Free Modules! Building a Course with SANS CyberAces

3RD ANNUAL

VIRGINIA CYBERSECURITY EDUCATION CONFERENCE

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About me

- Background is IT Networking and Security
- ~18 years at Blue Ridge Community College as Network Engineer and Information Security Officer, retired 2 years ago
- Developed(ing) course for Shenandoah Valley Governor's School in IT Security for seniors
- Adjunct instructor at BRCC
- Contact Info
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  - yorkj@svgs.k12.va.us

Course Origins

SANS Cyber Corps ~2012

- Assisted SVGS with an evening club

SANS Cyber Aces 2013 – 2019

- Asked to develop Cyber Security class at SVGS
- Primary goal: Hands-on experience in fundamentals
- Few textbooks were/are hands-on
- Used Cyber Aces as core
- Developed many labs and modules of my own

Links! Everyone wants Links!

- SANS Cyber Aces
  - https://www.cyberaces.org/ (Home page)
  - https://tutorials.cyberaces.org/tutorials.

Streaming Tutorials

1. Introduction to Operating Systems

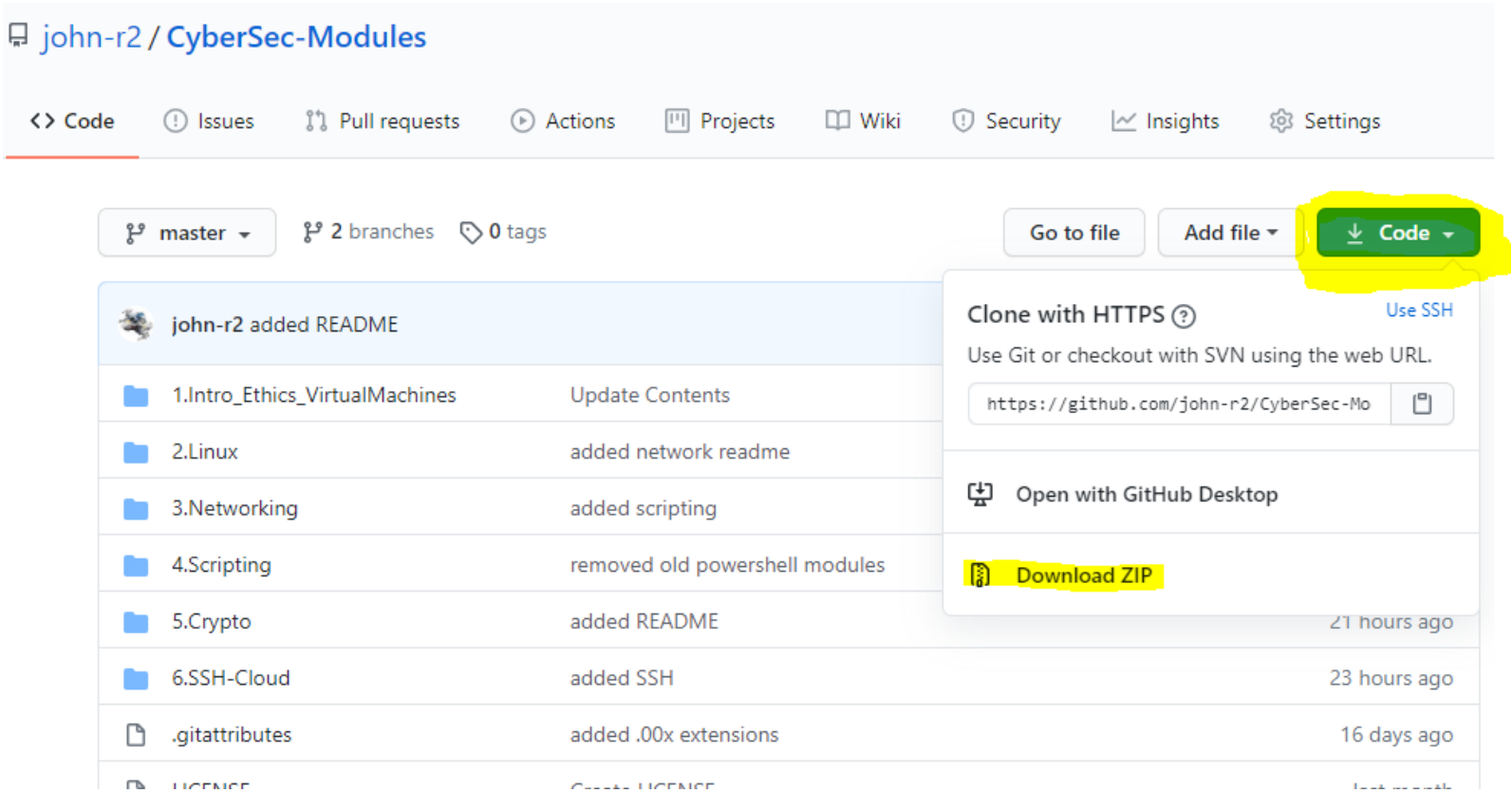
- Linux
  - VMware Installation and Configuration
  - OS Background & Building the Linux VM
  - Core Commands
  - Users and Groups
  - Applications and Services
  - Files and Permissions
  - Installing Software
- Windows
  - Windows Virtual Machine Installation
  - Updating Windows
  - Command Line Basics
  - File System
  - Users and Groups
  - Policies and Credential Storage
  - Registry
  - Networking and Sharing
  - Services and Processes

2. Networking

- Introduction and Layer 1
- Layer 2 - Data Link
- Layer 3 - Network, Part 1: Addressing & Masking
- Layer 3 - Network, Part 2: Routing
- Layer 3 - Network, Part 3: Communication

Links! Everyone wants Links!

- My Modules



- https://github.com/john-r2/CyberSec-Modules

Teaching through hands-on labs

- Labs are essential for future IT workers
  - IT workers create, they don't memorize lists
  - Troubleshooting is a critical skill, difficult to teach
- Lab Goals
  - Students set up as much of their own equipment as possible
  - Labs proceed quickly and smoothly
  - There's an obvious conflict

https://krebsonsecurity.com/2020/07/thinking-of-a-cybersecurity-career-read-this/

Skill area	Percent of cybersecurity job candidates who were unable to perform even basic tasks	Percent of cybersecurity job candidates who demonstrated hands-on mastery
Common exploitation techniques	66%	4.5%
Computer architectures	47%	12.5%
Networking	46%	4%
Linux	40%	14%
Programming	32%	11.5%
Data and cryptography	30%	2%

Labs in the time of Covid-19

- Lab Types
  - Virginia Cyber Range
  - Student's personal computers
  - Cloud—AWS Educate
  - Classroom computer labs
- New problem—where will the students be?
  - Completely online
  - Half online, half in class
  - In class

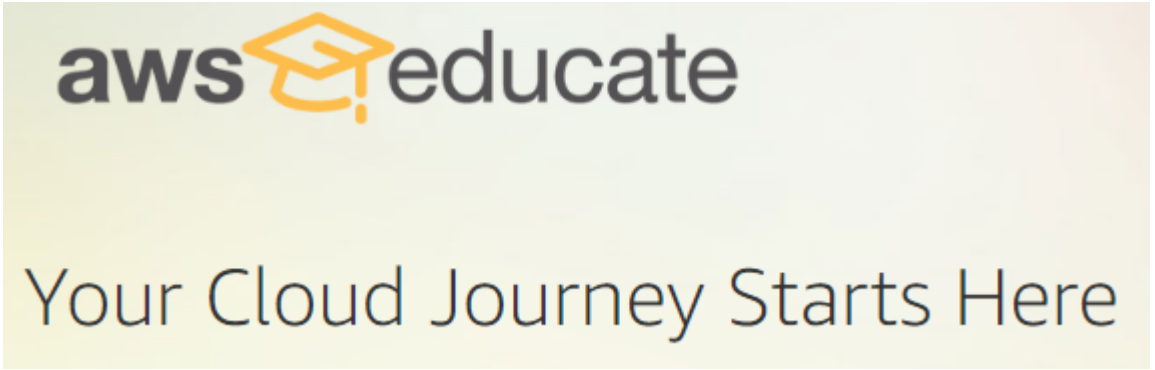
Virginia Cyber Range

- Available to all Virginia K-12/colleges (class must be cyber security)
- Pre-made VMs (Windows, CentOS, Kali, and Ubuntu)
- Pros
  - Only requires web browser and Internet connection
  - Students can work from home
  - Instructor can customize VM
- Cons
  - Students do not practice installing their own VM
- To use two VMs that communicate, find correct cyber range environment

Student personal computers

- Students install VMware Workstation Player (free) or other hypervisor
- Students create VMs as needed
  - Linux OSs are free, Windows eval downloads good for 180 days
- Pros
  - Teaches students to create their own labs
- Cons
  - Most difficult to teach
    - student errors and laptop capabilities
  - Some students do not have access to reasonable computers
    - Modern processor, >= 4 GB RAM, >= 250 GB hard disk

AWS Educate



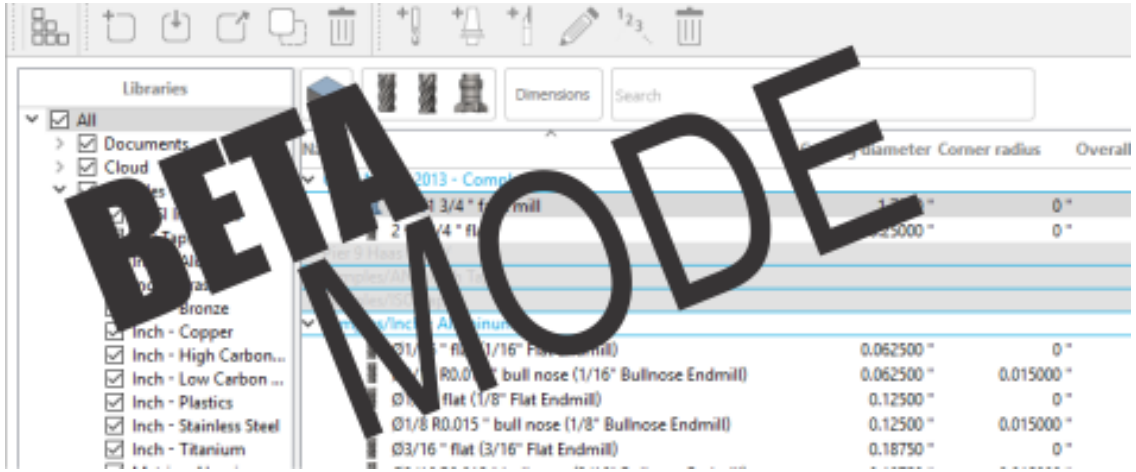
- Teachers can sign up at https://aws.amazon.com/education/awseducate/
- Need to provide URL of your class on your school website
- Each student gets $50 of AWS credit by default
- Pros
  - Students create their own VM lab environments
  - Students learn cloud basics
  - Instructors can see student VMs
- Cons
  - Can be intimidating for instructors first time they use it

School Computer Labs

- A lab dedicated for your class is best
  - (hard to come by)
- Otherwise, lab software must include a hypervisor to build VMs
  - VMware Workstation Player is common
    - Required for US CyberPatriots, https://www.uscyberpatriot.org/
  - Microsoft HyperV
    - Included on Windows 10 Enterprise, Pro, or Education
    - Must be enabled
    - https://docs.microsoft.com/en-us/virtualization/hyper-v-on-windows/quick-start/enable-hyper-v
  - Oracle VirtualBox
    - https://www.virtualbox.org/
- Some networking labs require admin access—difficult unless lab is dedicated

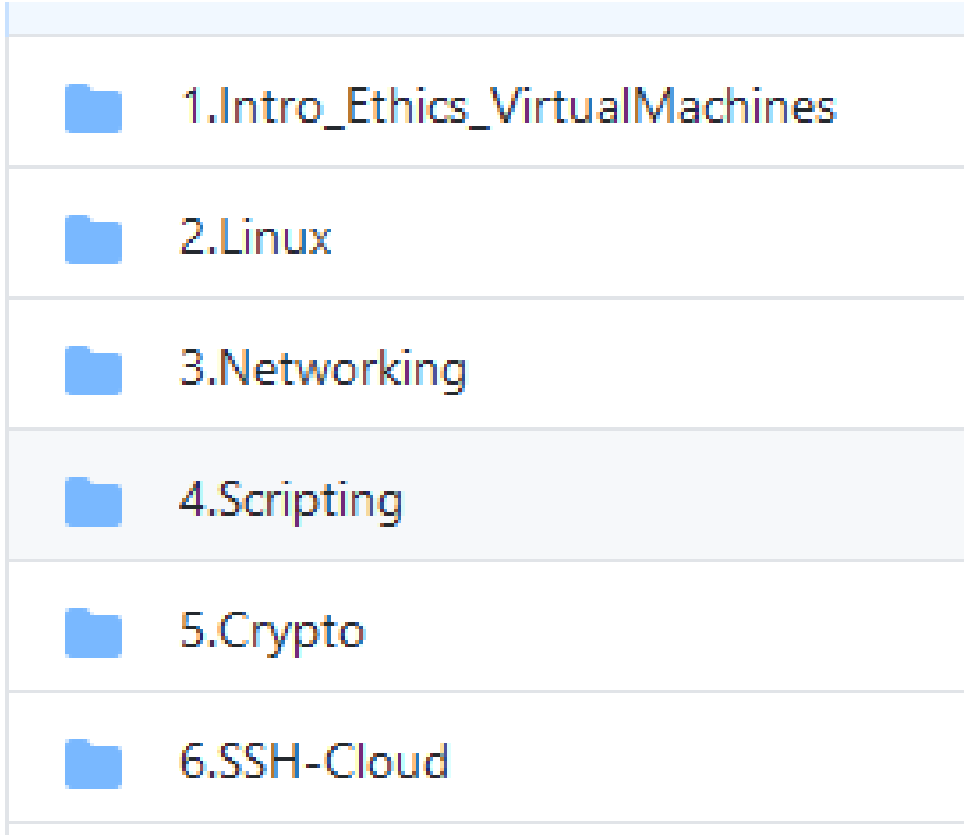
Warning—Beta mode!

- I’m the only one that has taught the modules I’ve written
- Things change *really* fast. Labs that worked last month may blow up today
- I will be glad to assist anyone using my modules
- Twitter DM @JohnYork_r2
- Email yorkj@svgs.k12.va.us



SVGS/BRCC modules

- Linux, Networking and Scripting modules expand on CyberAces modules
- No Windows module (yet) to go with CyberAces Windows module
- If you register for US Cyber Patriots, additional modules on cyber security, ethics, and Windows are available.

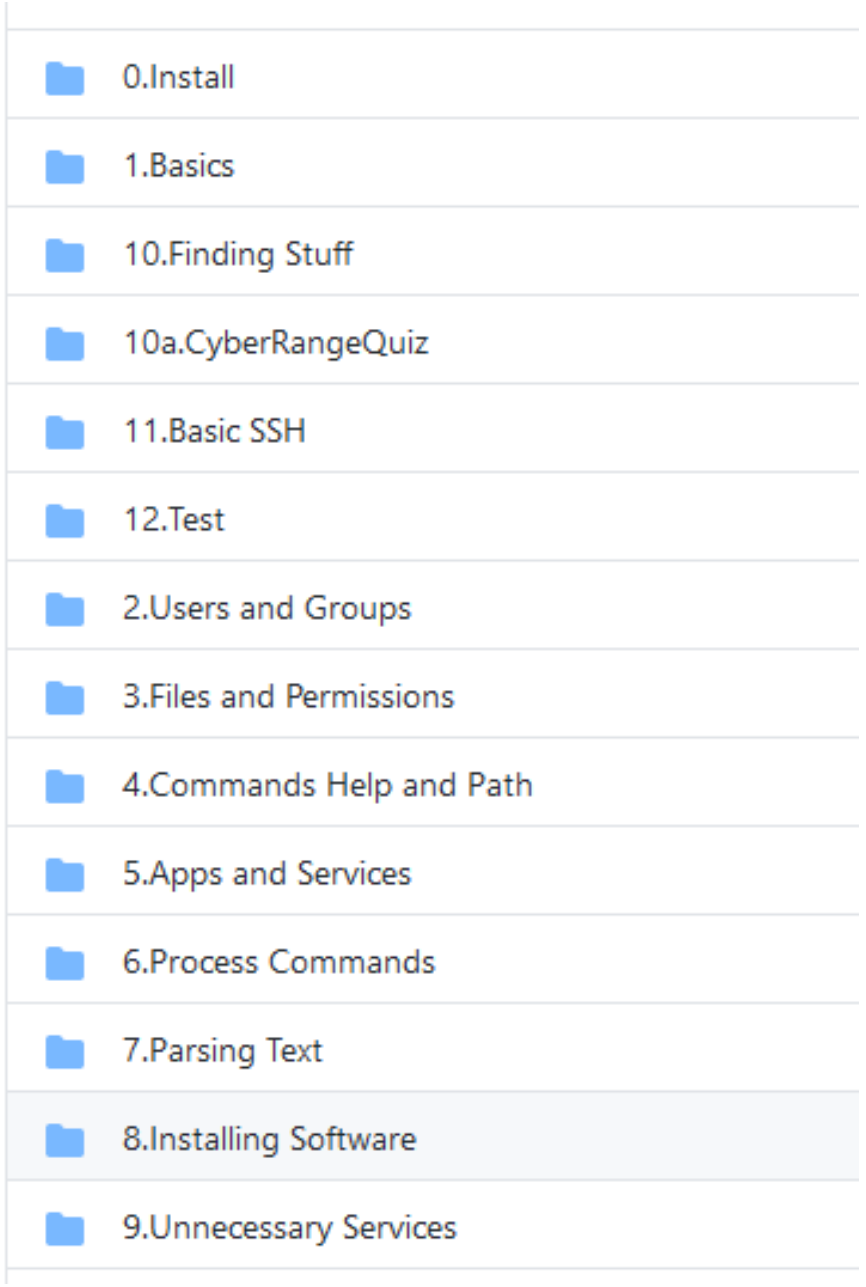


Linux Modules (1)

- CyberAces modules were not updated from 2015 until this year
  - During that time Linux moved from SysV to systemd for service control
  - I created new modules for systemd and SysV in response
- CyberAces uses CentOS, CyberPatriots competition uses Ubuntu
  - I adjusted modules for Ubuntu since my class competes in CyberPatriots
- The Linux Command Line book is very good and available for free
  - I adjusted modules to include it as well as CyberAces
  - http://www.linuxcommand.org/tlcl.php
  - https://svwh.dl.sourceforge.net/project/linuxcommand/TLCL/19.01/TLCL-19.01.pdf
- CyberAces modules have recently been updated
  - I am trying to make my modules compatible with both CentOS and Ubuntu

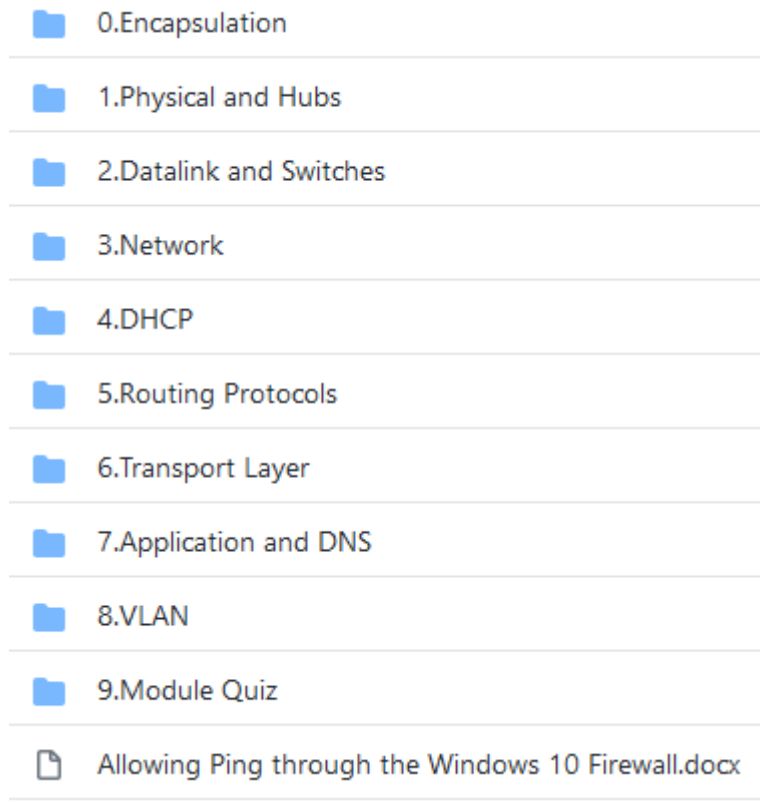
Linux Modules (2)

- CyberAces uses a CentOS VM
- CyberPatriots uses an Ubuntu VM
- Trying to make modules compatible with both
- Many modules follow CyberAces
- Module 4 is from The Linux Command Line
- Module 5 and 7 are new or expanded from CyberAces



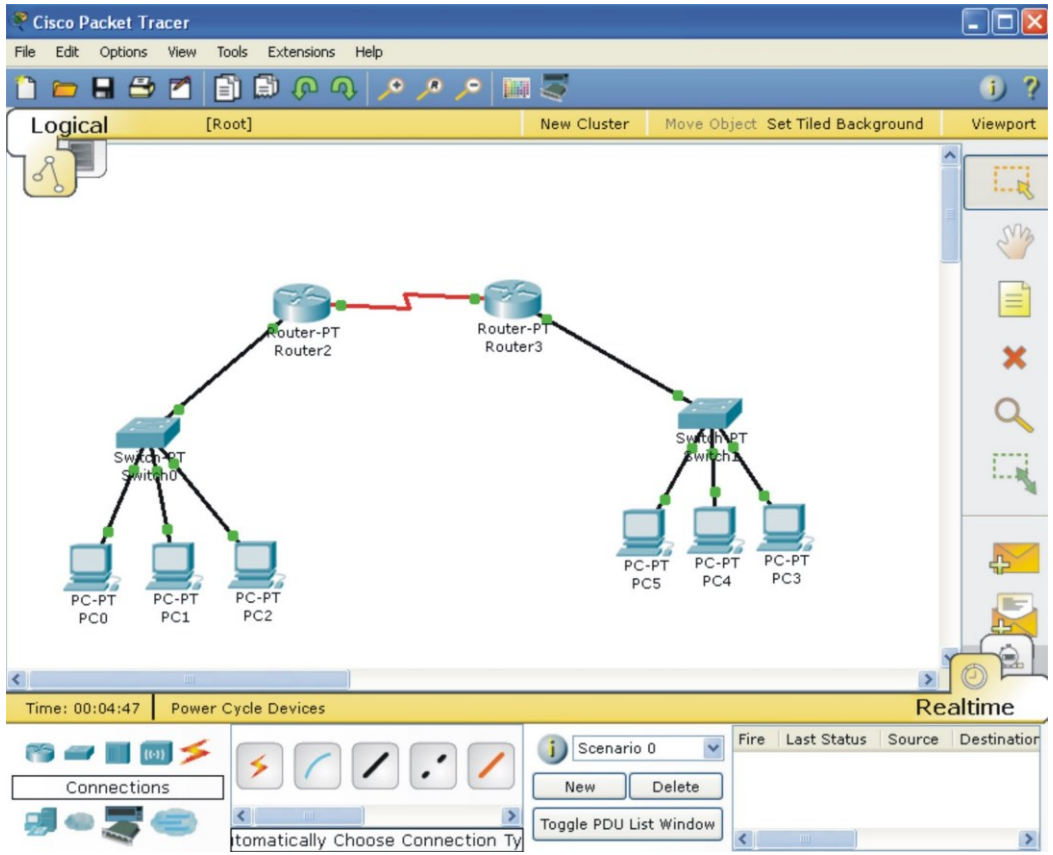
Networking Modules

- Generally follow CyberAces, although VLAN module is new and under development
- Labs originally written for hardware switches and routers
- Expanded to use Cisco PacketTracer



Cisco PacketTracer

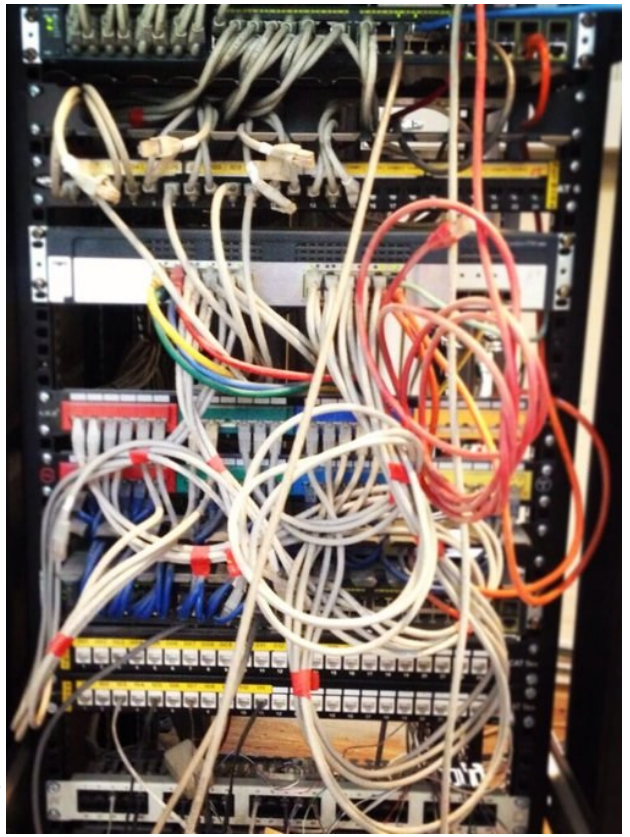
- Previously, only members of the Cisco Network Academy could get access
- My classes got access because it comes as part of Cyber Patriots
- A few months ago Cisco made it available for everyone



- https://www.netacad.com/courses/packet-tracer/introduction-packet-tracer

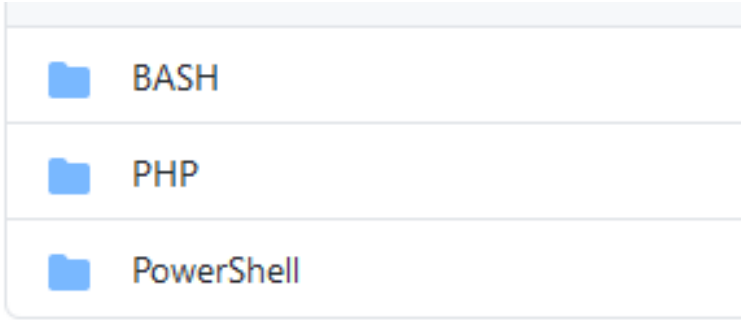
Network Labs with Hardware

- My preference. I learn better when I hold cables in my hands
- Requirements for a 12 – 15 person lab
  - 4 switches. The switches do not need to be enterprise switches with management. You can buy cheap switches at Amazon or a big box store for about $20 each.
  - ~30 Cat 5 or 6 network cables of varying length.
  - 3 routers. I prefer a Cisco 2911 router. At least 2 of the routers should have 3 Ethernet ports; one router may have 2 Ethernet ports. You can purchase these routers on Ebay for about $100 each.



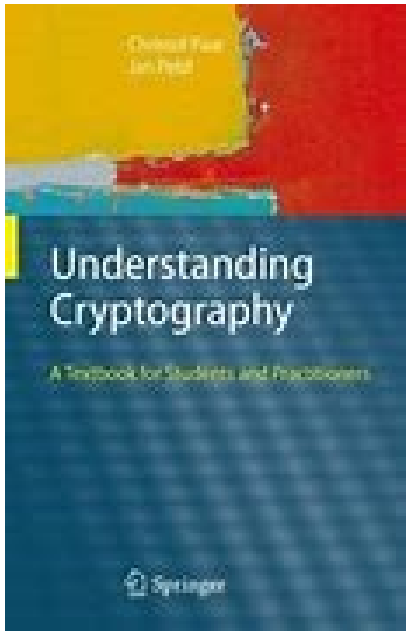
Scripting Modules (System Administration)

- BASH mostly follows Cyber Aces
  - Some additions for parsing text
- PHP was in the 2015 Cyber Aces, deleted in 2020
  - I kept the 2015 modules because I used them to demonstrate simple web vulnerabilities
  - My GitHub includes copies of old Cyber Aces PHP
  - Fun lab! Holiday Hack Trails lessons from the 2019 SANS Holiday Hack Challenge (HHC)
- PowerShell
  - Fun lab! Christmas Cheer Laser from 2019 HHC
- Python is on my to-do list



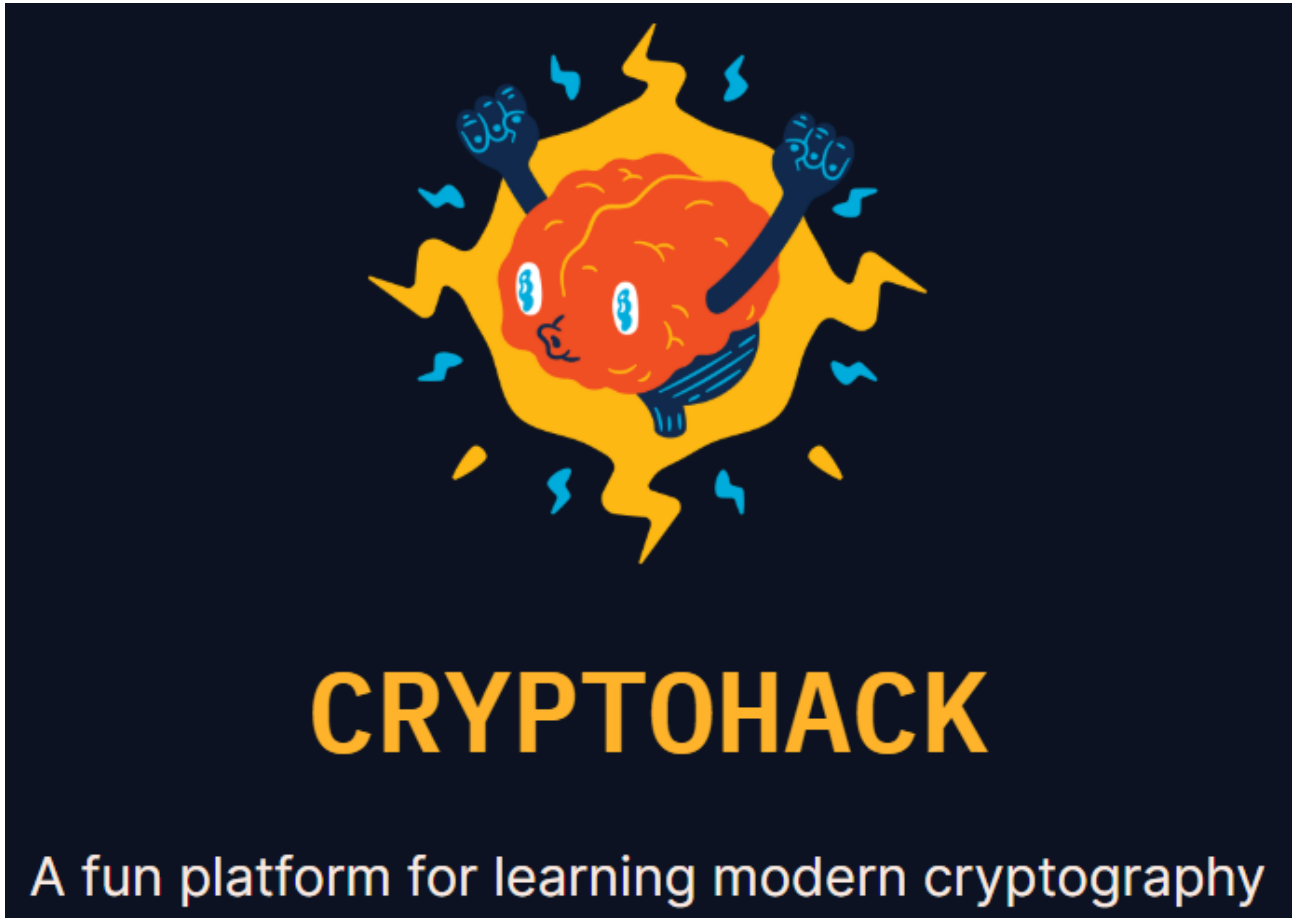
Cryptography Modules

- IMHO certification exams covering crypto are vocabulary tests
- Goals
  - Teach some of the math behind cryptography
  - Make the lessons accessible to non-math folks
  - Hands on as much as possible
  - Uses Python and PyCryptodome
- Inspired by “Understanding Cryptography” by Paar and Pelzl
- Terrific videos by Paar covering the book:
  - https://www.youtube.com/channel/UC1usFRN4LCMcfIV7UjHNuQg/videos



CRYPTOHACK

- Fun, always running
- Modern crypto challenges
- Not ciphers
- Range from easy/beginner to really hard
- Support available through cryptohack's Discord group
- https://cryptohack.org/



SANS Holiday Hack Challenge by CounterHack

- Excellent real-world challenges from basic to advanced
- Range is always open
- https://www.holidayhackchallenge.com/
- “Lessonized” instructions in my GitHub
- https://github.com/john-r2/HolidayHackLessonized