SIGPwny

Purple Team FA2025 • 2025-09-11

Intro to Blue Team

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- Helper & Purple Team Cyber Defense Lead
- B.S. Computer Science ‘27
- ICS Cybersecurity Engineer @ BW Design Group
- I have opinions about cucumbers

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- MS Information Management + Computer Security
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- Rush is the greatest rock band to exist.

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Expectations

- We have a limited number of proxmox PwnyOS logins
- If you miss 4 consecutive meetings, we will reallocate resources if necessary
- This is to accommodate whoever is actively participating

Our Approach

- We are here to share our own experience, approach, and methodology
- You will get the best return on your time investment by focusing on training
- We are dedicated students taking our own time to train and share
- If you are knowledgeable in one of these subject areas, ask to run a meeting!

Immediate Training Resources

- PwnyCTF by SIGPwny (https://ctf.sigpwny.com/)
  - Great place to learn the fundamentals, including forensics & reverse engineering!
- CyberDefenders.org (https://cyberdefenders.org/)
  - DFIR & SOC focused with *great* free content
- HackTheBox (https://www.hackthebox.com/)
  - On-demand vulnerable machines & networks, mostly red team with better blue content today than before
- TryHackMe (https://tryhackme.com/)
  - Designed for beginners, good for general training and exposure

Flagship Competition

National Collegiate Cyber Defense Competition

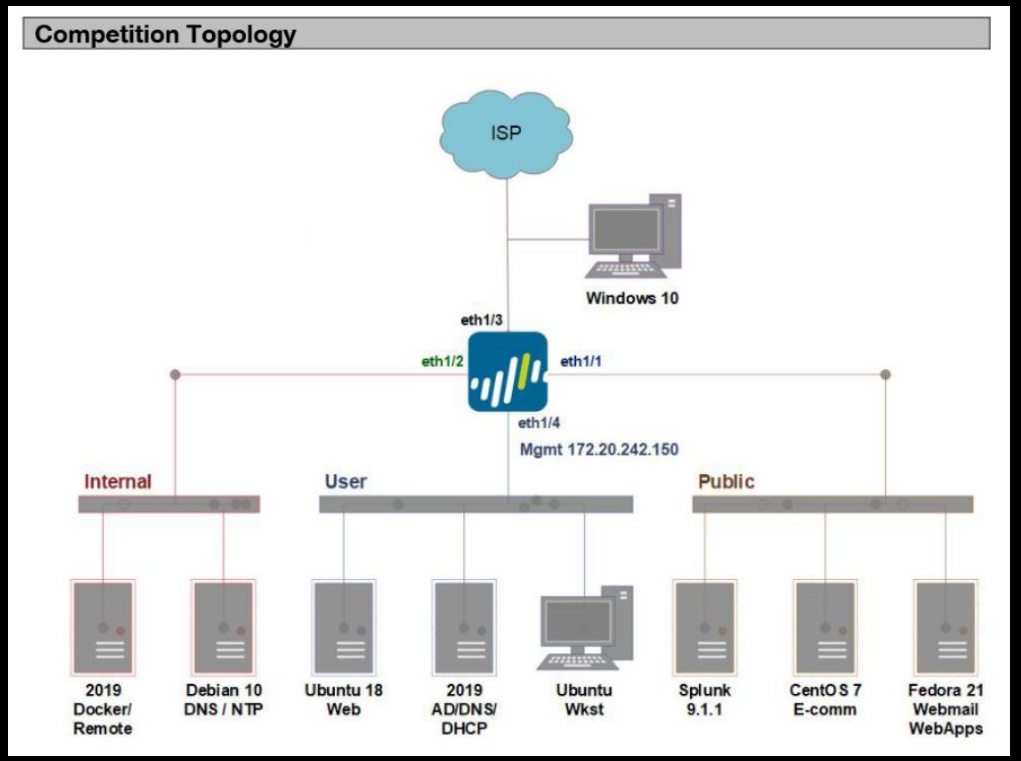
Flagship Competition: DoE CyberForce

CyberForce

Flagship Competition: TracerFIRE

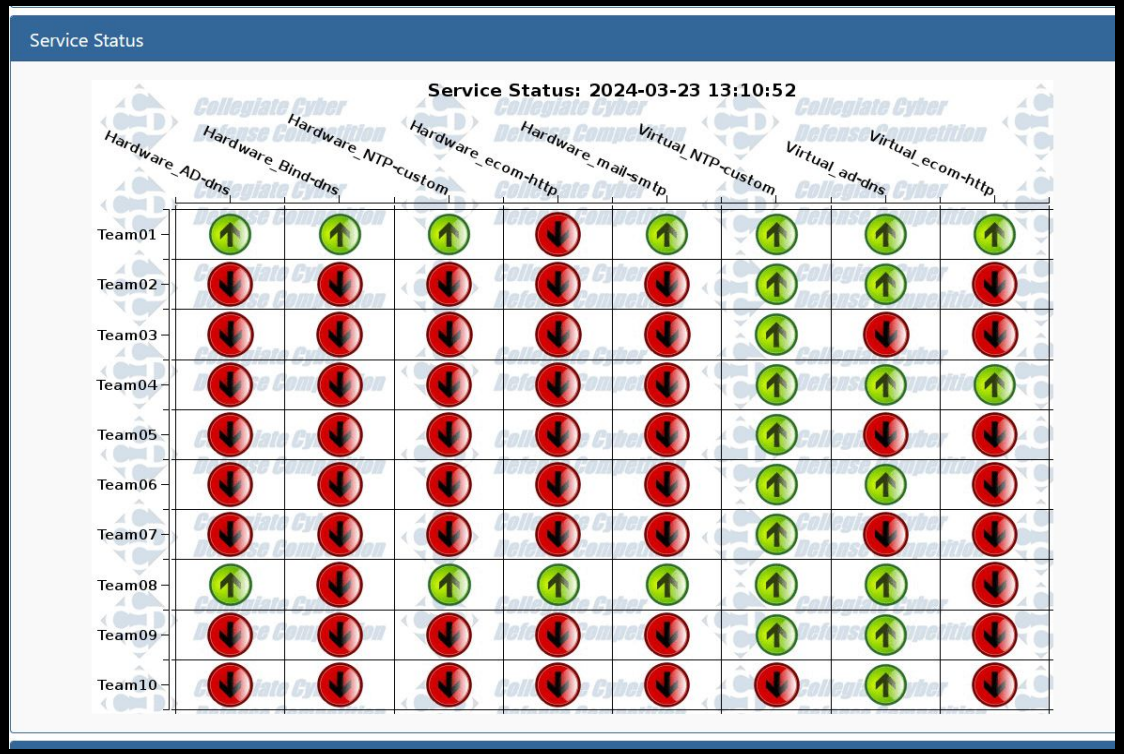
What is a Cyber Defense Competition?

- Blue teamers (us) are given systems to secure and maintain the functionality of various services
  - Services are scored by uptime
  - Red team will try to take our services down
- We will be given business tasks (injects) to do simultaneously
- Additionally, we are tasked with responding to random incidents, so we must submit IR reports as a form of sociotechnical (incident response)



Competition Plan

- Immediate Plan
  - Access each system and gather information
  - Rotate passwords & secure users/groups (document everything)
  - Harden system & services
    - Enable/configure firewalls, containerize everything, install Wazuh, etc.
- Threat Hunt & Audit System for Persistence
- Incident Response
- Respond to Injects



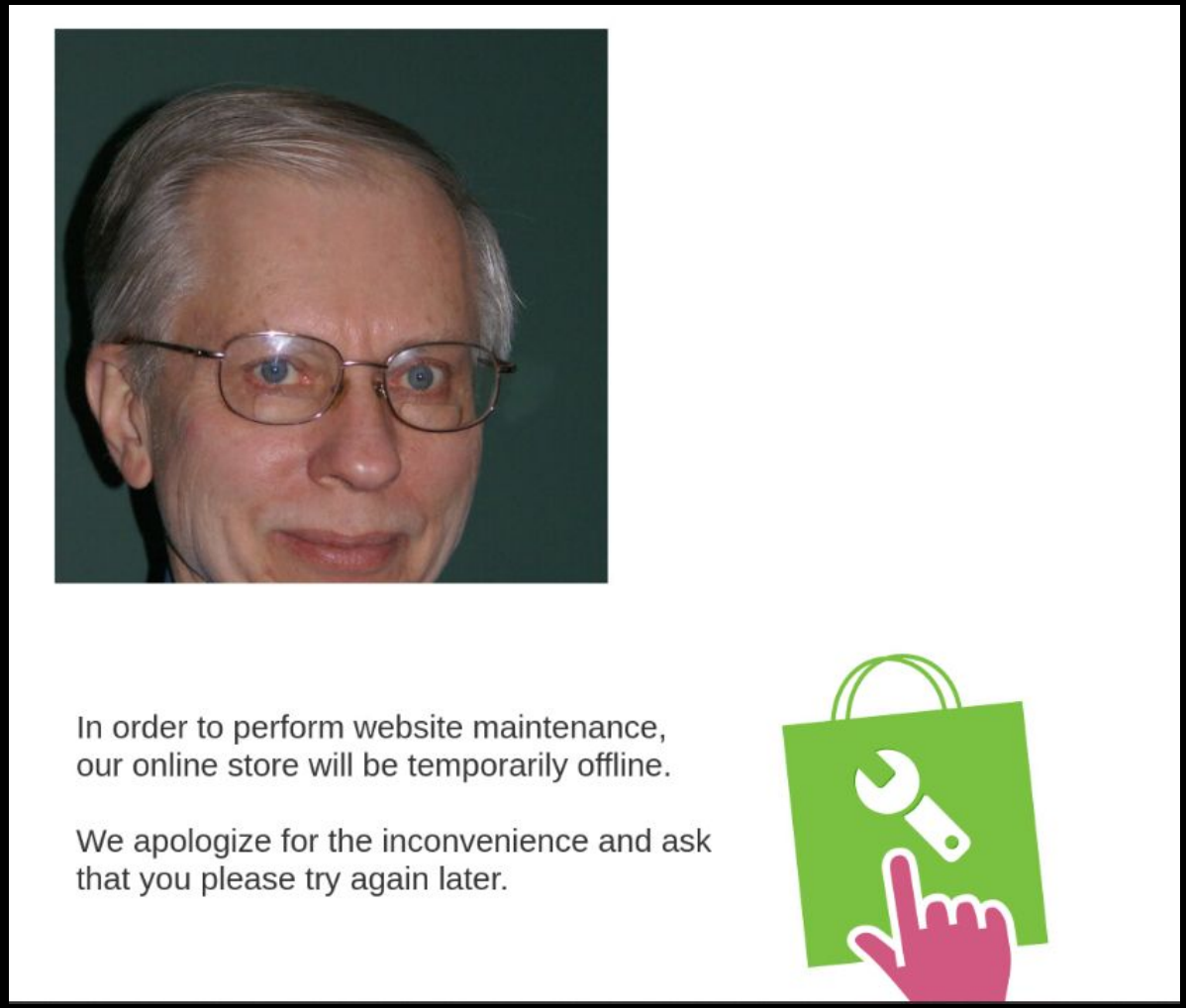
The Most Important Thang(s)

Communicate, and have **fun**!

(and for the love of all that is holy, check the crontab)

Additional Notes

- Cyber Defense competitions often have intentionally unrealistic time frames
- Keep a level head
- Expect the unexpected
  - This is what defense-in-depth is for!



Key Concepts

Services

- Any individual / organization / enterprise requires **exposing functionality**
- Individual **boxes** (read: machines) expose **services**
  - A **service** is something accessible over the network that provides functionality
  - For example, **web server**, **file share**, **secure shell**
  - Each box can have multiple services; Some have none
- The collection of exposed services that provide meaningful functionality is called **attack surface**

Attack Surface Reduction

- The more services you have exposed, the more chances an attacker will have to attack one of them
- Almost everyone will be actively reducing their attack surface through networking
- Not every computer needs to be exposed to the internet - in this way, **routers contribute to massively reducing attack surface**
- Not every service needs to be exposed to the internet, even on internet-exposed machines. This is done by a **firewall**
- Not every service needs to be exposed to your peers even on your own network - this can be done via **host firewalls** or other methods

Mandatory Door Analogy

- Imagine you live in a house with many points of entry of varying levels of security
- Which has more ways in (all things being equal)?
  - A house with one door
  - A house with ten doors
  - A house with 1000 doors

Mandatory Door Analogy

- Imagine you live in a house with many points of entry of varying levels of security
- Which has more ways in (all things being equal)?
  - A house with one door
  - A house with ten doors
  - A house with 1000 doors
- Even if you are great at securing houses, you will have a **much easier time** locking down the house with one door versus 1000

Closing Doors

- How can we close the doors?
- A **firewall** will block off certain ports and services from access
  - For example, **only allow ports 22, 53, 80, 443** and **445**
- A **router** will block off certain hosts
  - For example, someone from the internet cannot directly connect to your personal computer
- We can use **tunneling** to have services run only on the computer and expose it to select other computers
- In Cyber Defense, the best first step is to **start closing unnecessary doors**

Vulnerabilities & Exploits

- A **vulnerability** is some specific weakness in your software (usually a service)
  - If we can run arbitrary commands on your service, then that's a vulnerability
  - If we can overflow the buffer and overwrite variables on the stack, that's a vulnerability
  - If we can upload arbitrary files on your computer, then that's probably a vulnerability
- An **exploit** is a specific piece of code that will enable compromising a service via a vulnerability
  - The specific exploit code to deliver a shell via a buffer overflow or arbitrary file upload would be an **exploit**
- Less doors generally mean less vulnerabilities

Vulnerability Management

- Many enterprises will have dedicated vulnerability management teams that will go hunt for known vulnerabilities in their network and fix them
- Some pieces of software (Active Directory, Windows OS) will have certain vulnerabilities that are **required** for functionality, which will create an attack surface even in a "perfectly secure" environment
- You will never be able to fully remove all of the vulnerabilities, meaning you will always have **some** attack surface exposed
- This is why **defense-in-depth** is necessary

Defense in Depth

- Essentially a **layered defense**, this is **the most important defensive security concept**
- Defenses will be layered and overlapping, allowing for multifaceted detection of activities
- For example, having multiple sources of telemetry and analysis for hosts and networks, proactive security policies that encourage patching, restrictive firewalls, remote log forwarding, and a vulnerability management team
  - All of these things cover similar areas, but do it differently, so **what slips through one will get hit by another**

Catching Bad Guys

- Threat actors will do the following
  - Look for open doors
  - See if they know a way in (**known vulnerability**)
  - Break in (with a known or unknown vulnerability)
  - Enter your house (code execution and **implant** on your computers)
    - They will do this to establish **command and control**
    - The simplest command and control would be something like **SSH**
  - Establish **persistence** (drop malware to keep getting in over time)
    - This is basically propping the door open, or making a secret entrance
  - Steal your valuables

Catching Bad Guys

- We can catch folks snooping around the network by logging network traffic
- We can catch malware by logging files on the host
- We can automatically parse some of these logs, files and events
  - This is what **Antivirus** does
  - When you add behavioral detection, you get **Endpoint Detection and Response** (EDR)
- There are other sources
  - Process trees, memory dumps, disk carving, etc.
  - These generally demand **skilled human analysts** to reveal advanced attackers

Catching Bad Guys

- Generally, intrusions will be initially detected through automated alerts
  - Sometimes diligent users will report phishing or slow machines
- From there, an **Incident Responder** will triage the report and investigate
- If it's determined that there is a malicious actor, we will generally observe them briefly to determine their access and tactics, then remove them from the environment
  - This requires some core competencies, including malware reverse engineering, using EDR tools, packet captures, and general security awareness

Removing the Bad Guys

- Make sure to never delete or change any forensic evidence if possible
- Also, start the incident response process:
  - Isolate affected hosts
  - Search for and remove any persistence mechanisms
  - Remove backdoors, malicious user accounts
  - Patch vulnerabilities
  - Terminate malicious processes
  - etc.
- Sometimes, threat actors will wait a long time (>90 days!) for logs to **rotate**, which greatly complicates investigation and attribution

Threat Modeling

- **Threat Modeling** is understanding what services you offer and what attackers can do to go after them
- Threat Modeling overlaps heavily with risk management - you are going to have a mental model, informed by **Cyber Threat Intelligence**, as to what your vulnerabilities are and how threat actors exploit them
- Threat Modeling will inform what concrete defense steps you can take with your limited time and resources
- Sometimes, red teamers will perform **Adversary Emulation**, where they will attack a network with the specific tactics of an adversary that we are worried about

MITRE ATT&CK

- MITRE ATT&CK is a globally-accessible knowledge base of adversary **tactics, techniques, and procedures (TTPs)**
  - It is based on real-world observations derived from cyberattacks
- It helps defenders understand how attackers operate and enables a common tagging method for threat analysis
- Also helps inform **adversary emulation** and automated detection from **Endpoint Detection and Response**

Next Meetings

2025-09-16 • **This Tuesday**

- Network Security & Active Recon
- Bring your OSI knowledge

2025-09-18 • **Next Thursday**

- Network Security & Lateral Movement
- Examine trace files (captures) and map out out attack chains.

2025-09-23 • **This/Next Thursday/Sunday**

- Web Hacking For Red Teamers

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Meeting content can be found at sigpwny.com/meetings.

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