TRUST: Team for Research in Ubiquitous Secure Technology

Education Overview

Dr. Kristen Gates, TRUST Education Director
TRUST Overview

TRUST: Team for Research in Ubiquitous Secure Technology

TRUST MISSION. Science and Technology that will radically transform the ability of organizations to design, build, and operate trustworthy information systems for critical infrastructure

Center Approach
- Address fundamental cyber security and critical infrastructure protection problems of national importance
- Tackle “Grand Challenge” scale integrative research projects
- Include external (including international) collaboration for research project sponsorship and technology transition

Supporting Personnel
- Graduate Students: 88
- Faculty: 42
- Undergrad Students: 11
- Research Scientists: 10
- Staff/Other: 9
- Post Doctorates: 8
TOTAL: 168

Affiliated Institutions
- Berkeley
- Carnegie Mellon
- Cornell University
- Stanford University
- San José State University
- Vanderbilt University

Supporting Disciplines
- Computer Engineering
- Computer Science
- Economics
- Electrical Engineering
- Law
- Public Policy
- Social Sciences
Center Education, K. Gates, S. Meldal

To achieve the TRUST mission and objectives, Center activities are focused in three tightly integrated areas...

**Education/Diversity**
Curriculum development and teaching the next generation of computer / social scientists and engineers

- TRUST Academy Online
- Textbooks
  - SECuR-IT
  - WISE
  - TRUST-REU
  - TRUST Seminar

**Research**
Interdisciplinary projects lead to a science base and deliver breakthrough advances in trustworthy systems

- Financial Infrastructures
  - Web browser/server security
  - Botnet and malware defenses
  - Secure software infrastructure

- Health Infrastructures
  - Privacy Modeling and Analysis
  - HIS/Patient Portal Architectures
  - Patient Monitoring Sensors

- Physical Infrastructures
  - Embedded systems for SCADA and control systems
  - Sensor networks for Demand Response systems
  - Information privacy/security

**Knowledge Transfer**
Dissemination and transition of Center research results and collaboration opportunities with external partners

- BT
- CISCO
- HP
- Intel
- Microsoft
- Sun Microsystems
- United Technologies
- TATA Consultancy Services
- AFRL
- CSIT
- AMRITA-TIFAC-Core in Cyber Security
- iCAST
TRUST education activities have reached undergraduate and graduate students, postdoctoral scholars and junior faculty, and industry professionals to address the technical, policy, and economic issues essential to improving cyber security and trustworthy systems.
Undergraduate Programs

**Scale Across TRUST**
- Collaboration with USC ISI
- SCADA, DETER, eVoting, Flash Cookies
- Student interaction across TRUST

**Leveraging TRUST Relationship**
- CAHSI, WISE, CDSIA

**Curriculum Development**
- Continued course development
- 5 new security courses—2010-11
- Course offerings in the TAO

**Prototype AY 2010-11**
- Mentoring with Research
- Affinity Research Group (ARG) Model
- Collaboration: UCB & CAHSI
TRUST-REU Program

TRUST Summer Research Experiences for Undergraduates (TRUST-REU)

● Program Overview
  - 8-week summer research experience guided by TRUST faculty mentors and graduate students
  - Educational activities include lab tours and industry field trips
  - Graduate school advising and subsidized GRE prep course
  - $4,000 Stipend + travel allowance + room and board provided

● Program Participants
  - 2006-2010: TRUST has hosted 60 undergraduate students
    - 47% female
    - 48% URM
    - 97% U.S. persons
    - Most in grad school or applying
  - 2011: TRUST 13 students (across four Center institutions)

● Participant Testimonial
  “The best part was the exposure to both the academic and industrial pathways. Without the first-hand company seminars and research experience I gained from the program, I would have made a much weaker decision as in which path to choose!”

● More Information Online
  - Program Description at: https://www.truststc.org/reu/
### TRUST-REU Program Data 2006-2010

Participant Tracking – Graduate School for 2006-2010 Cohort

<table>
<thead>
<tr>
<th>Degrees Earned &amp; In-Progress</th>
<th>TRUST-REU Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD &amp; MS Degrees Awarded</td>
<td>2</td>
</tr>
<tr>
<td>PhD Pipeline</td>
<td>10</td>
</tr>
<tr>
<td>MS/MBA Pipeline</td>
<td>5</td>
</tr>
<tr>
<td>Applying to Grad School</td>
<td>35</td>
</tr>
<tr>
<td>Applying to Law School</td>
<td>2</td>
</tr>
</tbody>
</table>

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2006-2010 Cohort = 60

90% Pursuing Graduate Study
Leveraging Education Relationships

CAHSI: Computer Alliance for Hispanic Serving Institutions

CAHSI and TRUST working together to advance the mission and mutual goals of both organizations through collaborative efforts.

Education and mentoring

TRUST REU

CAHSI STUDENTS

URM student recruitment

TRUST-REU 2011 placed **six** REU students having research/academic affiliation with CAHSI

CAHSI and TRUST will work together to prepare CAHSI students for a successful REU with TRUST
Pending: NSF Program Solicitations

- Computing Education for the 21st Century (CE21) 
  Pathways to the Baccalaureate: to Recruit and Advance Women and Latinos/Latinas in Computer Science for community college students

- Research Experiences for Teachers (RET) 
  TRUSTed Pathways: TRUST Education, Pathways into Computer Security Research an RET for community college faculty

- Cyberinfrastructure Training, Education, Advancement, and Mentoring for Our 21st Century Workforce (CI-TEAM) 
  Pathways to the Baccalaureate: to Recruit and Advance Women and Underrepresented Minorities in Computer Science for high school, community college and four-year baccalaureate STEM students
Graduate Programs

Across TRUST Partners

Research

Graduate Cohort
- 66 student cohort (Year-5)
- Collaboration with USC ISI

TRUST Technical Seminar
- 2010-11: 23 speakers (920 participants)

SECuR-IT Internship
- 2011 Applicant pool: 153 MS & PhDs
- 8 Industry sponsors with 15 interns

Academic Programs

Curriculum Development
- 7 new course 2010-2011

Mentors

Graduate and Post-Doc mentors
- TRUST research topics into REU
- Mentor and advise undergraduate
- Tech talks for summer REU
SECuR-IT is a 10-week academic summer immersion program in computer security

Program Overview:
• Paid internship at a Silicon Valley and San Francisco technology company
• Learning cohort of MS and PhD students
• Program cost funded by industry partner
• Seminars conducted by TRUST faculty and industry experts that expose students to a range of information technology and computer security research topics
• Program details at: http://truststc.org/securit
TRUST Courseware Sampler

TRUST Research initiatives drive curriculum development across the center

CS142 Web Programming and Security @ Stanford
[Collaborators: UCB & CMU]

BMIF380/CS396
Data Privacy in Biomedicine @ Vanderbilt
[Collaborators: Stanford, CMU & Vanderbilt Medical School]

ECE 5680 Mobile Communications @ Cornell
[Collaborator: UCB]

CEC18-630
Introduction to Security and Policy @ CMU [Collaborator: UCB]

CMPE25 The Digital World and Society @ SJSU
[Collaborators: UCB & Vanderbilt]
## IMPACT: Courses Across the Center

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Program Level</th>
<th>Partner Campus</th>
<th>First Offered</th>
<th>Enrollment Per Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Digital World and Society (CMPE 25)</td>
<td>Lower Division</td>
<td>SJSU</td>
<td>2010</td>
<td>40</td>
</tr>
<tr>
<td>Security, Privacy, and Information Network Design: Wiretaps to Facebook (ENGRI 1280)</td>
<td>Lower Division</td>
<td>Cornell</td>
<td>2010</td>
<td>40</td>
</tr>
<tr>
<td>Computer Security (CS 161)</td>
<td>Upper Division</td>
<td>UCB</td>
<td>2010</td>
<td>100</td>
</tr>
<tr>
<td>Network Security (CMPE 209)</td>
<td>Upper Division</td>
<td>SJSU</td>
<td>2010</td>
<td>40</td>
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<tr>
<td>Embedded Systems (ECE 3140)</td>
<td>Upper Division</td>
<td>Cornell</td>
<td>2011</td>
<td>100</td>
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<tr>
<td>Secure Software Systems (ECE 18732)</td>
<td>Graduate</td>
<td>CMU</td>
<td>2010</td>
<td>32</td>
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<tr>
<td>Privacy, Security, and Cryptography (IS 219)</td>
<td>Graduate</td>
<td>UCB</td>
<td>2010</td>
<td>20</td>
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<tr>
<td>Security in Networked Systems (14-741/18-631)</td>
<td>Graduate</td>
<td>CMU</td>
<td>2010</td>
<td>60</td>
</tr>
<tr>
<td>Privacy in the Digital Age (94806)</td>
<td>Graduate</td>
<td>CMU</td>
<td>2010</td>
<td>40</td>
</tr>
<tr>
<td>Technology &amp; Policy Lab (IS 290)</td>
<td>Graduate</td>
<td>UCB</td>
<td>2011</td>
<td>8</td>
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<tr>
<td>Graduate seminar in high assurance cloud computing architectures (CS7412)</td>
<td>Graduate</td>
<td>Cornell</td>
<td>2011</td>
<td>16</td>
</tr>
<tr>
<td>Data Privacy in Biomedicine (BMIF-380 / CS-396)</td>
<td>Graduate</td>
<td>Vanderbilt</td>
<td>2011</td>
<td>7</td>
</tr>
</tbody>
</table>
Building a **critical mass** of cyber security and trustworthy systems faculty and practitioners in teaching and research universities.

**Women’s Institute in Summer Enrichment**
- Expanded program to 30 participants
- Build and leverage relations beyond WISE
- Recruiting tool for REU/WISE/TRUST campuses
- Use of TAO learning materials

**Annual Symposium on Curriculum**
- Signature program for CSU/MSI CS faculty
- Build and leverage relations beyond CDSIA
- Recruiting tool for REU/WISE/SECuR-IT
- Use of TAO learning materials
- Expanding the TAO community

**Broadening Participation**
- Research Experience for Teachers (RET)
- External Partnerships, i.e. CAHSI, CFP
- Expanding the TAO community: Community college, 4-year and URM institutions
Women’s Institute in Summer Enrichment

WISE 2011 at Carnegie Mellon University

“We came across miles with diverse backgrounds, lived like teens, convened daily for learning and most evenings for play. Everyone was smart, engaged in their careers and lovely in their own ways and demeanors. It was an honor to spend the week together, from which I have learned many lessons…”

- One-week residential summer seminar
- Graduates, post-doctoral, and professors
- Program topics: cyber security, healthcare and privacy
- 2011 Speakers:
  - Lorrie Cranor: CyLab, Carnegie Mellon University
  - Dorothy Glancy, Santa Clara University Law
  - Leslie Lambert: Juniper Networks
  - Brenda Fellows: Fellows Corporate Consortium
  - Michelle Nix: McKesson
  - Adrian Perrig: TRUST, Carnegie Mellon University
  - Brad Malin: TRUST, Vanderbilt University
  - Deb Frinkie, National Security Agency

http://www.truststc.org/wise
“It was an excellent space to learn from the expertise of Industry and academic leaders… a good platform for education to exchange ideas in IA, especially building capacity in IA.”

“My department is considering development of new courses in MBA and bachelors program of Information systems. I will take advantage of this seminar to coordinate the development of new curriculum.

Demographics
• 25% Female Participants
• 55% HSI/MSI/HBCU Institutions
• 15 California State University Institutions
• 4 Historical Black College or University
• 1 California Community College
• 1 Historically Female Institution

Participating Universities
- Cal Poly Pomona (HSI)
- Cal Poly San Luis Obispo
- CSU Chico
- CSU Dominguez Hills (HSI/MSI)
- CSU East Bay
- CSU Humboldt
- CSU Los Angeles (HSI/MSI)
- CSU Long Beach (HSI)
- CSU Northridge (HSI)
- CSU Sacramento
- CSU Stanislaus (HSI)
- CSU San Bernardino (HSI)
- San Francisco State University
- San Diego State University (HSI/MSI)
- San José State University (TRUST)
- Carnegie Mellon University (CyLab)
- UC Berkeley (TRUST)
- Colorado State University
- Drexel State University
- Mt. San Antonio College (HSI)
- Jackson State University (HBCU/MSI)
- Howard University (HBCU/MSI)
- Fisk University (HBCU/MSI)
- Mills College
- Tuskegee University (HBCU/MSI)
- Polytechnic University of Puerto Rico (HSI)
- Inter American University of Puerto Rico (HSI)
- Virginia State University
- Youngstown State University
Building Community: Professional Pipeline

CDSIA: Curriculum Development in Security and Information Assurance

Curriculum Development in Security and Information Assurance (CDSIA) at San José State University. The 4th CDSIA 2011 held April 29, 2011. 2010 → 36 participants 2011→ 60 participants

- Objectives:
  1. Reach out to the California State University system, HSI/HBCUs and to other universities whose mission is focused on work-force preparation and undergraduate education
  2. Share material and support structures developed by the TRUST partners
  3. Strengthen the TRUST-related community of educators, and
  4. Facilitate the education of members of underrepresented communities in the domain of secure technologies.

- Target Student Audiences
  1. The broad population of educated individuals – general education
  2. The designers of our future – STEM discipline students
  3. The future domain specialists – BS and MS IT discipline students
Trust Academy Online

The TAO Portal: URL http://www.tao.truststc.org/

Welcome to the TRUST Academy Online (TAO) Portal

TAO supports online community outreach for TRUST, an NSF Science and Technology Center. TAO Project Profiles share the stories of individual TRUST projects and provide access to related resources. TAO Courseware Profiles disseminate sets of learning materials contributed by TRUST investigators, institutions, and partners.

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Design by ProTotus at ISIS, Vanderbilt.
The purpose for evaluation is to understand the degree to which the project goals are being met and to monitor and improve project effectiveness along the way in an effort to help reach those goals.

Significant attention will be paid to gathering and tracking longitudinal data so that we can document overall impact of engagement with and support of TRUST on participant educational and career choices.
**Summary**

- **Priming the Pipeline.** Leverage TRUST programs across partner institutions and multiple communities: undergraduate to the professorate and beyond-- TRUST REU, SECUR-IT, WISE, CDSIA, TAO and pending CE21, CI-TEAM and RET.

- **Collaborations** will leverage and expand current programs as well as create new undergraduate research opportunities—e.g., USC’s Information Sciences Institute (ISI).

- **SECuR-IT** Expand program to 30 interns with 10+ industry partners. Scale program to include *Financial* Infrastructures at *Cornell* and *Health* Infrastructures at *Vanderbilt*.

- **CDSIA** will draw in community colleges and broaden participation.

- **Trust Academy Online.** Building an outstanding archive of cyber security and trustworthy systems learning materials, program resources, and technical seminars and be recognized as the primary source in cyber security research and academic program support.