


A **New** Application of **ML** for **Cybersecurity:** Attack Surface Management



Share in chat –
are you into
AI, cybersecurity,
both, neither?

Pamela Toman
Sr. Principal Machine Learning Engineer
Cortex Xpanse

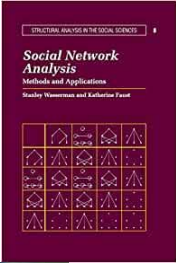
March 2023

Cybersecurity is mission + AI

ASM is impossible without AI

**AI for ASM means solving
cool, hard problems**

Nice to meet you



Event ID	Event Name	Event Type	Event Date	Event Location	Event Status
1	Event 1	Event Type 1	Event Date 1	Event Location 1	Event Status 1
2	Event 2	Event Type 2	Event Date 2	Event Location 2	Event Status 2
3	Event 3	Event Type 3	Event Date 3	Event Location 3	Event Status 3
4	Event 4	Event Type 4	Event Date 4	Event Location 4	Event Status 4
5	Event 5	Event Type 5	Event Date 5	Event Location 5	Event Status 5



EXPANSE

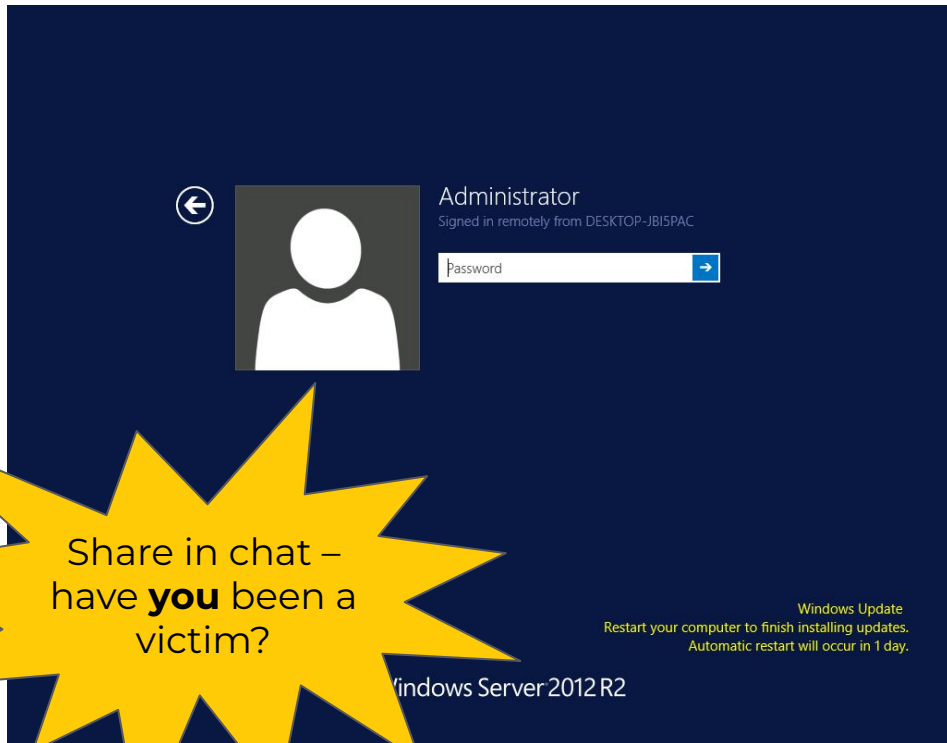


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Bad actors attack everyone all the time



Share in chat –
have **you** been a
victim?

our screenshot of publicly accessible system
(most dangerous systems aren't screenshot-able)

#	Lowercase	Mixed Case	Mixed Case + Numbers
1	0 \$	0 \$	0 \$
2	0 \$	0 \$	0 \$
3	0 \$	0 \$	0 \$
4	0 \$	0 \$	0 \$
5	0 \$	0 \$	0 \$
6	0 \$	0 \$	0 \$
7	0 \$	0 \$	2 \$
8	0 \$	6 \$	155 \$
9	1 \$	315 \$	12,118 \$
10	16 \$	16,391 \$	945,165 \$
11	416 \$	852,312 \$	73.7 M\$
12	10,820 \$	44.3 M\$	6 B\$
13	281,330 \$	2 B\$	449 B\$
14	7.3 M\$	120 B\$	34 T\$
15	190.2 M\$	6.2 T\$	-
16	5 B\$	324 T\$	-
17	129 B\$	-	-
18	3.3 T\$	-	-

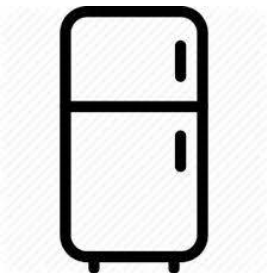
brute forcing passwords is easy
turingpoint.de, February 2020

Attacks produce money and power



- Sell data
- Hold data for ransom
- Rent the machine
- Mine cryptocurrency
- Drop malware installer
- Download non-public info
- Break infrastructure

Increased internet connectedness makes it worse



Product Team Enterprise Explore Marketplace Pricing

eternal blue 7 Sign in Sign up

Repositories	110
Code	?
Commits	358
Issues	880
Discussions	13
Packages	0
Marketplace	0
Topics	1
Wikis	289
Users	7

Languages

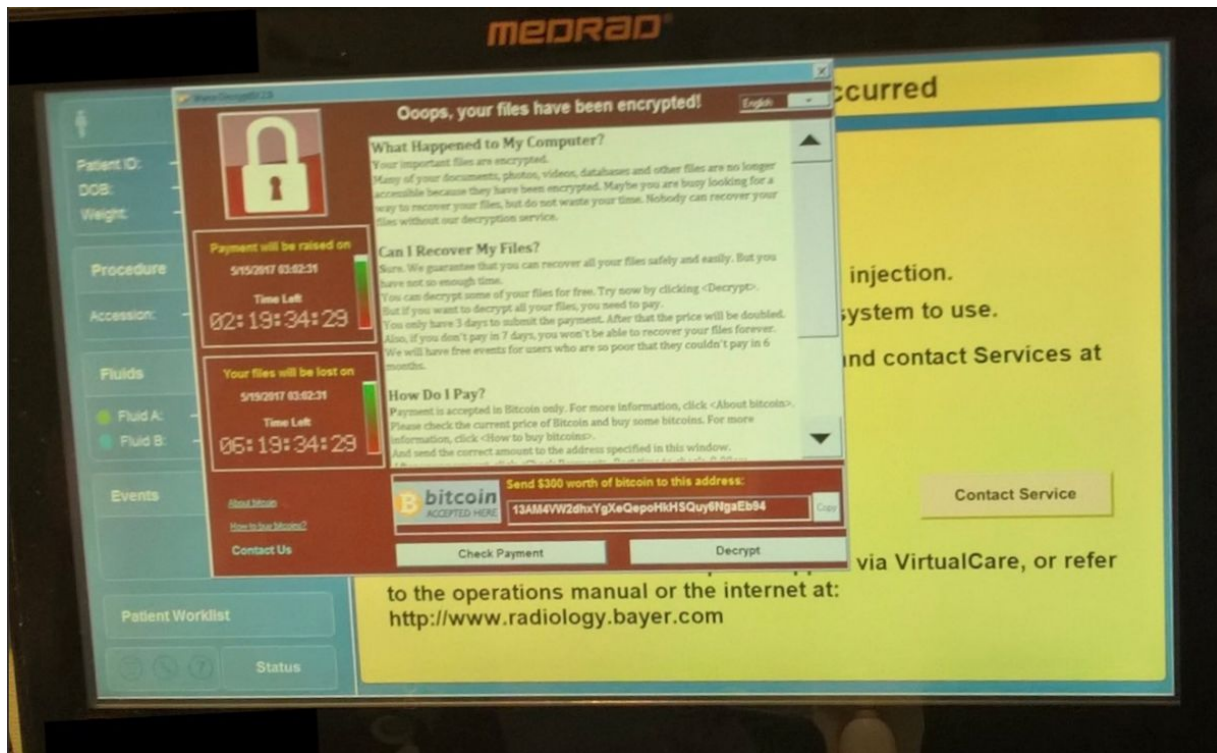
Python	28
Ruby	8
HTML	7
Shell	6
JavaScript	5
C#	3
C++	3
PowerShell	3
Visual Basic .NET	3
C	2

Advanced search Cheat sheet

110 repository results Sort: Best match

- [bhassani/EternalBlueC](#)
EternalBlue suite remade in C/C++ which includes: MS17-010 Exploit, EternalBlue vulnerability detector, DoublePulsar ...
☆ 398 ● C Updated on Apr 29
- [peterpt/eternal_scanner](#)
An internet scanner for exploit CVE-2017-0144 (Eternal Blue) & CVE-2017-0145 (Eternal Romance)
☆ 288 ● Shell MIT license Updated on Jan 28
- [tevora-threat/eternal_blue_powershell](#)
Port of eternal blue exploits to powershell
☆ 143 ● PowerShell Updated on Jun 2, 2017
- [hanshaze/MS17-010-EternalBlue-WinXP-Win10](#)
EternalBlue Metasploit Port to various Windows Versions from Windows XP SP2 up to Windows 10 Pro
☆ 129 ● Ruby Updated on Jan 5, 2019
- [w0rtw0rt/EternalBlue](#)
ElevenPaths EternalBlue Metasploit module - works better than Rapid 7
☆ 47 ● Python Updated on Jul 18, 2017
- [rhmoult/EternalBlue](#)
NSA EternalBlue SMB exploit by python 3
☆ 24 ● Python Updated on May 22, 2017
- [peterpt/eternal_check](#)
Ip Vulnerability check to Eternal Blue , Romance , Synergy , Champion , Erraticgopher & Eagerlever
☆ 118 ● Shell Updated on Feb 9, 2020

Without defense innocent people will fall



leaked

Without defense innocent people will fall

The **settlement**, if approved by a judge, would end a seven-year legal effort to win compensation for more than **21 million current and former federal employees** who were victims of the hack of the Office of Personnel Management (OPM) in

information was intensely personal. It included background check forms that delved into victims' **financial and romantic lives** as well as **Social Security numbers** and — in a subset of about 5.6 million cases — **fingerprint information**.

OPM victims have faced a number of hurdles, including legal precedents that make it difficult or impossible to win compensation from data breaches that don't create direct economic loss. That's a high bar for OPM victims because the breach appears to have been for espionage purposes and there's no definitive evidence any of the stolen data

The Washington Post
Democracy Dies in Darkness

THE CYBERSECURITY 202

Lawyers are nearing a settlement deal for the infamous 2015 OPM hack



Analysis by [Joseph Marks](#) and [Aaron Schaffer](#)
May 9, 2022 at 7:28 a.m. EDT

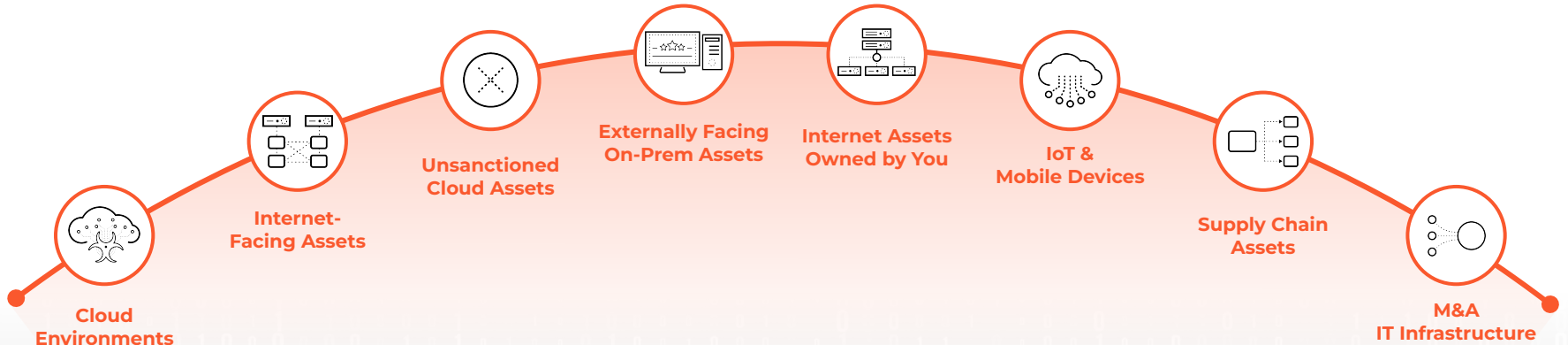
Attorneys are closing in on a settlement deal that could deliver up to \$63 million to some victims of one of the most cataclysmic data breaches in history.

The settlement, if approved by a judge, would end a seven-year legal effort to win compensation for more than 21 million current and former federal employees who were victims of the hack of the Office of Personnel Management (OPM) in 2015, which intelligence officials say was almost certainly perpetrated by the Chinese government.

The OPM breach marked a devastating blow to the U.S. government's reputation for cybersecurity and sparked intense anger among many victims — largely because the breached information was intensely personal. It included background check forms that delved into victims' financial and romantic lives as well as Social Security numbers and — in a subset of about 5.6 million cases — fingerprint information.

OPM victims have faced a number of hurdles, including legal precedents that make it difficult or impossible to win compensation from data breaches that don't create direct economic loss. That's a high bar for OPM victims because the breach appears to have been for espionage purposes and there's no definitive evidence any of the stolen data was ever used for cybercrime.

Our mission: Know what's there so you can defend it



Attack Surface

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Observe

Attribute

Act

Observe: We need AI to explore IP space & find “what exists”

Brute force search? Not anymore...

IPv4 (32-bit)

34.107.151.202

4,294,967,296



IPv6 (128-bit)

2607:f8b0:4005:807::200e

340,282,366,920,938,463,463,374,607,431,768,211,456



Alderaan explodes... us too...

Attribute: We need AI to identify the owner

IP address
34.107.151.202

domain
pppds.com

certificate
MIIGbDCCBVsg...



Act: We need AI to make remediation possible

55% of enterprises
see more than **10k alerts** a day

79% of security teams
feel **overwhelmed** by the volume of threat alerts

85% of security professionals
think their security team is **understaffed**

sources: SC Media via survey at 2018 RSA; analyst report by Enterprise Management Associates; SOC report by Ponemon Institute

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Let's sample cool, hard problems in 4 roles

Who owns what on the internet?

ML

Framing the question

Engineering

Scaling the answer

MLOps

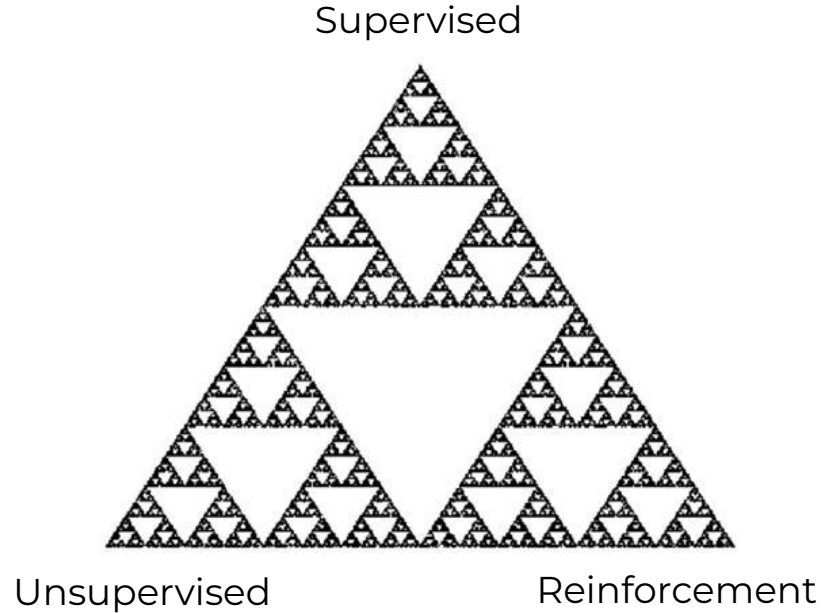
Supporting the lifecycle

Ethics

Monitoring the effects

Share in chat –
which are most
compelling to
you?

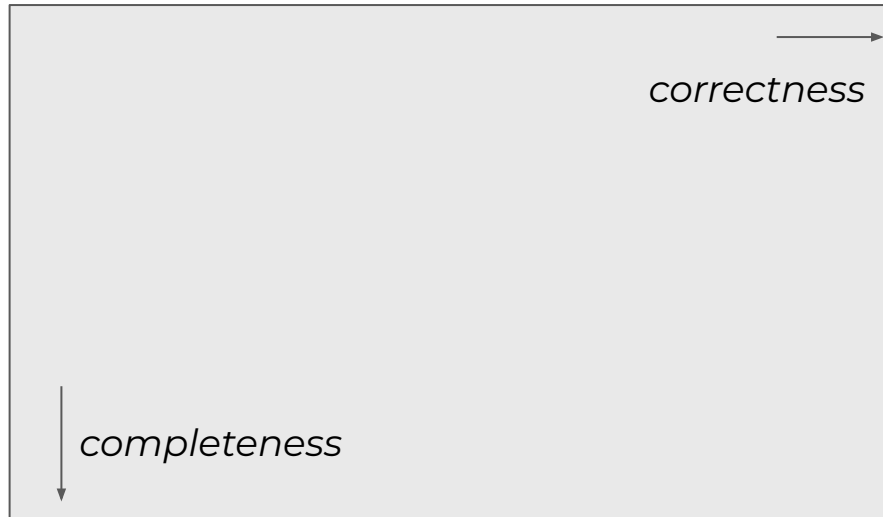
ML: How should we frame the attribution question?



Engineering: How do you attribute ownership at internet scale?

Naively doing inference is too expensive

Direct & indirect field values



Every domain/IP/etc.

(* every organization)

MLOps: How do you support the ML development lifecycle?

Hidden Technical Debt in Machine Learning Systems

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Google, Inc.

Dietmar Ebner, Vinay Chaudhary, Michael Young, Jean-François Crespo, Dan Dennison
{ebner, vchaudhary, mwyong, jfcrespo, dennison}@google.com
Google, Inc.

Abstract

a fantastically powerful toolkit for building useful code quickly. This paper argues it is dangerous to think of using for free. Using the software engineering framework it is common to incur massive ongoing maintenance systems. We explore several ML-specific risk factors to design. These include boundary erosion, entanglement, undeclared consumers, data dependencies, configuration external world, and a variety of system-level anti-patterns.

community continues to accumulate years of experience with live, but maintaining them over time is difficult and expensive.

through the lens of *technical debt*, a metaphor introduced by reason about the long term costs incurred by moving quickly in debt, there are often sound strategic reasons to take on technical debt. Not all debt is bad, but all debt needs to be serviced. Technical debt may be paid down by refactoring code, improving unit tests, deleting dead code, reducing dependencies, tightening APIs, and improving documentation [8]. The goal is *not* to add new functionality, but to enable future improvements, reduce errors, and improve maintainability. Deferring such payments results in compounding costs. Hidden debt is dangerous because it compounds silently.

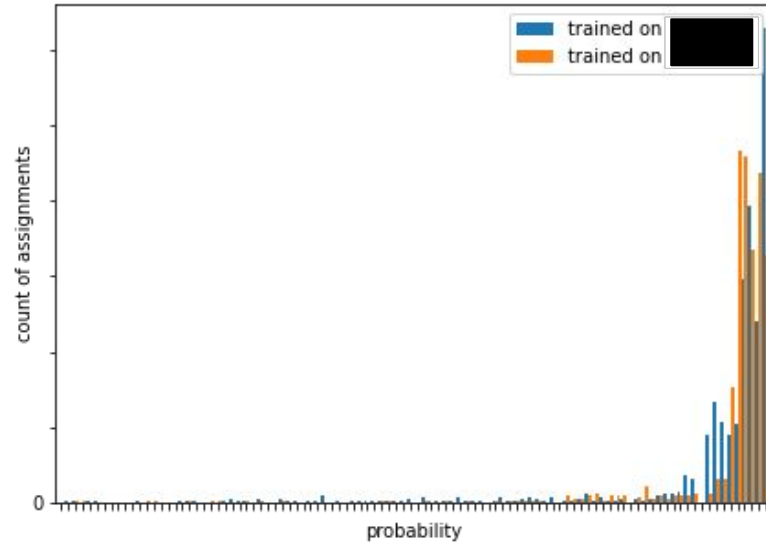
In this paper, we argue that ML systems have a special capacity for incurring technical debt, because they have all of the maintenance problems of traditional code plus an additional set of ML-specific issues. This debt may be difficult to detect because it exists at the *system* level rather than the code level. Traditional abstractions and boundaries may be subtly corrupted or invalidated by the fact that data influences ML system behavior. Typical methods for paying down code level technical debt are not sufficient to address ML-specific technical debt at the system level.

This paper does not offer novel ML algorithms, but instead seeks to increase the community's awareness of the difficult tradeoffs that must be considered in practice over the long term. We focus on system-level interactions and interfaces as an area where ML technical debt may rapidly accumulate. At a system-level, an ML model may silently erode abstraction boundaries. The tempting re-use or chaining of input signals may unintentionally couple otherwise disjoint systems. ML packages may be treated as black boxes, resulting in large masses of "glue code" or calibration layers that can lock in assumptions. Changes in the external world may influence system behavior in unintended ways. Even monitoring ML system behavior may prove difficult without careful design.

1

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Ethics: How do you monitor for adverse effects?



*“Data Slices” paper in NeurIPS ‘21
Data-Centric AI workshop*

We have cool, hard problems coming out our ears!

Who owns what on the internet?

ML

Framing the question

Engineering

Scaling the answer

MLOps

Supporting the lifecycle

Ethics

Monitoring the effects

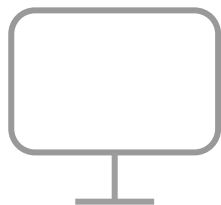
Drilling out on Palo Alto Networks

Our leadership drives innovation

**“We’re driving an AI-based
SOC transformation.”**

– CEO Nikesh Arora
in the 23 February 2023 earnings call

We have the data, scope & customers to build big



endpoint
clients

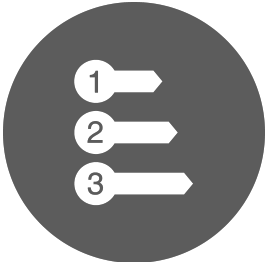


firewall
traffic

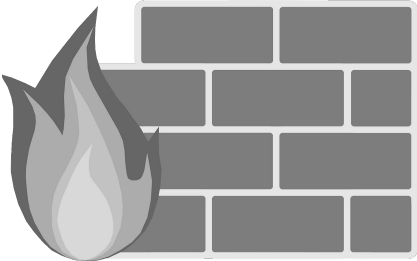


internet
servers

Our whole organization is solving cool, hard problems



Prioritization



Zero-day blocking



Correct configuration



Data exfiltration



Malware identification

Thank you

Happy to answer questions!

Pamela Toman
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Cortex Xpanse



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