Vulnerability Taxonomies

Objectives: Understand common vulnerbility taxonomies and how they relate.

- U.S. National Vulnerability Database ***NVD***
- Common Platform Enumeration ***CPE***
- Common Vulnerabilities and Exposures ***CVE***
- Common Vulnerability Scoring System ***CVSS***
- Common Weakness Enumeration ***CWE***
- Common Attack Pattern Enumeration and Classification ***CAPEC***
- Adversarial Tactics, Techniques & Common Knowledge ***ATT&CK***
- Open Web Application Security Project ***OWASP***

National Institute of Standards and Technology (NIST)

- Founded in 1901
- Standards organization responsible for weights, measurements, and cybersecurity standards
- Also has a solid (if small) page of memes

U.S. National Vulnerability Database ***NVD***

- Created by the National Institute of Standards and Technology (NIST)
- repository of standards based Vulnerability management data
- Includes multiple databases of security checklists, security related software flaws, misconfigurations, product names, and impact metrics.
- CVE, CVSS, and others are all a part of the NVD

nvd.nist.gov

Common Platform Enumeration ***CPE***

- Basically just an official naming and versioning scheme for IT systems, software, and packages.
- Try using it on one of your projects sometime!
- Contains a dictionary of platform names and versions to automate decisions based on known vulnerabilities.

CPE

What's in a name?

- Why do we need a common detailed way to name something?
- Well Formed Name == attribute pair set that can describe a number of products or identify a specific product
- WFN is a logical construct, the CPE is the specific data structure we care about

CPE naming scheme in a nutshell

From Wikipedia

`cpe:<cpe_version>:<part>:<vendor>:<product>:<version>:<upda`

Traditionally, both a blank field or an asterisk `*` refer to a wildcard character.

Some examples:

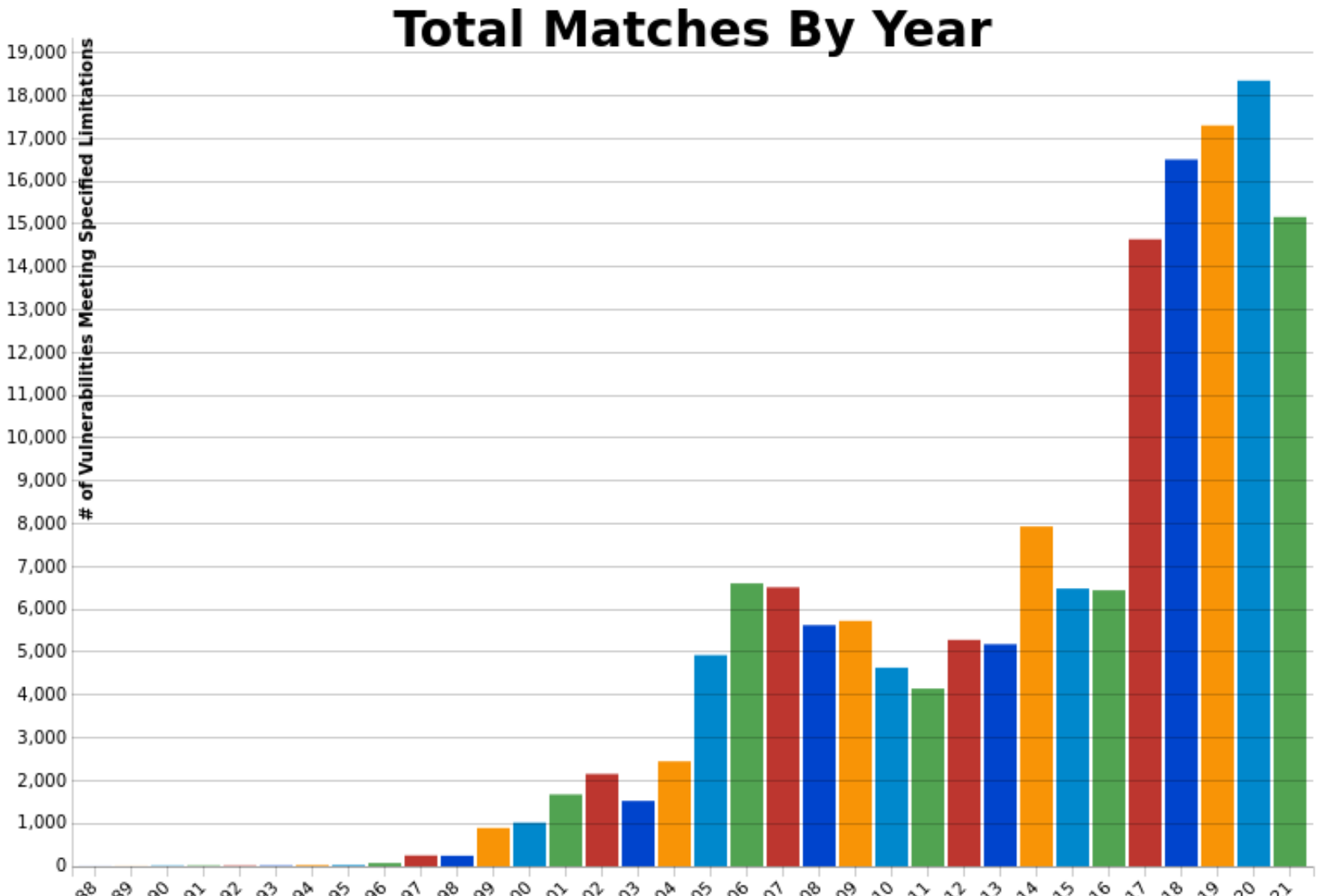
- `cpe:2.3:o:microsoft:windows_11:-:*:*:*:*:*:*:*`
  Probably not specific enough for use in this class.
- `cpe:2.3:a:discord:discord:-:*:*:*:*:*:*:*` from cpe lookup

Common Vulnerabilities and Exposures ***CVE***

- Reference method for publicly known information security vulnerabilities and exposures
- A CVE name/number/ID is a unique identifier for a a single vulnerbility
- Only CVE Numbering Authorities (CNA) can issue CVE's
  - MITRE is the primary CNA
  - There are many other public CNA's available to request a CVE
  - Various companies can assign CVE numbers for their own products (Microsoft, Oracle, Red Hat, etc.)
- CVE database contains several specified fields

CVE Further information and search

- CVE Wikipedia
- NVD CVE Lookup
- MITRE CVE Lookup



Common Vulnerability Scoring System ***CVSS***

- Given the growing number of CVE's each year we need a way to focus on the most important ones
- CVSS is a means of assigning a numerical score based on the ***severity*** of a given CVE
- Scores range from 0 to 10, low being not very important and 10 being a critical security vulnerability
- Several changes to this scoring metric have occured, be sure you are comparing similar versions of CVSS scores

CVSS Wikipedia

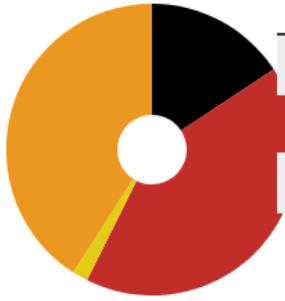
Know your limits

NVD Dashboard

CVEs Received and Processed

Time Period	New CVEs Received by NVD	New CVEs Analyzed by NVD	Modified CVEs Received by NVD	Modified CVEs Re-analyzed by NVD
Today	0	0	0	0
This Week	436	30	0	8
This Month	2059	163	0	61
Last Month	2749	1310	0	746
This Year	7417	4263	0	1167

CVSS V3 Score Distribution



Severity	Number of Vulns
CRITICAL	23013
HIGH	60925
MEDIUM	59882
LOW	2528

CVSS V2 Score Distribution

Severity	Number of Vulns
HIGH	56837
MEDIUM	104170
LOW	19074

CVE Status Count

Total	242323
Received	128
Awaiting Analysis	3654
Undergoing Analysis	101
Modified	93929
Rejected	14007

NVD Contains

CVE Vulnerabilities	242323
Checklists	783
US-CERT Alerts	249
US-CERT Vuln Notes	4486
OVAL Queries	10286
CPE Names	1262384

More Acronyms (YAY! or maybe OMGWTFBBQ)

- **KEV** Known Exploited Vulnerabilities, boolean value to specifiy whether a CVE is being exploited
- **EPSS** Exploit Prediction Scoring System, 0 to 1 value with a ton of input (KEV, media, social media, security vendor info, etc.), establishing a *likelihood of exploitation* in the next 30 days.

EPSS model

Common Weakness Enumeration ***CWE***

- Category system for software and hardware weaknesses and vulnerabilities
- Over 600 categories including
  - Buffer Overflow
  - path/directory traversal errors
  - hard-coded passwords
  - insecure random numbers. . . etc.

Vulnerbility cange by year MITRE about CWE CWE Top 25

Common Attack Pattern Enumeration and Classification

CAPEC

- Public catalog of common attack patterns to help users understand how weaknesses are exploited
- Based on Software Design Patterns
- Relates weaknesses (CWE) and vulnerbilities (CVE).
- Similar to CWE, the same CAPEC may apply to many CVEs
- CAPEC-139: Relative Path Traversal

Attack Patterns Wikipedia CAPEC Website

Adversarial Tactics, Techniques & Common Knowledge

ATT&CK

- Knowledge base of adversarial tactics
- The more you know (or a more theatrical: know your enemy)

MITRE ATT&CK

CAPEC & ATT&CK

Use CAPEC for:

- Application threat modeling
- Developer training and education
- Penetration testing

Use ATT&CK for:

- Comparing computer network defense capabilities
- Defending against the Advanced Persistent Threat
- Hunting for new threats
- Enhancing threat intelligence
- Adversary emulation exercises

Open Web Application Security Project ***OWASP***

MITRE is just one (pretty big) organization. There are others that attempt to classify similar things.

OWASP is a community that attempts similar classification for just web applications.

OWASP Wikipedia

OWASP.org

Homework

Properly Formatted `Yourname.md` uploaded to pilot. Style counts, I will be reading this in Github!.

- Read the following:
  - 2023 top 25 software CWE's
  - 2023 top 10 CWE by KEV
  - Semantic Versioning 2.0.0
- Choose 1 of the top 25 that you have personally put in code you used/submitted. Do a deep dive on that CWE (read all about it).
- Write up (at least) three paragraphs on the CWE, how your code was vulnerable to it, and how you could have changed the code to not be vulnerable.
- Be sure to include:
  - What CWE you chose (name, CWE number, link to web, and an explanation in your own words)
  - Your Well Formed CPE name (fake but well formed!!!, unless you actually have a CPE for it), explain each field you chose to use, be sure to assign a version via Semantic Versioning 2.0
  - Is it in the top 10 KEV list as well? What are your thoughts on the severity of the weakness.