Overview
Department of Integrated Information Technology
University of South Carolina

Jorge Crichigno
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The Center for Advanced Technical Studies and Lexington Technical Center
Chapin, SC - November 8, 2022
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
**IT vs CS**

**Computer Science (CS) graduates can perform many different tasks.**

- We use mathematical approaches to invent and improve new algorithms.
- Progress in CS enables innovation in other fields, such as...
  - bioinformatics
  - robotics
  - machine learning
  - data visualization

**Information Technology**

- In Information Technology we are principally focused on how to configure, use, and support technology infrastructures within organizations.
- Organizations are dependent upon information technology and IT professionals help support it.
- We understand computer systems and their software and help to solve computer-related problems.
- We possess a combination of theoretical knowledge and practical, hands-on expertise.
- We also do software development, especially in applied areas such as web sites and mobile apps.
- We can help configure and improve an organization’s security infrastructure.
- We install, customize, and maintain both applications and devices for an organization and its users.
IT vs CS

On the Job
Use new theories to create cutting edge software.
Focus on the theoretical aspects of technology.
Utilize theory to research and design software solutions.
Use a wide range of foundational knowledge to adapt to new technologies and ideas.
Apply mathematical and theoretical knowledge in order to compare and produce computational solutions.

On the Job
Integrates hardware and software.
Applies technology to solve practical problems.
Provides a support role, within an organization, to help others make the best use of its technical and information resources.
Uses a wide range of foundational knowledge to adapt to new technologies and ideas.
Understands both technology and business, but with a focus more on the technical side.
Graduates

Dakota McDaniels
Building automation superpowers for every investor
Marina del Rey, California, United States
476 followers · 476 connections

Keegan Sprinkle
Enterprise Technical Support Specialist at Airtable and Recent grad of the UofSC iIT program.
Columbia, South Carolina Metropolitan Area
184 followers · 184 connections

https://www.linkedin.com/in/dakota-mcdaniels

https://www.linkedin.com/in/keegan-sprinkle-270487184
Graduates

Nathan Bohmer
Project Coordinator at Black Box
Southport, North Carolina, United States
245 followers · 243 connections

Josue Hernandez
Security Services Specialist at IBM
Chicago, Illinois, United States
679 followers · 500+ connections

https://www.linkedin.com/in/nathan-bohmer

https://www.linkedin.com/in/josueihernandez
# IIT Program

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

## Minor Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITEC 101</td>
<td>Thriving in the Tech Age</td>
<td></td>
</tr>
<tr>
<td>ITEC 233</td>
<td>Introduction to Computer Hardware and Software</td>
<td></td>
</tr>
<tr>
<td>ITEC 245</td>
<td>Introduction to Networking</td>
<td></td>
</tr>
<tr>
<td>ITEC 293</td>
<td>Cybersecurity Operations</td>
<td></td>
</tr>
<tr>
<td>ITEC 445</td>
<td>Advanced Networking</td>
<td></td>
</tr>
<tr>
<td>ITEC 493</td>
<td>Information Technology Security for Managers</td>
<td></td>
</tr>
</tbody>
</table>

Courses map learning objectives to the U.S. NICE framework (ITEC 293, ITEC 445, ITEC 493)

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>
</tr>
<tr>
<td>Cyberoperations</td>
<td>ITEC 293</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Security+</td>
<td>ITEC 293</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CCNA Security</td>
<td>ITEC 493</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CCNA Routing/witching</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>
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</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)
  - 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

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

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

Additional credentials

Job search
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
NSF ATE 2021- ...

- National Online Platform
- Consortium of Colleges and Universities
- Industry
  - Palo Alto Networks Cybersecurity Academy
  - Cisco Network Academy
  - VMware IT Academy
  - ...

The University of South Carolina partners with VMware IT Academy to help students learn digital technology skills to fill high-demand jobs.

Who we are:
Located in Columbia, South Carolina, the University of South Carolina (USC) is a...
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)

Global distribution of exploited IoT devices; results from this research project

Malware exploiting default credentials
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)

**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

Abstract—The security issue impacting the Internet-of-Things (IoT) paradigm has recently attracted significant attention from the research community. To this end, several surveys were put forward addressing various IoT-centric topics including intrusion detection systems, threat modeling and emerging technologies. In contrast, in this work, we exclusively focus on the ever-evolving IoT vulnerabilities. In this context, we initially provide a comprehensive classification of state-of-the-art surveys, which address various dimensions of the IoT paradigm. This aims at facilitating IoT research endeavors by amalgamating, comparing and contrasting dispersed research contributions. Subsequently, we provide a unique taxonomy, which sheds physical therapy [4], while the Autism Glass [5] aims at aiding autistic children to recognize emotions of other people in real-time [6].

Safety-centric IoT solutions endeavor to minimize hazardous scenarios and situations. For example, the concept of connected vehicles prevents the driver from deviating from proper trajectory paths or bumping into objects. Further, such concept enables the automatic emergency notification of nearest road and medical assistance in case of accidents [7]. Additionally, autonomous, self-driving mining equipment
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>
</table>
Graduate Projects

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

From: Christopher Cummings <chris.cummings@es.net>
Sent: Friday, December 2, 2022 4:19 PM
To: Crichigno Benitez, Jorge <jCRICHIGNO@ec.sc.edu>
Subject: Student Internship

Hello Jorge,

I hope all is well since we met at CENIC 2022! I was wondering if any of your students are still interested in participating in the ESnet Spring/Summer student Intern program for a P4/FPGA project surrounding IPv6 NAT on the esnet-smartnic platform. We have the posting online here, and I’d greatly appreciate if you would pass this along to any students who are interested. I know that the student who was with you at CENIC 2022 was interested, but I seem to have failed to grab his email information.

Thanks, and happy Friday!

—
Chris Cummings