Overview
Department of Integrated Information Technology
University of South Carolina

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Virtual Meeting – College of Engineering and Computing
November 12, 2020
IIT Program

• B. S. Integrated Information Technology
• 120 credit hours, 400-hour internship
• Curriculum includes
  ➢ Cybersecurity
  ➢ IT Business Operations
  ➢ Databases
  ➢ Networking
  ➢ Project Management
  ➢ Web Development
• The department is developing a fully online BSc
• ABET accredited ("quality assurance")
IIT Program

- Programs are more practical than theoretical
- Courses reinforce the theoretical knowledge with hands-on activities
- What do graduates do?
- They build, maintain, operate, and repair hardware and software associated with computer systems
  - Network engineer
  - Cybersecurity analyst
  - Web design and services
  - User experience / human-computer interaction professional
  - Cloud system specialist
  - Security Operation Center (SOC) analyst
  - Data analytics professional
IIT Program

• Minor in Integrated Information Technology
• 18 credit hours
• Several concentrations
  ➢ Cybersecurity Operations
  ➢ IT Business Operations
  ➢ Databases
  ➢ Networking
  ➢ Project Management
  ➢ Web Development

The National Initiative for Cybersecurity Education (NICE) Framework is a national-focused resource that categorizes and describes cybersecurity work.
Additional Credentials

• DoD’s Information Assurance (IA) workforce is classified in IA technical (IAT):
  ➢ Level 1 (IAT 1): Computing environment information assurance
  ➢ Level 2 (IAT 2): Network environment information assurance
  ➢ Level 3 (IAT 3): Enclave, advanced network & computer information assurance

• It requires partnership
  ➢ Cisco Systems, Palo Alto Networks, VMware, Juniper, Intel

<table>
<thead>
<tr>
<th>Certificate</th>
<th>Material Covered in</th>
<th>IAT 1</th>
<th>IAT 2</th>
<th>NICE framework</th>
<th>Networks cert.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>ITEC 233</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Cyberoperations</td>
<td>ITEC 293</td>
<td>✓</td>
<td></td>
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<tr>
<td>Security+</td>
<td>ITEC 293</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>CCNA Security</td>
<td>ITEC 493</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CCNA Routing/Switching</td>
<td>ITEC 245, ITEC 445</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ACE</td>
<td>ITEC 493</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PCNSE</td>
<td>ITEC 493</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

NICE: National Initiative for Cybersecurity Education
Office of Naval Research (ONR) Project

- “Enhancing the Preparation of Next-generation Cyber Professionals”
- South Carolina cybersecurity needs
  - NIWC Atlantic, SRNL, Fort Jackson, Shaw Air Force Base, private industry
- Recruiting the American military’s cyber force is more difficult than ever
  - DoD has been struggling to hire more than 8,000 cyber positions (2018)¹
  - Shortage of cybersecurity professionals
- The College of Engineering and Computing is addressing the workforce needs:
  - Encourage students to acquire “cyber” knowledge
  - Undergraduate applied research
  - Private cloud
  - Collaboration among industry, government, education institutions

Cybersecurity job openings in four metro areas near Columbia, Feb. 2020

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ONR’s Cyber Project

• Collaboration
  ➢ Applied teaching and research -> professional tools, platforms, market validation
  ➢ Cisco Systems, Palo Alto Networks, VMware, Juniper, Intel

✓ Bachelor’s degree
✓ IAT credential
✓ Theory
✓ Hands-on expertise

Pod deployed in private cloud

Job search
ONR’s Cyber Project

- Collaboration
  - Applied teaching and research -> professional tools, platforms, market validation
  - Cisco Systems, Palo Alto Networks, VMware, Juniper, Intel

Additional credentials

Job search

✓ Bachelor’s degree
✓ IAT credential
✓ Theory
✓ Hands-on expertise
ONR’s Cyber Project

- Undergraduate students work 18 hours per week, 15 weeks, $18 per hour ($4,050)
  - Applied research
  - Professional tools, platforms, market validation
  - Cisco Systems, Palo Alto Networks, VMware, Juniper, Intel
  - Focus on relevant technology, customized scenarios; e.g., IPsec-based VPNs with NGFWs
NSF ATE and CC

- NSF Advanced Technical Education (ATE) and NSF Campus Cyberinfrastructure (CC) (2019)
- Development of a multi-state distributed cloud to support teaching, research
- 2+2+2 program (HS + College + University)
- Distributed cloud pools resources from SC and NC, serves institutions seamlessly
- Requests to use the platform
  - Berkeley National Lab
  - SANS institute (“girlsgocyber”)
  - Multiple higher-ed institutions
  - International Networks at Indiana
  - Fort Gordon (PAN’s NGFW, VMware Clouds)
  - Texas’ Lonestart Education and Research
• National Online Platform
• Consortium of Colleges and Universities
• Industry
  ➢ Palo Alto Networks Cybersecurity Academy
  ➢ Cisco Network Academy
  ➢ VMware IT Academy
  ➢ …
Graduate Projects

- Development of new techniques against attacks targeting “Internet-of-Things” devices
- Agreement with the Center for Applied Internet Data Analysis (CAIDA) (San Diego)
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Demystifying IoT Security: An Exhaustive Survey on IoT Vulnerabilities and a First Empirical Look on Internet-scale IoT Exploitations

Nataliia Neshenko, Elias Bou-Harb, Jorge Crichigno, Georges Kaddoum and Nasir Ghani
Graduate Projects

• Performance testing Google’s new communication protocol
• Feedback to Google (used in Youtube, Chrome, and other apps)
• Emulating behavior in private cloud before Google’s protocol public release
Graduate Projects

- Improving system’s performance using next-generation switches
- Offloading computational tasks to network switches
  - Orders of magnitude faster than general-purpose CPU
  - Very limited instructions set (e.g., no multiplication, no division, simple operations)
- Agreement with Intel (chips, software development environment)

Application example: media (voice) relay server

<table>
<thead>
<tr>
<th></th>
<th>Programmable Switch</th>
<th>General-purpose CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost</strong></td>
<td>$6,000</td>
<td>$10,000 - 25,000</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>~35,000,000 connections per switch</td>
<td>~500 connections per core</td>
</tr>
<tr>
<td><strong>Latency</strong></td>
<td>400 nanoseconds</td>
<td>Tens to hundreds of milliseconds</td>
</tr>
</tbody>
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