Experiential Learning Via Cyber Ranges

National Institute of Standards and Technology (NIST)
Federal Information Systems Security Educators' Association (FISSEA)
Awareness – Training – Education

UMUC
University of Maryland University College
UMUC.EDU

Center for Security Studies
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Questions to Explore

1. How do we increase the pipeline of cybersecurity talent?

2. How does experiential learning via Cyber Ranges support this objective?

3. How is the Cyber Range industry developing and who are the players?

Increasing the Supply of Cyber Talent

Cybersecurity Ventures predicts 3.5 million unfilled cybersecurity positions by 2021

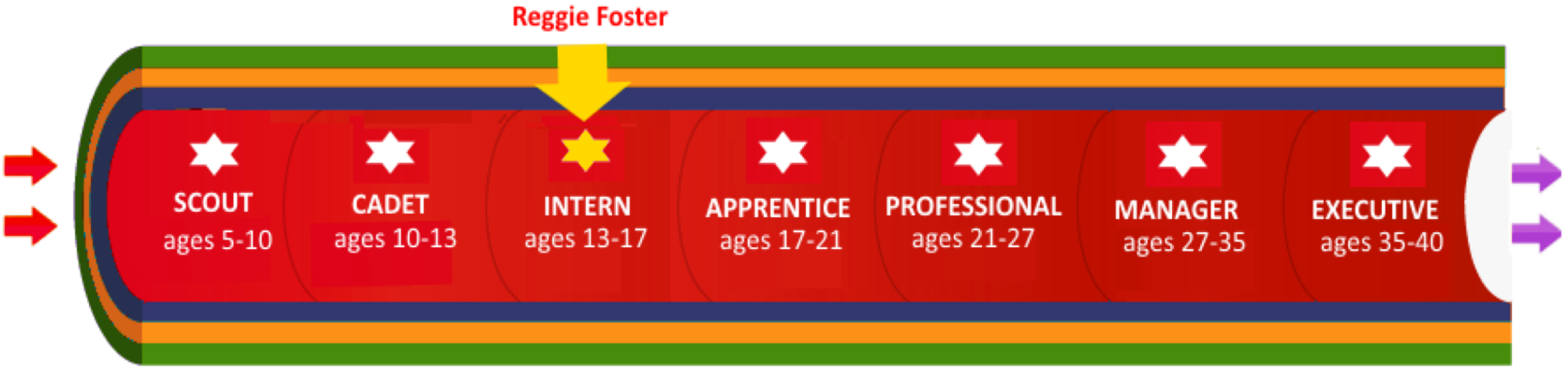
NICE Cybersecurity Workforce Framework

- Analyze
- Collect and Operate
- Investigate
- Operate and Maintain
- Oversee and Govern
- Protect and Defend
  - Defense Analysis
  - Defense Infrastructure Support
  - Incident Response
  - ** Vulnerability Assessment & Mgmt*
- Securely Provision

Vulnerability Assessment & Mgmt
A0001: Ability to identify systemic security issues based on the analysis of vulnerability and configuration data.
A0044: Ability to apply programming language structures (e.g., source code review) and logic.
A0120: Ability to share meaningful insights about the context of an organization's threat environment that improve its risk management posture.
A0123: Ability to apply cybersecurity and privacy principles to organizational requirements (relevant to confidentiality, integrity, availability, authentication, non-repudiation).

https://niccs.us-cert.gov/workforce-development/cyber-security-workforce-framework

KP Professional Maturity Model



Vulnerability Assessment & Mgmt	Intern (13-17) (Awareness)	Apprentice (17-21) (Novice)	Professional (21-27) (Intermediate)
A0001	50-75	75-100	100-125
A0044	50-75	75-100	100-125
A0120	50-75	75-100	100-125
A0123	50-75	75-100	100-125

Cyber Ranges & Experiential Learning

Cyber ranges are interactive, simulated representations of an organization's local network, system, tools, and applications that are connected to a simulated Internet level environment. - NIST

Why Use A Cyber Range?

- Provide Performance Based Learning And Assessment
- Provide a Simulated Environment Where Teams Can Work Together
- Provide Real-Time Feedback
- Simulate On-the-Job Experience
- Provide an Environment Where New Ideas Can be Tested

https://www.nist.gov/sites/default/files/documents/2017/05/23/cyber_ranges_2017.pdf

Experiential Learning via Cyber Range

- Red teams attempt cyber attacks against an enterprise's security posture

- Green teams are legitimate users connected with various devices (wireless and/or wired)

- Blue teams defend an enterprise's use of info systems by maintaining its security posture

- White teams create the situations under which the teams compete and monitor results

Experiential Learning: Sample Blue Team Scenario

Congratulations! You are now responsible for rhinoribbons.org, here are your credentials: admin:Rhinos

Machines in the network:

External:

Web: www.rhinoribbons.org - 185.110.107.59

Mail: mail.rhinoribbons.org - 185.110.107.131

Internal:

Database: db.rhinoribbons.org - 10.0.0.15

File server: fileserver.rhinoribbons.org - 10.0.0.39

Border:

Firewall: fw.rhinoribbons.org - 185.110.106.2, 10.0.0.1, 185.110.107.1

There is a backup of the website in root's home directory on www.rhinoribbons.org

Experiential Learning: Sample Blue Team Scenario

You should complete the following before the close of business today:

1. Setup your email client and check it often. There may be important emails that you will need to attend to.
2. Ensure the firewall is properly configured such that only absolutely required traffic can get from the DMZ to the LAN
3. Ensure all external servers are safe from SSH brute force attacks. Policy change is at your discretion.
4. Inspect your network for any additional flaws or poor security practices and take appropriate action or report your findings.

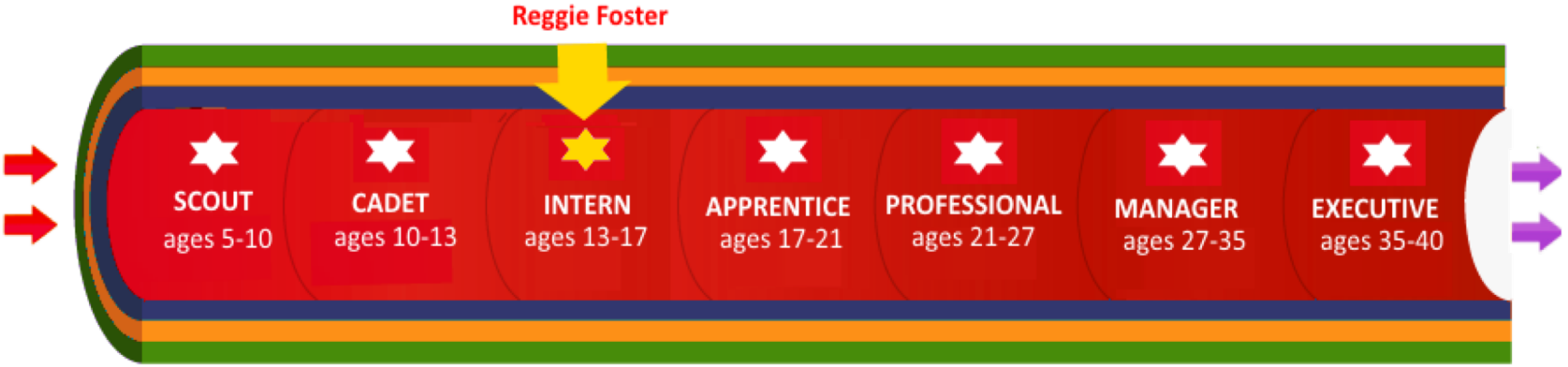
Configuring your email client:

1. Open Thunderbird and press "Skip this and use my existing email"
2. Enter your name: email: admin@rhinoribbons.org; password: Rhinos
3. Use mail.rhinoribbons.org for both the incoming and outgoing server hostname and choose re-test.

Experiential Learning: Capture the Flag (CTF)

- Teams compete for flags that hold point value placed on network
- Teams can be co-located (separate rooms) or Virtual
- Attack – Defend
  - Red Team Vs. Blue Team
- Jeopardy Style
  - Red Team vs. Red Team
  - Blue Team vs. Blue Team
- Resources
  - Open Web Application Security Project (OWASP)
  - National Cyber League (NCL)
  - International Capture The Flag (ICTF)
  - CTFTime.org

Sample Learning Path



Intern (Aware)

- Module 1:
  * Basic Learning Skills
- Module 2:
  * IT Basics
  * Modeled on Comp TIA A+ Program

Apprentice (Novice)

- Module 3:
  * Workstations/Servers/ Networks
- Module 4:
  * Networks / System Admin
- Module 5:
  * Admin/IT Security/Cyber

Professional (Intermediate)

- Module 6:
  * Security Ops/Cyber Review / Tools
- Module 7:
  * Hands on Cyber Range
  * Practice Handling Real World Threats

Baltimore Cyber Range (https://www.baltimorecyberange.com/)

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Cyber Range Industry Profile

Military/Government, Academia and the Private Sector are all engaged in building cyber ranges with significantly different scale and capabilities

Cyber Range Industry Profile

Military / Government

- National Cyber Range (NCR)
- DoD Cyber Security Range (CSR)

Private Sector

- Metova (CENTS/SLAM-R)
- IBM (X-Force)
- Raytheon (CODE)
- Financial Sector Information Sharing and Analysis Council (FS-ISAC)

Academia

- AR: University of Central Arkansas (https://uca.edu/cnsm/2017/10/05/cyber-range-announcement/)
- AZ: Grand Canyon University (https://www.azcwr.org/)
- FL: University of West Florida (https://floridacyberrange.org/)
- GA: Augusta University (http://cyber.augusta.edu/georgia/)
- MI: Wayne State/Oakland University (https://www.merit.edu/cyberrange/)
- VA: Regent University (https://www.regent.edu/institutes/cybersecurity/cyber-range/home.cfm)
- VA: Virginia Tech (https://virginiacyberrange.org/)

Who is Using Cyber Ranges?

Who	How
Professionals	Professionals from diverse groups such as information technology, cybersecurity, law enforcement, incident handlers, continuity of operations, and others use cyber ranges to improve individual and team knowledge and capabilities.
Students	Students can use cyber ranges to apply knowledge in a simulated network environment, develop cyber skills, work as teams to solve cyber problems, and prepare for cyber credentialing examinations.
Educators	Educators can use cyber ranges as a classroom aide or instruct or assess students virtually.
Organizations	Organizations can use cyber ranges to evaluate their cyber capability, test new procedures, train their team on new organizational and technical environments and protocols before they are introduced into the organizational environment and expand personnel abilities.

https://www.nist.gov/sites/default/files/documents/2017/05/23/cyber_ranges_2017.pdf

Questions & Answers

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