In May 2016, the Isaac and Carol Auerbach Family Foundation awarded $3 million to be paid over five years to Drexel’s Cybersecurity Institute. In appreciation of the endowment, the Institute was renamed the Isaac L. Auerbach Cybersecurity Institute (ILACI). ILACI made great strides forward in 2016 on three fronts: research, teaching, and community engagement.

**Research:** Drexel cybersecurity research made great strides this year in several categories, including new federal grants, several research proposal submissions, articles published in top-tier conferences and journals, a successful defense of an a M.S. student, and continued steps toward technology commercialization.

**Teaching:** Drexel cybersecurity education also made great strides this year in several categories, including several new courses, our graduate class of students graduating with the MS in Cybersecurity degree and undergraduate class in Cyber Security Technology, fruitful engagement with Drexel University online, engagement with the College of Engineering Peace Engineering Program, funding from the NSA and the U.S. Army Reserve, and the creation of a new student group called the Drexel CyberDragons.

**Community engagement:** ILACI continued its commitment to meaningful engagement with the community by giving several invited talks, organizing or co-organizing a number of symposia, invited lectures, and events on campus, and attending national security community events. ILACI hosted the first ever BSides Philly in December 2016, and started hosting a monthly meeting of the cybersecurity community, the Philadelphia Security Shell. In addition, ILACI took the first steps in forming a new alliance among leadership in the military, government, industry, and academia cybersecurity sectors in the Philadelphia region.

This document summarizes Drexel University cybersecurity-related activities in 2016. Activities are broken down into the following categories:

1. Research activities
2. Business development activities
3. Educational activities
4. Community engagement
5. “In the news”

An appendix includes additional information:

1. Scrapbook

Steven Weber  
Director, Drexel Isaac L. Auerbach Cybersecurity Institute
Contents

1 Acknowledgment ............................................................................................................................... 4

2 Research activities ............................................................................................................................. 5
   2.1 Research grants .......................................................................................................................... 5
   2.2 Research articles ....................................................................................................................... 6
   2.3 Graduate student thesis proposals and defenses ..................................................................... 7
   2.4 Technology commercialization ............................................................................................... 7

3 Business development ...................................................................................................................... 8

4 Educational activities ......................................................................................................................... 9
   4.1 Courses, Degrees, Certificates ............................................................................................... 9
   4.2 NSA/DHS CAE-CDE recertification ..................................................................................... 11
   4.3 U.S. Army Reserve Private Public Partnership (USAR-P3i) ................................................... 12
   4.4 Peace engineering and cybersecurity .................................................................................... 12
   4.5 CyberDragons ....................................................................................................................... 13

5 Community engagement ................................................................................................................... 14
   5.1 Invited talks by Drexel faculty .............................................................................................. 14
   5.2 Events organized by the Drexel Isaac L. Auerbach Cybersecurity Institute ......................... 15
   5.3 Security Community Events attended by the institute ....................................................... 16
   5.4 Bsides Philly ......................................................................................................................... 16
   5.5 Philadelphia Security Shell ................................................................................................. 16

6 Drexel cybersecurity in the news ................................................................................................... 17

A Scrapbook of events and meetings ................................................................................................ 19
1 Acknowledgment

The Isaac L. Auerbach Cybersecurity Institute gratefully acknowledges all of the assistance and guidance provided to us by the excellent administrators, faculty, staff, and students at Drexel University. We wish to give particular thanks to the following individuals, listed alphabetically:

- Murugan Anandarajan
- M. Brian Blake
- Debbie Buchwald
- Kapil Dandekar
- John Fry
- Joseph Hughes
- Spiros Mancoridis
- Aleister Saunders

We also gratefully acknowledge assistance from the following list of individuals, which is certainly not intended to be in any way exhaustive, also listed alphabetically:

- Pramod Abichandani
- Susan Aldridge
- Marcello Balduccini
- LeeAnn Black
- Kerry Boland
- Sean Clark
- Rob D'Ovidio
- Britt Faulstick
- Marie Fazio
- Daniel Filler
- Caitlin Gauthier
- Rachel Greenstadt
- Greg Hislop
- Tony Hu
- Nagarajan Kandasamy
- Constantine Katsinis
- Jennifer Katz
- Colleen Kavanaugh
- Brian Keech
- Sherry Levin
- Tharindu Mendis
- Denise McLeod
- Greg Montanaro
- Gaurav Naik
- Chika Nwankpa
- Ioannis Savidis
- Harish Sethu
- Ali Shokoufandeh
- James Shackelford
- Brenda Sheridan
- MaryAnn Skedzielewski
- Matthew Stamm
- Baris Taskin
- Kairi Williams
- Christopher Yang
2 Research activities

Cybersecurity research today is a far cry from its original focus on network protocols and cryptography. Today’s cybersecurity challenges require an incredibly diverse collection of interdisciplinary approaches, including machine learning, big data, signal processing, algorithm design, computer hardware and software, biometrics, and many others. The scope of research topics pursued by Drexel’s cybersecurity faculty illustrates this diversity. A brief list of topics includes:

1. Cyber crime and online identity theft (Anandarajan and D’Ovidio)
2. Adversarial stylometry (Greenstadt)
3. Sentiment analysis and security informatics (Yang)
4. Network and host anomaly detection (Sethu, Kandasamy, Mancoridis, Weber)
5. Biometric user authentication (Greenstadt and Weber)
6. Media forensics and anti-forensics (Stamm)
7. Wireless jamming and key generation (Dandekar)
8. Hardware security and trust (Savidis, Taskin, Stamm),
9. Malware detection, classification, and mitigation (Mancoridis and Balduccini)

Research activity in these and other areas is broken down into the following categories:

1. Research grants (§2.1)
2. Research articles (§2.2)
3. Graduate student thesis proposals and defenses (§2.3)
4. Technology commercialization (§2.4)

2.1 Research grants

The following is a list of ongoing cybersecurity research grants (initiated prior to 2016):


The following is a list of new cybersecurity research grants (initiated or recommended for funding in 2016):


### 2.2 Research articles

The following is a list of cybersecurity research articles published in 2016, listed in reverse chronological order:


2.3 Graduate student thesis proposals and defenses

The following is a list of cybersecurity-related M.S. student thesis defense, occurring in 2016:


2.4 Technology commercialization

The following is a list of cybersecurity patents developed by the Drexel research community and marketed by the Drexel Office of Technology Commercialization in 2016:


3 Business development

Drexel University had cybersecurity-oriented business development discussions and interactions with the following industry and government entities:

1. The Judge Group (July, 2015 – present)
2. Foreign Policy Research Institute (FPRI) (January, 2016)
3. Alion Science and Technology (June, 2016 – present)
5. U.S Army Reserve (persistent relationship)
6. 4A Security and Compliance (August, 2016 – present)
7. NetDiligence (June, 2016)
10. Kitware Inc. (December, 2015 – present)
11. Federal Bureau of Investigation (FBI) (December, 2014 – present)
12. Ben Franklin Technology Partners of Southeastern PA (April, 2016)
13. Navigant (August, 2016)
16. National Institute of Standards and Technology (NIST) (May, 2016)
17. Casualty Actuarial Society (March, 2015 – present)
18. Vanguard (October, 2014 – present)
19. Pro2Serve (September, 2015 – present)
21. FAA ASSURE Center of Excellence in Unmanned Aerial Systems Research (October, 2015 – present)
22. NSA National Cryptologic School (NCS) (November 2016 – present)
23. NSA Center of Academic Excellence (CAE) program (September 2016 – present)
4 Educational activities

Drexel has established its presence in cybersecurity education through a suite of cybersecurity degrees and certificates. This section breaks down our cybersecurity educational activities into the following categories:

1. Courses, Degrees, Certificates (§4.1)
2. NSA/DHS CAE-CDE Recertification (§4.2)
3. U.S. Army Reserve Private Public Partnership (USAR-P3i) (§4.3)
4. Peace Engineering and Cybersecurity (§4.4)
5. CyberDragons (§4.5)

4.1 Courses, Degrees, Certificates

Academic degree programs and certificates. Drexel cybersecurity-related academic degree programs and certificates include:

1. Masters of Science in Cybersecurity (CYBR)
2. Masters of Science in National Security Management (MSNSM)
3. Bachelor of Science in Computing and Security Technology (CST)
4. Bachelor of Science in Computer Science – Computer Security Concentration.
5. Certificate in Computing and Security Technology
6. Professional Development Certificates in National Security Management, including:
   (a) Cybersecurity, Law & Policy (online)
   (b) Continuity Management (online)
   (c) Homeland Security (online)
7. Undergraduate Minor in Computer Crime

Cybersecurity-related courses offered. Drexel offers a solid array of both undergraduate and graduate level cybersecurity courses. We briefly highlight two of these:

• Web Security I & II (H. Sethu). A list is topics covered in this two-quarter sequence provided.

  A security-conscious intro. to web protocols  |  DNS Security Extensions (DNSSEC)
Symmetric and public key encryption            |  Security and AJAX
Digital certificates and authentication       |  Web privacy
A security-conscious intro. to HTML & CSS     |  Anonymous web browsing
A security-conscious intro. to JavaScript      |  Illegal hosting and anonymous publishing
Origin-based isolation of content              |  Internet censorship and surveillance
Encrypted web communications (HTTPS)          |  Elliptic curve cryptography (ECC)
Attacks on Domain Name System (DNS)            |  Web-based malware

• Media Forensics & Security (M. Stamm). Learning outcomes are on the left, and the list of topics are on the right:
The following is a select list of cybersecurity-related course offerings over the past three academic years:

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
<th>Title</th>
<th>Instructor</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spr 2016</td>
<td>CS 475</td>
<td>Computer and Network Security</td>
<td>G. Naik</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>CS 680</td>
<td>Special Topics: Topics in Cryptography</td>
<td>O. Pandey</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>CT 402</td>
<td>Network Security II</td>
<td>B. Green, C</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>CT 420</td>
<td>Information Technology Security II</td>
<td>D. Comroe</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>CT 222</td>
<td>Security and Information Warfare</td>
<td>W. Pehrsson</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>INFO 333</td>
<td>Introduction to Information Security</td>
<td>C. Carroll</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>INFO 375</td>
<td>Introduction to Information Systems Assurance</td>
<td>C. Mascaro</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>INFO 517</td>
<td>Principles of Cybersecurity</td>
<td>S. White</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>INFO 710</td>
<td>Information Forensics</td>
<td>C. McClain</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>INFO 719</td>
<td>Introduction to National Security Enterprise</td>
<td>S. White</td>
<td>7</td>
</tr>
<tr>
<td>Win 2016</td>
<td>CS 303</td>
<td>Algorithmic Number Theory and Cryptography</td>
<td>J. Johnson</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>CS 680</td>
<td>Special Topics: Program Verification</td>
<td>C. Gordor</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>CST 614</td>
<td>Counterintelligence</td>
<td>S. White</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>CT 382</td>
<td>Special Topics: Applied Cryptography</td>
<td>W. Pehrsson</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>CT 395</td>
<td>Information Technology Security I</td>
<td>D. Comroe</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>CT 325</td>
<td>Operating System Security Architecture I</td>
<td>A. Podlronsky</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>CT 402</td>
<td>Network Security II</td>
<td>C. Schaffer</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>CT 422</td>
<td>Incident Response Best Practices</td>
<td>D. Whipple</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>CT 472</td>
<td>Security Defense Countermeasures</td>
<td>R. Derangescio</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>INFO 333</td>
<td>Introduction to Information Security</td>
<td>C. McClain</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>INFO 712</td>
<td>Information Assurance</td>
<td>P. Grillo</td>
<td>28</td>
</tr>
<tr>
<td>Fall 2015</td>
<td>ECEC 457</td>
<td>Security in Computing</td>
<td>L. Trachtenberg</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>INFO 375</td>
<td>Introduction to Information Systems Assurance</td>
<td>C. Mascaro</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>INFO 517</td>
<td>Principles of Cybersecurity</td>
<td>S. White</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>CST 609</td>
<td>National Security Intelligence</td>
<td>S. White</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>HSM 544</td>
<td>Introduction to Homeland Security</td>
<td>S. White</td>
<td>13</td>
</tr>
</tbody>
</table>
Table 2: AY 2014-2015

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
<th>Title</th>
<th>Instructor</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spr 2015</td>
<td>CS 303</td>
<td>Algorithmic Number Theory and Cryptography</td>
<td>B. Char</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>CS 475</td>
<td>Computer and Network Security</td>
<td>R. Greenstadt</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>HSM 554</td>
<td>Critical Infrastructure Protection</td>
<td>S. White</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>INFO 333</td>
<td>Introduction to Information Security</td>
<td>C. Carroll</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>INFO 375</td>
<td>Introduction to Information Systems Assurance</td>
<td>C. Mascaro</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>INFO 517</td>
<td>Principles of Cybersecurity</td>
<td>S. White</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>INFO 710</td>
<td>Information Forensics</td>
<td>S. Brown</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>INFO 718</td>
<td>Cybersecurity, Law and Policy</td>
<td>J. Walters</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>ECES 690</td>
<td>ST: Forensic Signal Processing</td>
<td>M. Stamm</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>CST 614</td>
<td>Counterintelligence</td>
<td>S. White</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>HSM 549</td>
<td>Terrorism and Homeland Security</td>
<td>S. White</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>INFO 333</td>
<td>Introduction to Information Security</td>
<td>C. Carroll</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>INFO 712</td>
<td>Information Assurance</td>
<td>P. Grillo</td>
<td>21</td>
</tr>
<tr>
<td>Fall 2014</td>
<td>ECEC 690</td>
<td>ST: Web Security I</td>
<td>H. Sethu</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>CST 609</td>
<td>National Security Intelligence</td>
<td>S. White</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>HSM 544</td>
<td>Introduction to Homeland Security</td>
<td>S. White</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>INFO 333</td>
<td>Introduction to Information Security</td>
<td>C. Carroll</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>INFO 375</td>
<td>Introduction to Information System Assurance</td>
<td>C. Mascaro</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>INFO 517</td>
<td>Principles of Cybersecurity</td>
<td>S. White</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>INFO 710</td>
<td>Information Forensics</td>
<td>S. Brown</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 3: AY 2013-2014

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
<th>Title</th>
<th>Instructor</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spr 2014</td>
<td>ECET 890</td>
<td>ST: SDR Security Laboratory</td>
<td>K. Dandekar</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>CS 303</td>
<td>Algebraic Number Theory and Cryptography</td>
<td>B. Char</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>CS 675</td>
<td>Reverse Software Engineering</td>
<td>G. Naik</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>INFO 333</td>
<td>Introduction to Information Security</td>
<td>C. Carroll</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>INFO 336</td>
<td>Distributed Systems Security</td>
<td>C. Geib</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>INFO 517</td>
<td>Principles of Cybersecurity</td>
<td>S. White</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>INFO 710</td>
<td>Information Forensics</td>
<td>C. McClain</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>INFO 718</td>
<td>Cybersecurity Policy</td>
<td>H. Rishikof</td>
<td>7</td>
</tr>
<tr>
<td>Win 2014</td>
<td>ECEC 690</td>
<td>ST: Web Security II</td>
<td>H. Sethu</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>CS 475</td>
<td>Computer and Network Security</td>
<td>R. Greenstadt</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>INFO 712</td>
<td>Information Assurance</td>
<td>P. Grillo</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>INFO 717</td>
<td>Cyber Crime Law</td>
<td>H. Rishikof</td>
<td>11</td>
</tr>
<tr>
<td>Fall 2013</td>
<td>ECEC 690</td>
<td>ST: Web Security I</td>
<td>H. Sethu</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>CS 680</td>
<td>ST: Privacy in Electronic Society</td>
<td>R. Greenstadt</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>INFO 333</td>
<td>Introduction to Information Security</td>
<td>C. Carroll</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>CJ 276</td>
<td>Introduction to Computer Crime</td>
<td>I. Schlanger</td>
<td>23</td>
</tr>
</tbody>
</table>

4.2 NSA/DHS CAE-CDE recertification

- Drexel University has held the designation as a National Security Agency (NSA) / Department of Homeland Security (DHS) Center of Academic Excellence (CAE) in Information Assurance Education for over ten years.
- Throughout 2016, the Institute worked on the application to be recertified as a NSA-CAE Cyber Defense Education (CDE). The application will be submitted in January 2017.
• Recertification required establishing coverage of each of twenty-two (22) knowledge units (KUs):

<table>
<thead>
<tr>
<th>Basic data analysis</th>
<th>Networking concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic scripting</td>
<td>Operating systems concepts</td>
</tr>
<tr>
<td>Cyber defense</td>
<td>Policy, legal, ethics, compliance</td>
</tr>
<tr>
<td>Cyber threats</td>
<td>Probability and statistics</td>
</tr>
<tr>
<td>Databases</td>
<td>Programming</td>
</tr>
<tr>
<td>Fundamental security design principles</td>
<td>Systems administration</td>
</tr>
<tr>
<td>IA Fundamentals</td>
<td>Advanced network technology and protocols</td>
</tr>
<tr>
<td>Intro to cryptography</td>
<td>Database management systems</td>
</tr>
<tr>
<td>IT system components</td>
<td>Low level programming</td>
</tr>
<tr>
<td>Network defense</td>
<td>Operating systems theory</td>
</tr>
<tr>
<td>Network technology and protocols</td>
<td>Security risk analysis</td>
</tr>
</tbody>
</table>

and demonstration of:

<table>
<thead>
<tr>
<th>Program outreach and collaboration</th>
<th>CD multidisciplinary efforts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center for CD education</td>
<td>Practice of CD at the institution level</td>
</tr>
<tr>
<td>A robust and active CD academic program</td>
<td>Student and faculty CD efforts</td>
</tr>
</tbody>
</table>

4.3 U.S. Army Reserve Private Public Partnership (USAR-P3i)

ILACI was notified on August 30th 2016 that the Drexel Cybersecurity for Soldiers Program (DCSP), a proposal written by Drexel, was recommended for funding by the NSA and U.S. Army Reserve.

• Use. The funds will be used to develope new cybersecurity courses and laboratories in CCI and in CoE over the next twelve months.

• Seminar series. Besides the courses, the DCSP Seminar Series, consisting of six cybersecurity seminars, will also be developed. Several talks were given in 2016, see (§5.2).

• Thanks to all the people at Drexel who helped with the process, including:

  | Ellen Bass          | Greg Hislop         |
  | Colleen Cannon     | Naga Kandasamy      |
  | Chris Carroll      | Kimberly Logan      |
  | Sean Clark         | ChiKa Nwankpa       |
  | Kapil Dandekar     | Aleister Saunders   |
  | Marie Fazio        | Ioannis Savidis     |
  | Wayne Hill         | Matthew Stamm       |


4.4 Peace engineering and cybersecurity

College of Engineering Dean Joe Hughes has initiated partnerships with Bernard Amadei (founder of Engineers without Borders) and the PeaceTechLab (a non-profit organization spun out of the U.S. Institute for Peace in Washington, D.C.), with the goal of establishing Drexel as an academic leader in the field
of peace engineering. The Drexel Cybersecurity Institute has been involved in these discussions, and will continue to play an active role moving forward.

4.5 CyberDragons

In August 2016, the Drexel CyberDragons, a student group was officially formed. The club focuses on general education in cybersecurity and the training for the Collegiate Cyber Defense Competition (CCDC). The logo and pictures for the club can be found at A Scrapbook.

- Initial Officers. Colbert Zhu (President), Jennifer Bondarchuk (Vice President), Maksim Bazhydouloski (Treasurer), and Chuck Clift (System Administrator).
- Mentorship. Mr. Chuck Ludwig, head of security at Susquehanna International Group (SIG).
- Outreach. Colbert made presentations at both CCI and ECE new student orientations.
- Structure. Any student with an interest in cybersecurity can join the CyberDragons and participate in the trainings.
- Equipment. SIG has donated equipment for use by the Drexel CyberDragons; the equipment is housed in the ECE Department.


5 Community engagement

Invited talks given in 2016 by Drexel faculty are listed in §5.1. Events, symposia, invited speakers, and panels organized or co-organized by the Drexel and the Isaac L. Auerbach Cybersecurity Institute are listed in §5.2. Security Community events attended by the ILACI are listed in §5.3. Drexel ILACI has been hosting meetups for the cybersecurity communities like §5.4 BSides Philly and §5.5 Philly Security Shell.

5.1 Invited talks by Drexel faculty

Drexel faculty from the ILACI have given the following invited presentations:


5.2 Events organized by the Drexel Isaac L. Auerbach Cybersecurity Institute

The Drexel Isaac L. Auerbach Cybersecurity Institute has organized or co-organized the following events in 2016:


5.3 Security Community Events attended by the institute

The Drexel Isaac L. Auerbach Cybersecurity Institute has attended the following events in 2016:


5.4 Bsides Philly

The first annual BSides Philadelphia Security Conference was held on December 2-3, 2016 on the Drexel campus. The BSides conferences are held in major cities across the nation, and are designed to provide an opportunity for the security community in the city to meet and exchange knowledge. BSides Philadelphia was organized by Mr. Brad Bowers. The figure 5 from [A] is the logo for the event. More information about Philly BSides Conference can be found here: [https://www.bsidesphilly.org/](https://www.bsidesphilly.org/).

5.5 Philadelphia Security Shell

Philly Security Shell is intended to be a meetup focused on hands-on learning and networking for those interested in information security. The community meets monthly on the third Thursday of the month. Other than their regular meetups, they organize or announce events related to cybersecurity in the Philadelphia area. Since June 2016, the Institute has hosted the monthly meetup at the Auerbach and Berger Cybersecurity Lab. The main organizers for this community are Leonardo Serrano and Chris Rossi. The meetings are open to everyone with an interest in cybersecurity. More information about this community can be found on their website here: [https://www.meetup.com/Philly-Shell-info-sec-meetup/](https://www.meetup.com/Philly-Shell-info-sec-meetup/).
6 Drexel cybersecurity in the news

Drexel cybersecurity-related activities mentioned in the news in 2016 include:


Snapshots of some of these articles are shown on the following pages.
In honor of National Cyber Security Awareness Month, we asked David Whipple, PhD, adjunct professor in Drexel's MS in Cybersecurity program and Steven Weber, PhD, professor in the College of Engineering, about cybersecurity and its omnipresent role in our lives.

Generally speaking, we are usually unaware of the full digital footprint we leave behind in cyberspace. From social media to email to internet browsing, our daily digital activity can leave us vulnerable.

"The devil is in the details," says Weber, emphasizing the fact that we often overlook the fine print and are completely unaware of where our personal information can go.

For example, free email services collect information that can be vulnerable to mass hackings; while websites and cloud services providers have policies that, in many cases, allow our data to be sold to third-parties, often without our consent.

With the explosion of IOT—the ‘Internet of Things’—more devices use internet connectivity to function, leaving us even more susceptible to cyber concerns.

While university researchers, government bodies and various industry representatives are analyzing the future of cybersecurity, it’s also up to individuals to maintain their own safety, to a certain degree.

In the United States, federal policies don’t always protect the user, and even in the majority of workplaces, cybersecurity remains a big question mark, according to Whipple. So start practicing good ‘cyber hygiene’ with these tips below.

**Virus Protection**

"Anti-virus software is a helpful but certainly not foolproof means of protecting your computer from malware. There are a variety of AV products available for all major operating systems. These products include active scanning to block unauthorized connections to your computer and check that the files on your system are malware-free."

(Weber)

**File Backup**

"I recommend a three-tiered approach for consumers wishing to back up their personal computers: cloud backup, local backup, and offline backup. A cloud backup consists of a file or file attached to your computer running in backup program such as Acronis True Image. An offline backup may consist of a second USB drive that you store in a secure location away from your home, such as in a safe-deposit box with your bank."

(Weber)

**Safe Emailing**

"Basic steps to detect phishing email include carefully looking at the ‘from’ email address and the web address (URL) of any links in the message. Also, be very careful of opening attachments—never open attachments sent to you by unknown parties, and be extra careful to check the legitimacy of a message asking you to open an attachment. Finally, never send passwords over email."

(Weber)

**Password Management**

"Use a unique password for every account that you have. I use something that’s at least eight characters long, no word that is found in the dictionary, use uppercase, lowercase and special characters."

(Whipple)

**Two-Factor Authentication**

"Any time you can go to a two-factor authentication system, you’re better. A password and your username can be passed around to other people—the two-factor authentication system can’t."

(Whipple)
A Scrapbook of events and meetings

The following pages hold pictures, announcements, and agendas for important events.

Figure 3: December 9, 2016 – Cybersecurity Military/Industry/Academia thought leadership meeting

Figure 4: December 2 - 3, 2016 – Drexel University held BSides Philadelphia
Abstract: Cybersecurity, and more recently cyberforensics, have been a national security priority for the U.S. and many other nations. Repeated cyber attacks, including the most recent IoT fueled Internet DoS affecting users reaching an array of sites, including Twitter, Amazon, Tumblr, Reddit, Spotify and Netflix, have become harsh realities in today’s world. With such expansive and complex attacks, it remains glaringly obvious that we are acutely under-prepared in countering sophisticated cyber criminals.

Investing in research and education, both very tightly coupled and perhaps the two sides of the same coin, are critical to dealing with current cyber-threats. The US government has specially created strong and well-balanced program standards for enabling academic institutions to incorporate cybersecurity and forensics topics into their academic curriculum. The primary objective of these program standards is to produce well-trained cyber workforce with the necessary technical skills, awareness, and security consciousness to design and build a secure cyberspace for the future.

In my talk, I will discuss my current research in cybersecurity and forensics, primarily focusing on current funded topics and future research plans. I will also talk about the STEM education needs and current opportunities for MOUs and exclusive funding vehicles supporting educational initiatives in cybersecurity and forensics.

Speaker Bio: Dr. Avinash Srinivasan has held numerous academic positions since 2008. Currently, he is an Associate Professor in the CIS department at Temple University (TU), Visiting Researcher at Center for Secure Information Systems (GMU), and a Fellow of the National Cybersecurity Institute at Washington D.C. Prior to joining TU in Summer 2014, he was an Assistant Professor in the CS department at George Mason University (GMU) from Spring 2012-Spring 2014, and an Assistant Professor of Computer Forensics at Bloomsburg University from Fall 2008 to Fall 2011. He is also a Certified Ethical Hacker since January 2015.

Dr. Srinivasan’s research interests broadly span the areas of Cybersecurity and Digital Forensics with primary focus in – networks, cloud computing, memory, and mobile and embedded devices; malware analysis and intrusion detection; conditional anonymity and privacy, and vehicular networks. He has published 42 refereed papers in scholarly conferences and journals, including IEEE INFOCOM, ACM SAC, IEEE ICC, IEEE ICDCS, and IEEE MALWARE, and recipient of the Best Paper Award at ICITIST 2012. Since 2008, Dr. Srinivasan has been involved as PI/Co-PI on federally funded research exceeding $1.2M, and his current research is funded by NSF and DoD/NAVY.

Dr. Srinivasan has over 450 hours of formal training in Cybersecurity and Digital Forensics. He has close working relationships with both industry and law enforcement (LE) agencies including FBI Regional Computer Forensics Lab, FBI Cybersquad, and DC3. Since 2008, he has trained LE officers and civilians in various cybersecurity and digital forensics topics including – Network Forensics, Macintosh Forensics, and Ethical Hacking & Pen Testing.

Dr. Srinivasan earned his B.E. (Industrial Production, 1999) from University of Mysore (India) with Honors and M.S. (Computer Science, 2003) from Pace University (NY, USA), with Distinguished Achievement Award for Academic Excellence. He received Ph.D. in Computer Science from Florida Atlantic University (FL, USA) in August 2008 and Prof. Jie Wu (IEEE Fellow) was his advisor.
You are cordially invited to attend

The Fall Symposium of the
Isaac L. Auerbach Cybersecurity Institute

Monday, November 14, 2016
2:30 to 5 p.m. Symposium
Reception to follow

The Paul Peck Alumni Center
3142 Market Street, Philadelphia

RSVP by November 10 to Kaylyn Edelman
kedelman@drexel.edu or 215.895.0982

The Symposium celebrates the recent endowment of the
Drexel Isaac L. Auerbach Cybersecurity Institute
through the generous donation of Carol Auerbach.

Remarks and Introductions:
M. Brian Blake, PhD
Executive Vice President and Provost
Drexel University
Dr. Steven Weber
Professor, Drexel College of Engineering
Director, Isaac L. Auerbach Cybersecurity Institute

Three prominent Drexel cybersecurity faculty researchers and
a distinguished Drexel alumnus will speak on topics of interest
to everyone in the age of cybersecurity.

Speakers:
Dr. Kapil Dandekar
Professor and Associate Dean of Research and Graduate Studies
Drexel University College of Engineering
Dr. Spiros Mancoridis
Distinguished Professor, Drexel College of Computing and Informatics
Technical Fellow, The Isaac L. Auerbach Cybersecurity Institute
Dr. Matthew Stamm
Assistant Professor
Drexel University College of Engineering
Mark Greisiger
President
NetDiligence

This message was sent to Vit est atibeaquamus solorem eiur?
Unt autem is dolore conectiur? Quidita quatur sed eosam ne molore vendus, uta alsiton
Steliwpi Bioikjooij;l,Ra doloreh enduciis et et entinam libus, odigenestem quiae e

Figure 6: November 14, 2016 – Drexel Cybersecurity Conference Invitation
Agenda

Check-In

Welcome, Logistics, and Roadmap Flag Ceremony
Tony Coulson (CSUSB), Lynne Clark (NSA), Rodney Peterson (NIST), Dan Stein (DHS)

CAE Community- Evolution and Mission
Tony Coulson (CAE Community Lead)

NSA/DHS: State of CAEs
Lynne Clark (NSA), Dan Stein (DHS)
CAE Program Team, Corby Hovis (NSF)

Morning Break (Sponsored by CyberWatch West)

CAE Fast Pitch Sessions (8 Minutes Each)
See page 2 for descriptions.

Working Lunch - CAE Website and Signups
Anastacia Webster

KU Refinement
Art Conklin

Dismiss to Special Interest Group Sessions (4)
See page 2-4 for room locations and descriptions.

Afternoon Break (Sponsored by CyberWatch West)

Presentations
See page 3-4 for room locations and descriptions.

Government Representative Appointments
DHS – Dan Stein (High School, Internships, Infrastructure)
NSA – Lynne Clark (NSA CAE CD Program Office)
NSF – Corby Hovis (Grants)
NIST – Rodney Peterson/ Bill Newhouse (NICE)

Interactive Plenary & SIG’s Work/Open Mic/ Farewell

WiFi
Network(Guestrooms): WESTIN-GUEST
Network (Meeting space): WESTIN-MEETING
Passcode: NICE2016

Figure 7: November 3, 2016 – NSA-CAE-PI Meeting Agenda
<table>
<thead>
<tr>
<th>Start</th>
<th>End</th>
<th>Mobile Health</th>
<th>Big Health Data</th>
<th>Cyber Security</th>
<th>Privacy &amp; Compliance</th>
<th>Governance &amp; Risk Management</th>
<th>Legal &amp; Regulatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:30</td>
<td>1:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Registration</td>
</tr>
<tr>
<td>1:00 PM</td>
<td>1:30 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The Industry's #1 Threat - Part 1</td>
</tr>
<tr>
<td>1:40 PM</td>
<td>2:50 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Day 1 - Breakout Sessions 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tech, Security &amp; Privacy</td>
<td>Governance &amp; Risk Management</td>
<td>Legal &amp; Regulatory</td>
<td>CISO, CPO, Mobile Health &amp; Big Data - Part 1</td>
<td>Cyber Risk and the Board of Directors - Part 1</td>
<td>Data Sharing Agreements</td>
</tr>
<tr>
<td>2:50 PM</td>
<td>3:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Break</td>
</tr>
<tr>
<td>3:00 PM</td>
<td>4:30 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Day 1 - Breakout Sessions 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CISO, CPO, Mobile Health &amp; Big Data - Part 2</td>
<td>Cyber Risk and the Board of Directors - Part 2</td>
<td>HHS OCR, FDA &amp; FTC Healthcare Regulatory Compliance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:30 PM</td>
<td>5:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The Industry's #1 Threat - Part 2</td>
</tr>
</tbody>
</table>

Figure 8: October 4 - 5, 2016 – 4A Security Healthcare Data Privacy Symposium Agenda
Figure 9: August 16, 2016 – Philly Security Shell regular meeting is held at Drexel University

Figure 10: August, 2016 – Drexel CyberDragons was officially formed (logo)
### International Security Education Workshop Agenda

**June 13-15, 2016 – Sheraton Philadelphia Society Hill Hotel**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 8:00 AM – 1:15 PM | Follow CISSE Agenda  
                  | Note: ACM JTF Introduction to CISSE (10:45-11:30 AM)                      |
| 1:30 PM – 4:20 PM | ISEW Opening Session  
                  | Workshop Opening  
                  | Diana Burley, George Washington University  
                  | Scott Buck, Intel                                             |
| 1:35 – 2:15 PM | Keynote: “Cybersecurity Across the Professions – Who Should Know What”  
                  | Dr. Herb Lin  
                  | Senior Research Scholar, Center for International Security and Cooperation  
                  | Research Fellow, Hoover Institution  
                  | Stanford University                                             |
| 2:20 – 2:30 PM | Workshop Introduction – Purpose/Goals  
                  | Matt Bishop, University of California, Davis  
                  | Scott Buck, Intel                                             |
| 2:30 – 3:20 PM | Panel: Academia/Industry Collaboration in Cybersecurity Programs  
                  | Moderator:  
                  | Herb Mottard, Kennesaw State University                                    |
|               | Panelists:  
                  | Ron Dodge, Palo Alto Networks                                  |
|               | Lisa DePew, Chief of Staff, Intel Security CTO                       |
|               | Drew Marin, T-Mobile                                                   |
|               | Barbara Endicott-Popovsky, University of Washington                   |
| 3:25 – 3:55 PM | Community Engagement – Contextualizing the Curriculum Development Process  
                  | Allen Parrish, US Naval Academy                                    |
| 4:00 – 4:30 PM | Introduction to ACM Joint Task Force (JTF) on Cybersecurity Education and  
                  | Preparation for Working Sessions  
                  | David "Woo" Gibson, USAF Academy                                    |
|               | Beth Hawthorne, Union County College                                  |
|               | Costa Michalidis, Knowinnovation                                       |
| 4:30 PM – 6 PM | Follow CISSE Agenda  
                  | ACM JTF Working Dinner [By Invitation Only]                          |

**6 PM**  
ACM JTF Working Dinner [By Invitation Only]

---

**Sponsored by:**

![Sponsor Logos]

**Last update:** 6 June 2016

---

Figure 11: June 13 - 15, 2016 – Snapshot of CISSE/ISEW Conference Agenda
HB Litigation Conferences presents the

**NetDiligence® Cyber Risk & Privacy Liability Forum**

June 7-8, 2016 | Philadelphia | Welcome reception June 6, 2016

*Program Chairs*

- David Navetta Norton Rose Fullbright
- Bo Holland AllClear ID
- John Merchant Validus
- Rebecca Swanson Markel
- Jill Salmon Berkshire Hathaway Specialty Insurance

---

**Monday, June 6**

5:30 p.m. | Welcome Reception

---

**Tuesday, June 7**

All-Day Coffee Bar

---

7:00 a.m. | **Registration & Breakfast**

Figure 12: June 6- 7, 2016 – Snapshot of NetDiligence Conference information
SID SEAL Academic Day at NSA  
Wednesday, 01 June 2016

Thank you for participating in the Academic Day at NSA. Please read this information thoroughly to ensure a smooth arrival to our campus.

Please park in the lot adjacent to National Vigilance Park, located at 8223 Colony Seven Rd, Annapolis Junction, MD 20701. The visitors’ center (VCC 1) is across the street from this parking lot and about a five minute walk. In case the aforementioned lot is full by the time you arrive, you may park at the National Cryptologic Museum located at 8290 Colony Seven Rd, Annapolis Junction, MD 20701. There is a shuttle labeled N11 that will bring you to the VCC or you may walk to the VCC 1. There is a sidewalk that will lead you to the VCC and it is approximately a 10-15 minute walk. Please see attached maps for further detail.

Important: Before you leave your parked car, please remember to leave your cell phone and any other electronic devices in your vehicle. This includes laptops, iPads, wearable fitness devices, etc. These items are not allowed in our facilities and security will ask you return it to your vehicle once you arrive.

It is recommended that you arrive to VCC 1 at 0800 on Wednesday, 01 June 2016, as it will take a few minutes to clear security and acquire your visitor badge. Please ensure that you have a valid, government-issued, picture ID.

You will be met at the Visitors’ Center (VCC 1) at 0830 by LTJG Jason Lawless, and escorted into the building. Briefings and discussions will begin at 0900.

Topics that will be covered during Academic Day include:

- REDHAWK: Framework supporting Software Defined Radios,
- Greybox: the unclassified mock-up and associated APIs of NSA architecture, and
- Code Breaker Challenge: unclassified reverse software engineering challenge.

In addition, multiple senior Technical Directors from various mission elements will present briefings and host discussions regarding current areas of interest at NSA.

Figure 13: June 1, 2016 – Snapshot of SID SEAL Day invitation
Drexel Collegiate Cyber Defense Team

Information meeting:
Monday April 4 5pm
Bossone 302

Drexel is starting a NEW Collegiate Cyber Defense Team to train for and participate in the National Collegiate Cyber Defense Competitions (CCDC).

What:
Security experts from Susquehanna International Group (SIG) will mentor and coach the team. SIG representatives will be at this meeting to answer questions. This is the information meeting for YOU to learn about the team.

Why:
Knowledge - You will learn valuable cybersecurity skills from working experts that dramatically increase your value on the job market.
Fun - CCDC competitions are incredibly FUN events.
School pride - Drexel has not participated in CCDC in the past, and we need to show the world we have what it takes to win.

Who:
CCDC teams develop a DIVERSE collection of cybersecurity / computing / IT / networking / programming skills.
If you have SOME of these skills and want to learn MORE, then come to the meeting.
We are looking for ALL RANKS of students: undergraduate and graduate students.

Contact:
Steven Weber - Director
Drexel Cybersecurity Institute
sweber@coe.drexel.edu

Figure 14: April 4, 2016 – CCDC Introductory meeting
Figure 15: April 4, 2016 – CCDC Introductory meeting
Figure 16: April 2, 2016 – Snapshot of Drexel Cybersecurity Conference flier
Figure 17: February 20-21, 2016 – Philly CodeFest at Drexel University
Figure 18: January 28, 2016 – Judge Group Presentation on job search skills for ECE Graduate students