computers to address the need of organizations that must or prefer to keep their software assurance activities on premise. This marks a major step in the SWAMP's now four-year effort to bring continuous software assurance capabilities to mainstream code developers.



## Infrastructure for Privacy-Assured CompuTations

[cacr.iu.edu/news/2017/RENCI-and-CACR-partner-on-NSF-project.php](http://cacr.iu.edu/news/2017/RENCI-and-CACR-partner-on-NSF-project.php)

CACR is contributing its cybersecurity expertise to a new three-year, \$3 million project, funded by the National Science Foundation. The Infrastructure for Privacy-Assured CompuTations (ImPACT) project, led by the Renaissance Computing Institute, will allow researchers to focus more fully on science by building a technology infrastructure that supports best practices in moving data, managing data, ensuring security, and preserving privacy.

## The Information Security Practice Principles

[cacr.iu.edu/principles](http://cacr.iu.edu/principles)

CACR developed the Information Security Practice Principles based on its own experiences in providing cybersecurity leadership to communities. Over the last year they have become a flagship CACR offering in their own right to the security community at large. They are the foundation of our collaborative work with NSWC Crane, the subject of briefings to senior leadership at the Pentagon and DoD, and presentations by CACR staff at O'Reilly OSCON.

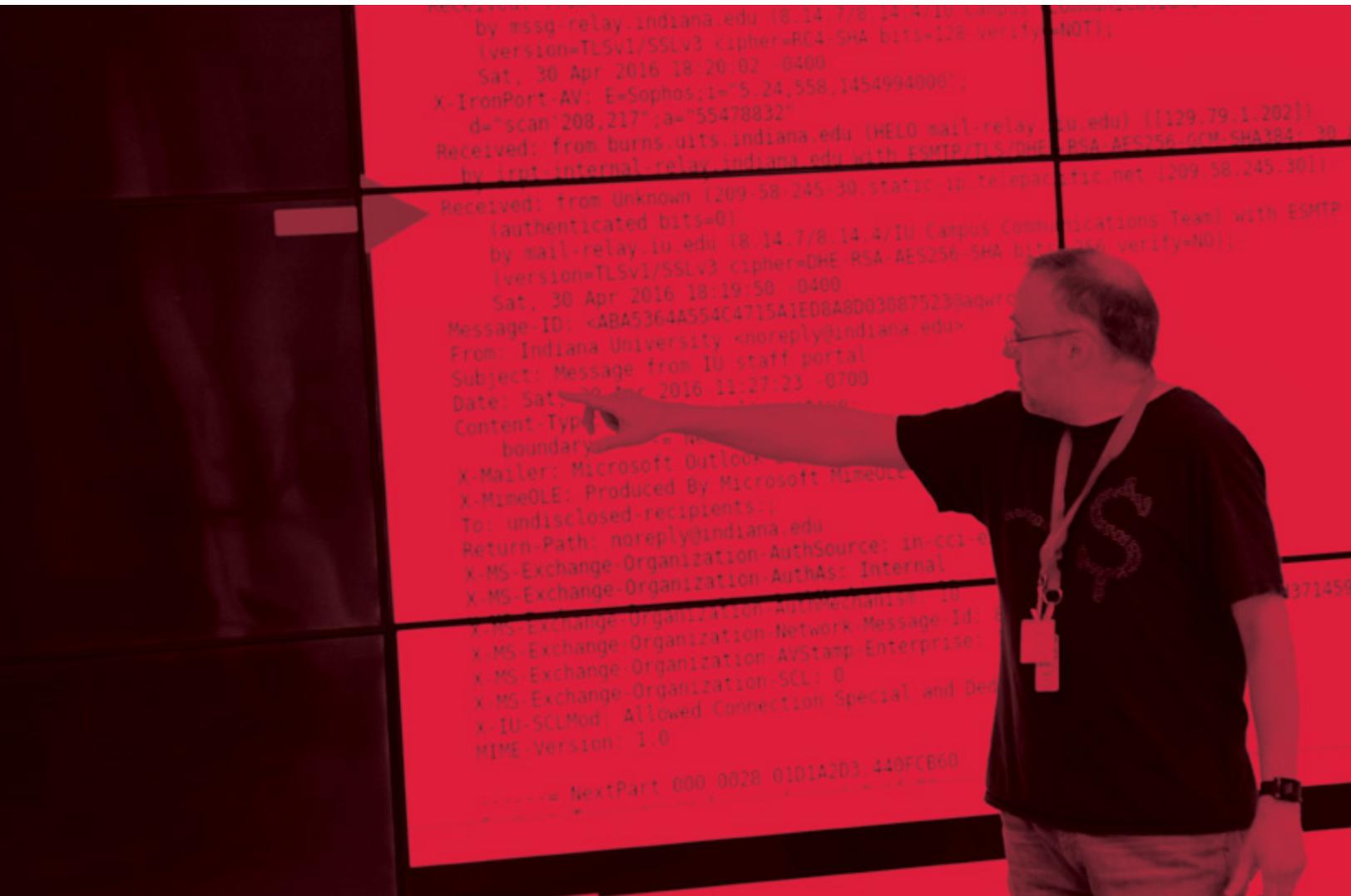
## NSF Cybersecurity Center of Excellence

[trustedci.org](http://trustedci.org)

Led by CACR, the NSF Cybersecurity Center of Excellence (CCoE) completed its first 18 months as a clear success. The CCoE undertook one-on-one collaborations with nine different NSF projects (the US Antarctic Program, Gemini Observatory, WildBook/IBEIS, Array of Things, SciGaP, HUBzero, OSiRIS, the TransPAC IRNC network, and IGO) to address their cybersecurity challenges.

The CCoE undertook partnerships to advance cybersecurity. With the Department of Energy's Energy Science Network, it developed the Open Science Cyber Risk Profile to guide science projects in better understanding and addressing risks to valuable scientific assets. In collaboration with NSF's newly launched \$15M Science Gateway Community Institute (SGCI), the CCoE is tackling science gateway security, a key means of using the web to make science broadly accessible.

# Educating the nation on CYBERSECURITY



## IU Cybersecurity Master's Program

[cybersecurityprograms.indiana.edu](http://cybersecurityprograms.indiana.edu)

CACR supported the Indiana University School of Informatics, Computing, and Engineering, Kelley School of Business, and Maurer School of Law in launching the Indiana University Cybersecurity Master's program. This two-year degree provides the foundation for our workforce to address cyber threats to national and international security through holistic training in privacy, intellectual property, and information and systems security.

# The CACR Speaker Series

DRAWS EXPERTS FROM ACROSS THE COUNTRY.

## **Patrick Traynor**

University Of Florida  
*Who do I think you are?*

## **Mohammad Khan**

University of Connecticut  
*Understanding & Altering Users'  
Motivation to Follow Computer  
Security Advice*

## **Jessica Staddon**

North Carolina State  
*Privacy Incidents, News &  
News About Incidents*

## **Nate Cardozo**

Electronic Frontier Foundation  
*Encryption and the Law*

## **Stephanie Pell**

West Point's Army Cyber Institute  
*Broken*

## **Brad Wheeler**

Indiana University VP for IT & CIO  
*It's worse than you think... and what  
to do about it.*

## **Jackie Kerr**

Lawrence Livermore National  
Laboratory  
*Authoritarian Soft Power?*

## **LTC Ernest Wong**

West Point  
*The Next Big Idea*

## **Ryan Gagnon**

New York Army National Guard  
*The Next Big Idea*



## Media Appearances

To help educate the public and advance the national discourse on cybersecurity, CACR works with the press to provide background and clarity regarding cybersecurity. Some highlights of our media appearances include:

- Being highlighted in the Coalition for Academic Scientific Computation 2017 brochure: [casc.org/page/Brochures](http://casc.org/page/Brochures)
- Susan Sons on maintaining and securing the internet's infrastructure: [oreilly.com/ideas/susan-sons-on-maintaining-and-securing-the-internets-infrastructure](http://oreilly.com/ideas/susan-sons-on-maintaining-and-securing-the-internets-infrastructure)
- Susan Sons talks about Trump-era FCC regulations for your internet browsing history: [youtube.com/watch?v=aExb49k5yuE](https://www.youtube.com/watch?v=aExb49k5yuE)
- Von Welch talks to the BBC about smart city security: [bbc.com/news/business-36854293](http://bbc.com/news/business-36854293)
- Susan Sons talks to the Observer about open source software security: [observer.com/2016/11/open-source-too-big-to-fail](http://observer.com/2016/11/open-source-too-big-to-fail)





## **NSF Cybersecurity Summit for Large Facilities and Cyberinfrastructure**

Through its leadership of the NSF CCoE, CACR organized and hosted the NSF Cybersecurity Summit for Large Facilities and Cyberinfrastructure in Arlington, VA. One hundred community members attended presentations and discussions — and 71 of them also took at least one of the eight training sessions offered on topics like identity management, log analysis, and secure coding.



# CACR Cybersecurity Summit

[cacr.iu.edu/events/cybersecurity-summit/index.php](http://cacr.iu.edu/events/cybersecurity-summit/index.php)

CACR has been bringing together leading visionaries in the area of applied cybersecurity technology, education, and policy in an annual Cybersecurity Summit since 2010. During this one-day event, attendees discuss the proper balance of public needs, homeland security concerns, and individual privacy rights. The 2016 CACR Cybersecurity Summit focused on privacy vs. security, and featured Drew Minnick from AccessNow and Kevin Branzetti from the New York County District Attorney's Office. There were 107 individuals in attendance, representing 67 organizations and institutions such as Tanium, Indiana Department of Homeland Security, Rose-Hulman Institute of Technology, Eli Lilly and Company, Barnes & Thornburg, Purdue University, and the IN-ISAC Security Operations Center.





## **CACR Helps Educate the Next Generation of Cybersecurity Professionals**

[cacr.iu.edu/news/2016/CACR-Security-Matters-Cybercamp.php](http://cacr.iu.edu/news/2016/CACR-Security-Matters-Cybercamp.php)

CACR continued its education and outreach efforts by holding two more Security Matters Cybercamps — one for high school students and one (co-hosted by CEWiT) for college students. Both events were designed to expose students to professional cybersecurity concepts in a format that interested and challenged them. This year's camps stressed the importance of online security and privacy, provided insight into a hacker's mind, delved into topics such as ransomware and computer forensics, and gave students tools to protect themselves against cybercrime. They also discussed potential cybersecurity careers.

## CACR Helps Secure Protected Health Information

CACR provided HIPAA consulting service to IU's University Information Technology Services (UITS) through a custom, NIST-based risk management framework that secures protected health information end-to-end through a nuanced, workflow risk based approach. Through CACR's efforts, IU's has become one of the few central IT organizations nationwide that is compliant both with cybersecurity standards and with the HIPAA Security Rule and Centers of Medicare and Medicaid Services (CMS) data security requirements. This year, CACR helped UITS add eight new NIST/HIPAA compliant systems. This includes the Bomgar, Big Red II, Data Capacitor 2, Global ConfigMgr, Intelligent Infrastructure, OnBase, Slashtmp, and WebCAMP. CACR also engaged in over 80 HIPAA consultations and collaborative projects with researchers and IT professionals within the Indiana Clinical and Translational Sciences Institute and other IU areas, assisted Regenstrief Institute in establishing a NIST-based HIPAA security process, and trained over 350 UITS staff on the HIPAA Security Rule.

On the national front, CACR provided six HIPAA consultations to academic and other organizations and presented its NIST-based framework at the American Medical College Conference on Privacy and Security.

## Educating Journalists

[cacr.iu.edu/events/2017/cybersec-for-journalists.php](http://cacr.iu.edu/events/2017/cybersec-for-journalists.php)

Journalists increasingly need private communications to protect their sources and works in progress. Along with colleagues from the Electronic Frontier Foundation, the IU Center for International Media Law and Policy Studies, the Indianapolis Star, and the IU Maurer School of Law, CACR hosted a panel to explore and educate journalists on cybersecurity to support their needs.





# Leadership

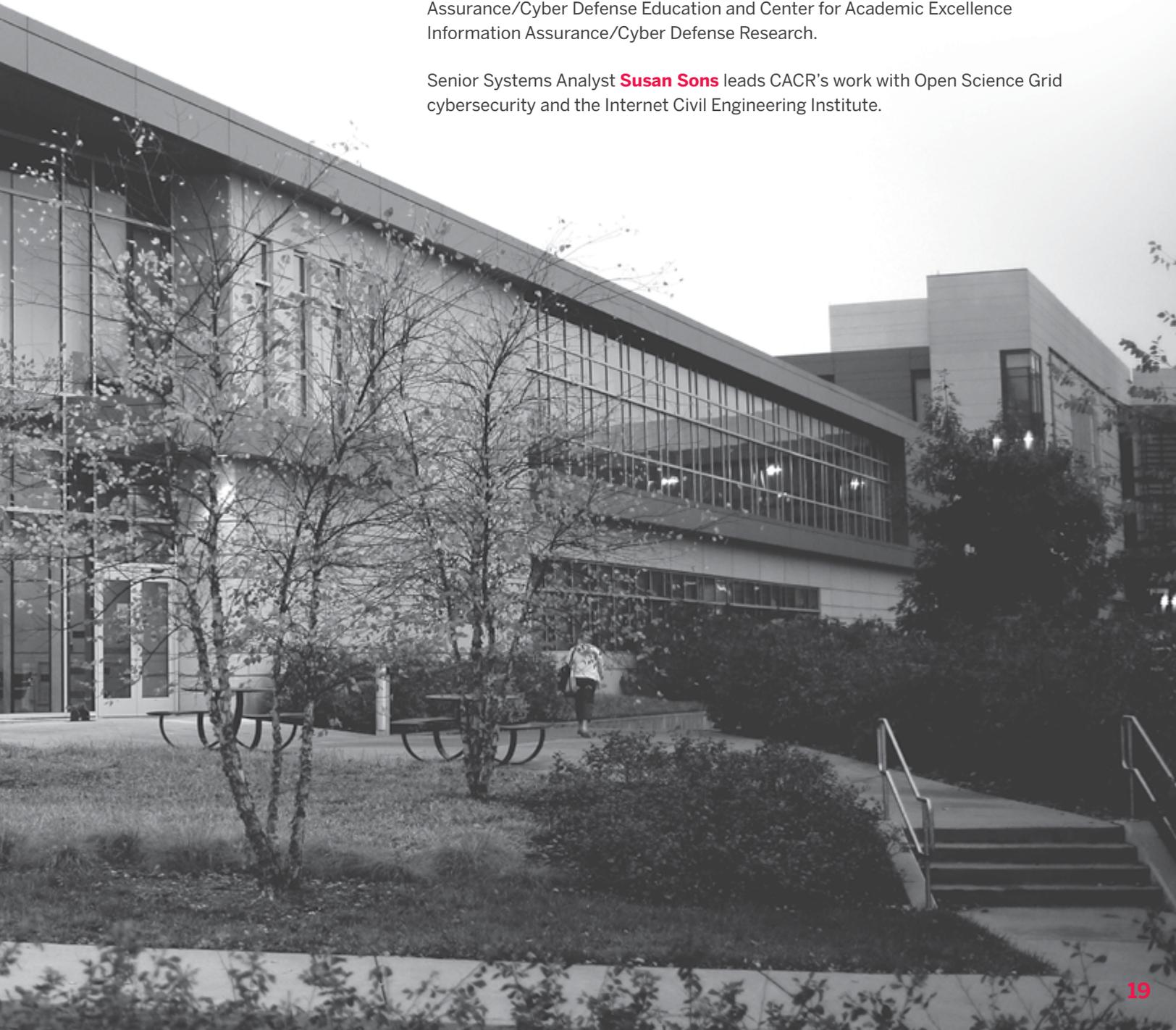
CACR Director **Von Welch** has more than a decade of experience developing, deploying, and providing cybersecurity for private and public sector HPC and distributed computing systems.

Administrative Director **Leslee Bohland** has over two decades of accounting and financial management experience.

Chief Policy Analyst **Craig Jackson** is a co-PI on the NSF Cybersecurity Center of Excellence and lead for CACR's collaboration with Naval Surface Warfare Center Crane.

Associate Director **Scott Orr**, School of Science at IUPUI, leads the coordination of Indiana University's designation as a Center for Academic Excellence in Information Assurance/Cyber Defense Education and Center for Academic Excellence Information Assurance/Cyber Defense Research.

Senior Systems Analyst **Susan Sons** leads CACR's work with Open Science Grid cybersecurity and the Internet Civil Engineering Institute.



## Staff

CACR staff help manage the daily operations of the Center. CACR staff includes administrative, management, external relations support, as well as security and policy analysts.

### **Amy Starzynski Coddens**

Education, Outreach and Training Manager

### **Anurag Shankar**

Senior Security Analyst

### **Diana Borecky**

Senior Administrative Assistant

### **Mark Krenz**

Lead Security Analyst

### **Randy Heiland**

Senior Systems Analyst/Programmer

### **Ryan Kiser**

IT Specialist

### **Scott Russell**

Senior Policy Analyst

### **Zalak Shah**

Systems Analyst

## Fellows and Key Liaisons

CACR has a dozen fellows, each one bringing unique insights and connections to the Center, allowing it to capitalize on the interdisciplinary strengths of Indiana University and the broader community. Fellows represent a wide range of perspectives, including law, policy, ethics, and informatics.

**Fred H. Cate**, Maurer School of Law

**L. Jean Camp**, School of Informatics, Computing, and Engineering

**Jake Chen**, School of Informatics and Computing (IUPUI)

**Robert Cowles**, Brightlite Information Security

**Rachel Dockery**, Maurer School of Law

**Arjan Durressi**, Department of Computer and Information Science (IUPUI)

**David P. Fidler**, Maurer School of Law

**Apu Kapadia**, School of Informatics, Computing, and Engineering

**Steven Myers**, School of Informatics, Computing, and Engineering

**Scott J. Shackelford**, Kelley School of Business

**Robert Templeman**, Naval Surface Warfare Center Crane

**Joseph Tomain**, Maurer School of Law

**Xiaofeng Wang**, School of Informatics, Computing, and Engineering

**Xukai Zou**, Department of Computer Science (IUPUI)

Associate Director **William K. Barnett** is the Indiana CTSI and Regenstrief Chief Research Informatics Officer.

Associate Director **Mark Bruhn** is Indiana University's Associate Vice President for Assurance and Public Safety.

## Acknowledgment

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