Computer Security Education Are We There Yet?
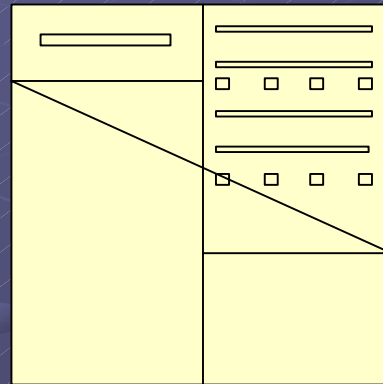
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Outline

- Introduction
- Past Security Education
- Present Security Education
- Institutional Experiences
  - University of Idaho
  - Indiana University of Pennsylvania
- Future Security Education
- Conclusion and The Future

Introduction

- Computer Security - 1975

Inside | Outside

Not connected

No PC's

No Internet

Introduction

- Computer Security – 1975
  - Threats
    - Inside users access forbidden information
    - Physical breach of systems
    - System failures
  - Mechanisms
    - Encryption
    - Access Control
    - Isolation – physical
  - Academic Programs
    - No official programs

Introduction

Computer Security – 2006

Network spans the globe

PC's, Cell phones, PDA's

All Connected!!!

No secure perimeter

Introduction

- Computer Security – 2006
  - Threats
    - Inside users
    - Outside users – hackers, organized crime, others
    - Physical and virtual system breach
  - Mechanisms
    - Encryption, Access control, Isolation
    - Add on security, firewalls, intrusion detection, hardware devices
  - Academic Programs
    - Many Graduate and undergraduate programs
    - Junior college programs
  - Other Training
    - Large number of Certified training programs

Introduction

- Where are we after 30 years of Progress?
  - Are we there yet?
    - Evidence says no ....
    - Botnets, Worms, spam, viruses, daily vulnerabilities even in security products
  - The Fix?
    - No easy answer
  - Hope is in education
    - Train or teach future developers to produce secure software or design secure systems

Introduction

- Wanted to look at Security education from the past to the present
  - Industry, academia and government
- Plus assess the future
  - How can we move forward?

Past

- Academic
  - Few academic programs
  - Emphasis was on graduate education, cryptography, multi-level security
  - Reflected government interests
    - Main concern was privacy of multi-level data

Past

- Government
  - 1996 Presidential Decision Directive 63 recognized vulnerabilities of US infrastructure
  - 1999 NSA established Centers for Academic Excellence in Information Assurance
  - 2000 National Plan for Information System Protection established the SFS program
  - 2002 Department of Homeland Security was created

Past

- Government
  - 2003 President's National Strategy to Secure Cyber Space
    - Has four major initiatives for education and training

  - Lots of initiatives and directives
    - One allotted money to academic security education
      - NFS - SFS program

Present

- **Academic**
  - Many Schools with security programs
  - Two main ways of establishing security tracks
    - Integrate security into existing curriculum
    - Create a security track containing specialized courses
  - Selecting specialized vs. integration depends on available resources and goals for students

Present

- Academic
  - Teaching Security within context of other courses
    - All CS students are exposed to security instead of just a few who take security courses
    - Security concepts learned within context of broader CS topics
      - Network security, software engineering
    - Available to all schools of even limited resources
      - Don't need new faculty or major re-training

Present

- Government
  - Good news
  - Programs have grown
    - Centers of Academic Excellence
      - From 7 to 67 schools
    - DOD Scholarship for Service
    - NSF-SFS
      - From 150 to 350 graduates by 2005

Present

- Government
  - Bad News
  - Research Funding
    - Lack of long-term research funding
    - Major funding agency of cyber security NSF
      - Only 8% proposals submitted are funded
    - DARPA cut portion of academic funding from $214 million to $123 million
      - Shift towards product orientation with shorter time frames
    - DHS budget $1 billion for Science and Technology
      - Only $18 million allocated for cyber security or ≈ .02%

Present

- Industry
  - Increasingly critical of Universities for producing graduates ignorant of security concepts
  - Few companies actively support security education in any way
    - Microsoft is an exception
    - Have a two year old security curriculum initiative for $750,000 per year
    - Goal is to produce curriculum in security topics available to all on their web site

Institutional Experiences

- Two Institutions Presented
  - Both NSA Centers of Academic Excellence in Information Assurance Education
  - Experiences typical of schools committed to security education
  - NOT typical for CS Departments in general
    - Most smaller schools struggle with security
    - Have a difficult time fitting in security courses without experienced faculty and no security standards

University of Idaho

- One of the original Centers of Academic Excellence
- Began courses in computer security in 1991
  - Started with two courses
    - General purpose security course
    - Network security course

University of Idaho

- Specialized courses in security
  - Currently seven courses in security
    - Lower division General Security Course
    - Upper division General Security Course
    - Network Security
    - Attack/Defend course
    - Computer Forensics course
    - Infrastructure security
      - Electric power industry and SCADA systems
    - System Survivability
  - Have SFS program
    - Strong student interest in security and SFS program

University of Idaho

- Accomplishments
    - Good program in Security Education
        - Small school, limited faculty and resources
        - Graduate program
        - Competitive for grants
- Hindrances
    - No curriculum standards
    - No widely available materials for courses
    - Not enough industry involvement

IUP CS Curriculum so far

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- Designated a Center in 2002
- In 2003 –Bachelor of Information Assurance Track
  - Criminology Dept
  - Computer Science
- In 2005- Masters in Information Assurance
  - Computer Science (CS)
  - Criminology (CRIM)
  - Political Science (PLS)
  - Business Technology Support and Training Department (BTST)
- University wide IA course

IA Curriculum

- Cybersecurity Basics- Host security
- Network Security
- Cryptography
- Security topics have been integrated into most of our courses.

The Masters of IA

- Core courses
  - Theory & Practice of Information Assurance (Computer Science)
  - Information Security Policy (Political Sciences)
  - CyberLaw and Ethical Issues (Criminology)
  - Information Security in the Enterprise (BTST)
  - Digital Forensics (Computer Science, CRIM)
- Tracks
  - Criminology
  - Computer Science
  - Business

IA Awareness course

- An introduction to information security
- Securing your own computer
- Organizational security
- Internet Security
- Network Attacks
- Internet Fraud and Cyber Crime
- Special Topics in information security

Future of Security Education

- Goal- To increase the number of CS graduates with an understanding of computer security principles.
  - Increase the number of CS programs that teach computer security.
- Obstacles and barriers

Obstacles and barriers

- Investment on the part of both institutions and the faculty members.

Institution	Faculty
Release time for faculty	Being ready for further training
Travel and training grants	Collaboration links
Tenure support	Travel to conferences and workshops

Other obstacles and barriers

- No standard for CS curriculum development
  - departments must work harder to define course content
  - the inadequacy of the 40XX Training Standards for academic programs
- Lack of government funding in basic research
- Limited industry involvement
  - CISSE conference objective (government, industry and academia partnership)
  - Faculty exchange programs/workshops
- Difficulties in recruiting qualified IA faculty.

Conclusion

- Presented government initiatives and other events from the past eight years.
- Examined the current state of academic progress
- Discussed future objectives for promoting security within CS and perceived barriers to success.

Future work

- A survey of CS and IT departments to determine current status, future plans and needs for security education is needed.
- CNSS 40XX mapping experience survey by Idaho University
    - Presented at CISSE 2006

Other projects

- An academic curriculum standard for both undergraduate and graduate programs
- Integration of computer security into accreditation programs (e.g. ABET)
- Support for schools beginning security programs
  - Curriculum help and mentorship from established programs