TREND MICRO™

Beat Cybercriminals at Their Own Game

A Guide to Winning the Vulnerability Race and Protecting Your Organization

Contents

INTRODUCTION

Staying ahead of cybercriminals

Stealth is the watchword in vulnerability research. That's why relatively few people know the true extent of the value that ethical vulnerability research delivers to individuals, companies, governments, and software vendors.

The truth is that white hat vulnerability researchers—those who report vulnerabilities to vendors so they can be fixed—continually race to stay ahead of cybercriminals and black hat hackers. The goal? To identify vulnerabilities in our vast network of systems before they can be discovered and exploited for malicious purposes.

This ebook shines a spotlight on the expanding, increasingly essential market that is vulnerability research today. You'll gain an understanding of what vulnerability research can accomplish, and, at the same time, be introduced to the industry-leading role that Trend Micro plays within the world of vulnerability research.

More importantly, you'll learn not only how this research helps everyone better protect their systems against exploitations of vulnerabilities, but specifically how Trend Micro customers can take advantage of protection far ahead of actual public disclosure of vulnerabilities.

DID YOU KNOW?

The number of vulnerabilities published every year continues to grow. MITRE's Common Vulnerabilities and Exposures (CVE) List included 894 CVEs in 1999 and 6,447 CVEs published in 2016, with 2017 more than doubling the previous year's figure with 14,712 CVEs.

Source: Common Vulnerabilities and Exposures List, The MITRE Corporation

CHAPTER 1

Vulnerabilities and how they are exploited

What is ...

A vulnerability?

It's a programming error or flaw that can potentially be exploited by cybercriminals to bypass security and gain access to a system or network. Given the complexity and amount of software today, vulnerabilities are widespread and difficult to identify.

An exploit?

When cybercriminals want to attack using a vulnerability, they may create an exploit—that is, code that can be used to take advantage of the vulnerability. Exploits are often sold on the black market to would-be attackers who use them to control or damage a device, network, or application.

A zero-day attack?

When an attack is launched that exploits a previously unknown vulnerability, it is called a zero-day attack, or simply a zero-day.

A zero-day vulnerability?

A vulnerability that has been newly disclosed, but is not yet patched is a zero-day vulnerability. That's because the vendor essentially has zero days to fix the issue, or has chosen not to fix it.

An undisclosed vulnerability?

This is a vulnerability that has been discovered by a security researcher and reported to a bug-bounty program (a rewards program for reporting vulnerabilities). The vulnerability is disclosed to the affected vendor but is not disclosed to the general public until a patch is issued.

Which organizations are impacted?

Any organization that has systems (with vulnerabilities) that are:

- Not yet patched
- Obsolete, and therefore no patch will be developed
- Unpatchable because of device policies and restrictions
- Not protected by countermeasures empowered by the latest vulnerability research

What are the risks?

Cybercriminals actively seek to use vulnerabilities to:

- Gain access and escalate privileges in systems
- Conduct denial-of-service attacks
- Exfiltrate data
- Install malware
- Modify files and databases
- Take control of systems

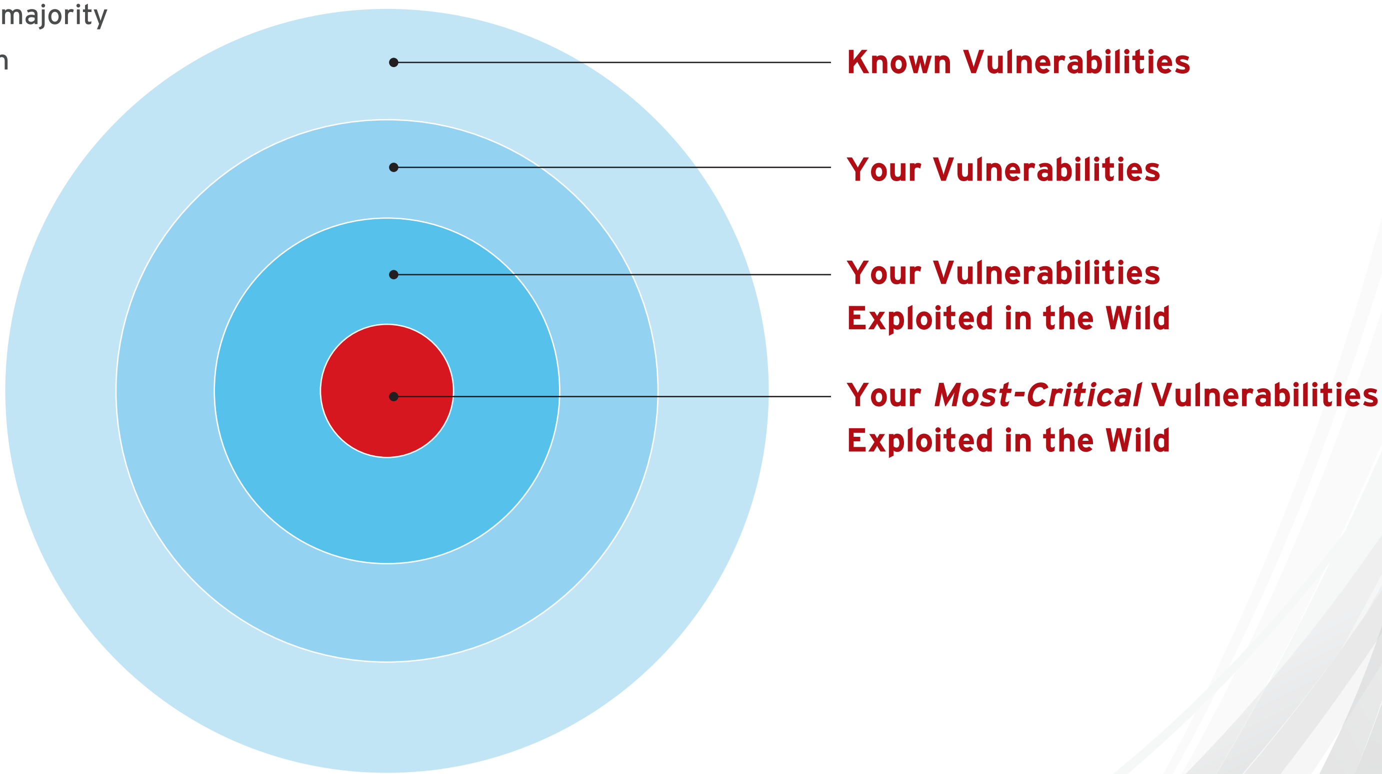
How can exploited vulnerabilities impact your business?

- Loss of consumer/customer trust
- Revenue loss
- Decreased shareholder value
- Mitigation costs
- Potential fines for non-compliance with data protection regulations

Creating a prioritized patching process

According to research and analysis firm Gartner, vulnerabilities and their exploitation are still the root cause of most information security breaches.[1] Yet patching every vulnerability immediately throughout your ecosystem is impossible for the vast majority of organizations. Instead of trying to patch all vulnerabilities as quickly as possible, Gartner and other industry analysts recommend focusing on aligning vulnerability management priorities with the biggest security threats.

One way to do this is to focus first on those vulnerabilities that are present within your operating systems, devices, and applications that are also actively being exploited in the wild. This significantly reduces the number of vulnerabilities that you need to patch while mitigating risks for your business. Another factor to consider, of course, will be the level of potential impact associated with any given vulnerability. Those that are not only being exploited in the wild but also designated as "critical" or "important" due to the degree of compromise they enable (e.g., providing remote access to a system), will certainly warrant attention before all others.



Known Vulnerabilities

Your Vulnerabilities

Your Vulnerabilities Exploited in the Wild

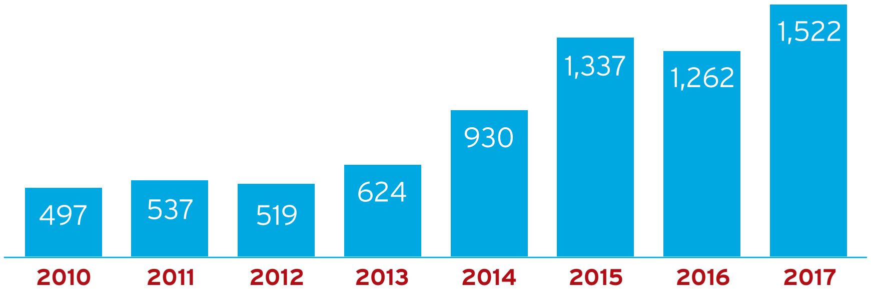
Your *Most-Critical* Vulnerabilities Exploited in the Wild

[1] "Focus on the Biggest Security Threats, Not the Most Publicized," Susan Moore, Gartner, November 2, 2017.

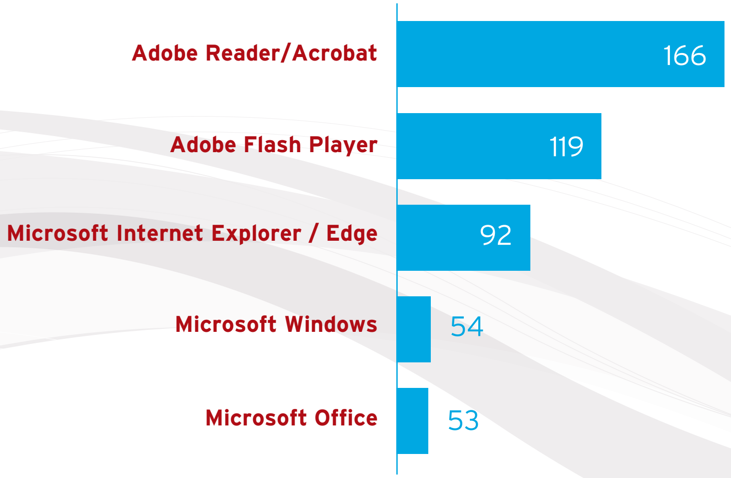
CHAPTER 2

A by-the-numbers look at vulnerabilities

1,522 total number of vulnerabilities disclosed by public vulnerability reporting organizations (a subset of the total number of published vulnerabilities and exposures) in 2017. Public reporting organizations include individuals, security vendors, governments, and anonymous submissions.



Top Five Applications with the Highest Number of Unique Confirmed Vulnerabilities in 2017

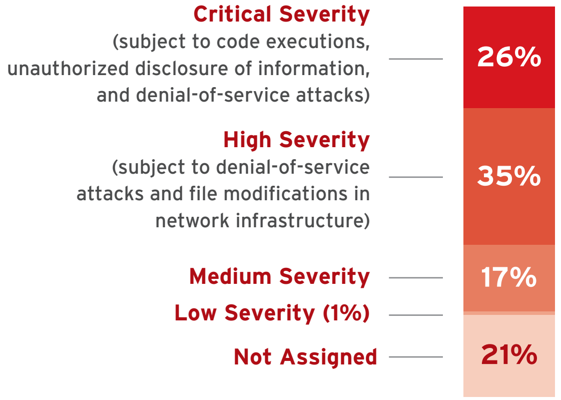


Source: Frost & Sullivan analysis

2% of all reported vulnerabilities are self-disclosed

98% of all reported disclosures are from third-party sources

Severity of All Vulnerabilities Disclosed in 2017



In 2017, Trend Micro Disclosed:

66.3% of the publicly reported vulnerabilities

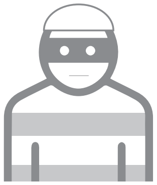
67.8% of the 929 critical- and high-severity vulnerabilities reported

CHAPTER 3

How vulnerability research works

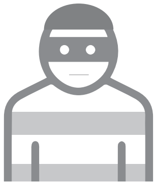
Vulnerability research is a critically important, yet chronically misunderstood, part of protecting users, companies, and governments from cyberattack. The discipline encompasses all the various processes that engineering teams and security researchers use to pinpoint and disclose flaws in software programs that could lead to security issues. These efforts include: reverse engineering, fuzzing, source code analysis and an array of other techniques to uncover potential vulnerabilities.

However, not everyone conducting vulnerability research wears a white hat. In fact, the total vulnerability research market includes:



White market

Bug bounty programs, hacking contests, and security researchers identify vulnerabilities and use responsible disclosure to create accountability.



Gray market

Some legitimate companies and researchers operate in a legal gray zone within the zero-day market, selling exploits to governments and law enforcement agencies around the world.

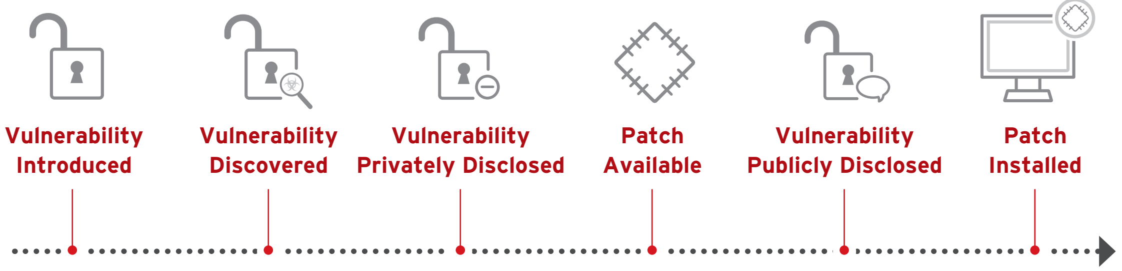
Black market

In the black market, flaws are sold to the highest bidder. They can then be used to create exploits for disrupting private or public individuals, businesses, and groups.

The countdown to public disclosure

White market organizations such as Trend Micro follow a responsible-disclosure process to report vulnerabilities to manufacturers privately, giving them (in Trend Micro's case) 120 days to address the issue before it's made public. The countdown-clock nature of responsible disclosure pushes companies to quickly and effectively handle the issue, fostering accountability and transparency across the software ecosystem.

Vulnerability Lifecycle



DID YOU KNOW ?

A bug bounty is a rewards program for reporting vulnerabilities. Reputable vendors such as Intel, Yahoo, Snapchat, and many others encourage ethical hacking of their software through bug bounty programs. Some of the top bounties paid by companies for bugs (programming flaws) include:

- **Dropbox:** Offers between $12,167 and $32,768 for a discovered vulnerability
- **Apple:** Will pay $100,000 to the bug bounty hunter who can extract data protected by Apple's Secure Enclave technology
- **Yahoo:** Offers to pay as much as $15,000 for detecting important bugs in its system
- **Google:** Will pay $31,337 for design and implementation issues in its Google applications
- **Microsoft:** Will pay a maximum of $250,000 for a critical and important vulnerability in its Online Services

Source: Guru99, "Top 20 Bug Bounty Programs in 2018"

CHAPTER 4

The leader in the vulnerability research market

At Trend Micro, our entire focus is on innovating to stay ahead of the bad guys to make the connected world safer to exchange digital information. With more than 500,000 companies worldwide relying on us to help them do business safely, we dedicate significant resources to:

In-house research

The threat researchers and data scientists in Trend Micro Research labs around the world identify and disclose new vulnerabilities across a wide range of platforms, including: operating systems (Windows, Linux, Mac, and others), applications (consumer and business), and mobile platforms and devices. Our extensive capabilities include: vulnerability analysis, malware and exploit analysis, security product development, and custom research. Using workflows and techniques refined through years of collaboration with our partners, our highly skilled team of researchers can reverse engineer a security threat and provide protection to our clients quickly.

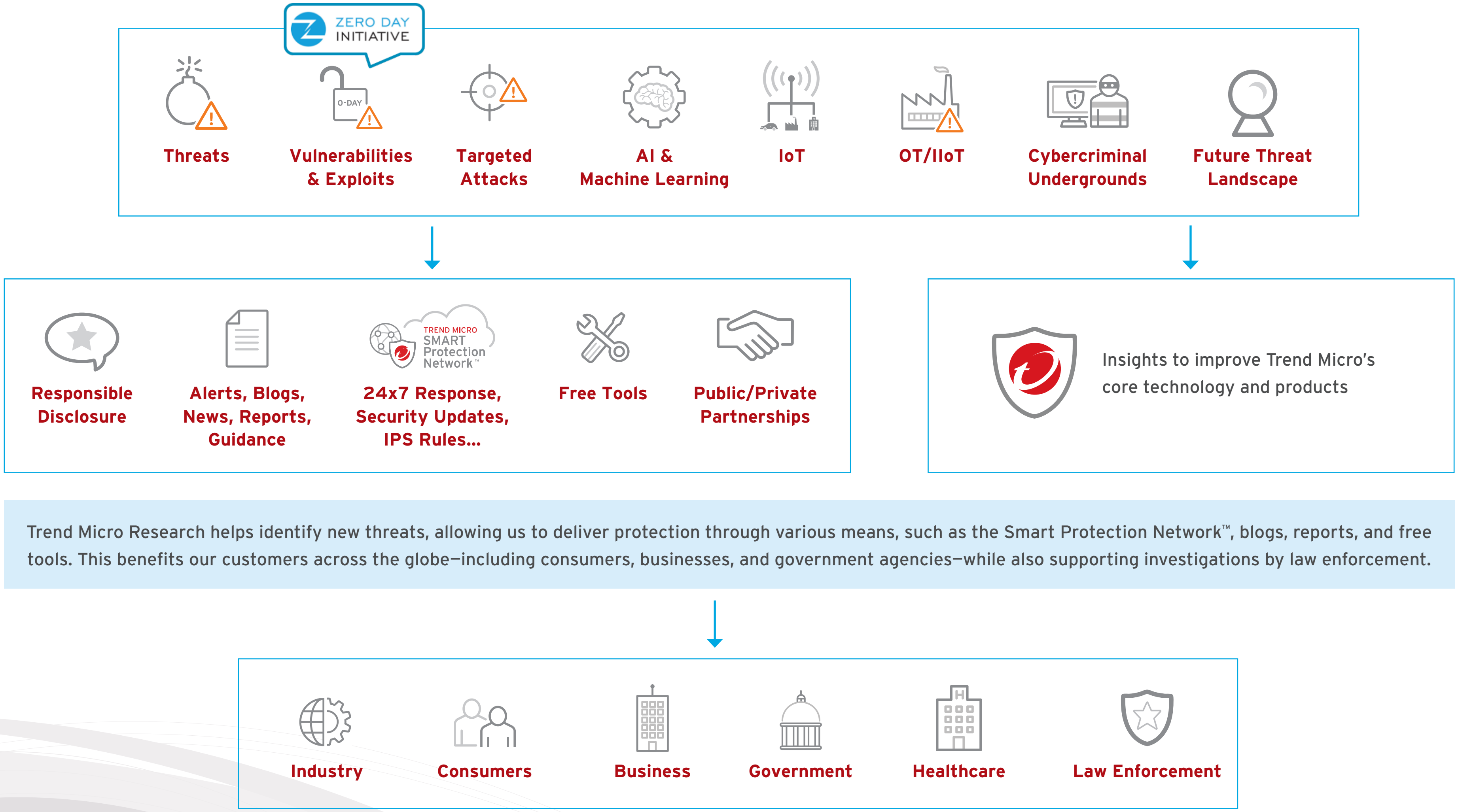
Bug bounty program

Bug bounty program: The world's largest vendor-agnostic bug bounty program, Trend Micro Zero Day Initiative is the leader in global vulnerability research and discovery. More than 3,500 independent researchers across the globe contribute to the Zero Day Initiative program.

Internet of Things (IoT), industrial IoT (IIoT) and operational technology (OT) research

Trend Micro actively invests in research that identifies how devices and the processes they use could be exploited by threat actors and then determines how to protect them. For example, our research includes identifying vulnerabilities in robotic manufacturing equipment, medical devices used in healthcare facilities, and communication protocols used by drones approved for use over large groups of people. It also includes active research into consumer devices such as kitchen appliances, smart TVs, smart homes, and more, all of which are increasingly connected to the internet.

Trend Micro Research



Threats

Vulnerabilities & Exploits

Targeted Attacks

AI & Machine Learning

IoT

OT/IIoT

Cybercriminal Undergrounds

Future Threat Landscape

Responsible Disclosure

Alerts, Blogs, News, Reports, Guidance

24x7 Response, Security Updates, IPS Rules...

Free Tools

Public/Private Partnerships

Insights to improve Trend Micro's core technology and products

Trend Micro Research helps identify new threats, allowing us to deliver protection through various means, such as the Smart Protection Network™, blogs, reports, and free tools. This benefits our customers across the globe—including consumers, businesses, and government agencies—while also supporting investigations by law enforcement.

Industry

Consumers

Business

Government

Healthcare

Law Enforcement

CHAPTER 5

Wanted: White hat hackers

The world's largest vendor-agnostic bug bounty program, Trend Micro Zero Day Initiative (ZDI) was founded in 2005 to encourage the responsible reporting of zero-day vulnerabilities to affected vendors by financially rewarding researchers through incentive programs. It pioneered the vulnerability white market with a focus on disrupting the black market by legitimately purchasing vulnerability research that can then be disclosed to affected vendors. Vulnerabilities are taken off the market, away from possible abusers, enabling affected vendors to address them before the information is made public.

In addition to operating systems, devices, and applications, the ZDI also covers industrial control systems (ICS). ICS encompasses several types of control systems and technologies, including supervisory control and data acquisition (SCADA) systems, distributed control systems (DCSs), human-machine interfaces (HMIs), and other control system configurations such as skid-mounted programmable logic controllers (PLCs) often found in industrial sectors as well as critical infrastructure. Like all forms of technology, ICS has its share of security vulnerabilities and can be a highly valuable target for cybercriminals.

ZDI-sponsored hacking contests

Pwn2Own

ZDI has sponsored the Pwn2Own computer hacking contest since 2007. Contestants are challenged to exploit widely used software and systems using previously unknown vulnerabilities. The Pwn2Own contest demonstrates the vulnerability of devices and software in widespread use while also providing a checkpoint on the progress made in security since the previous year.

Pwn2Own Tokyo

Created to address the growing attack surface on mobile devices and the IoT, Pwn2Own Tokyo shows that vulnerabilities exist and can be exploited on mobile and IoT devices to achieve compromises similar to those seen on more traditional platforms. Pwn2Own Tokyo seeks to harden these devices by identifying bugs and getting them fixed before they are actively exploited.

DID YOU KNOW?

Facts about the Trend Micro Zero Day Initiative:

3,500+
researchers from more than 80 countries across six continents participate

4,500+
vulnerabilities have been published since inception

More than **US$18 million**
has been awarded since inception

It's the **top provider**
of vulnerabilities to ICS-CERT, Adobe and Microsoft

CHAPTER 6

Protection before and after vulnerabilities are disclosed

Vulnerability research is critical to successfully defending against exploits by giving security companies the information they need to build protections into their products and services—especially ahead of patches being available or for systems that are not readily and immediately patchable.

While Trend Micro's research and commitment to discovering and disclosing vulnerabilities helps make everyone more secure, customers using Trend Micro products experience the greatest benefit. That's because with its exclusive access to vulnerability information from both its internal research as well as the Zero Day Initiative, Trend Micro can deliver both pre-emptive and post-disclosure coverage to customers of its security solutions.

What is pre-emptive coverage?

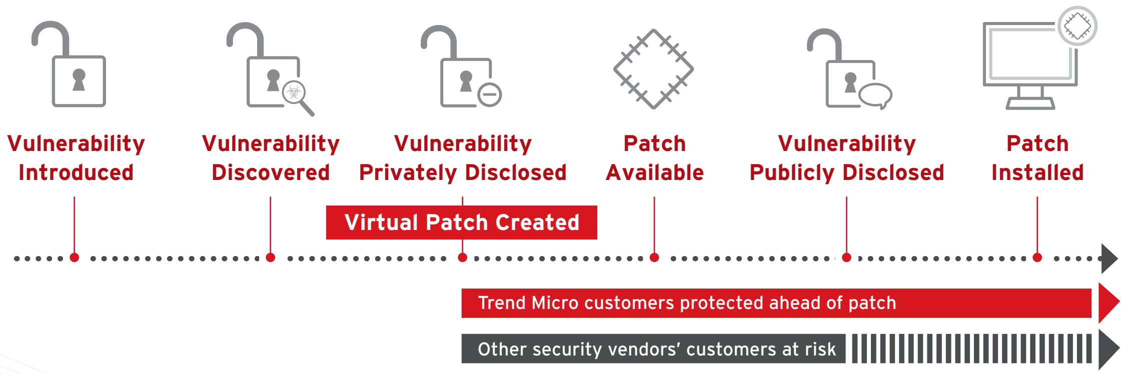
Using various means, such as virtual patching, filters, and policies, pre-emptive coverage provides protection against exploits of newly discovered vulnerabilities before a patch is available from the vendor.

What is a virtual patch?

A virtual patch is a security policy, filter, or rule that prevents an exploit against a vulnerability from being used before a publicly disclosed patch is made available by the affected vendor. Virtual patches can also protect out-of-support software for which no patches will be created.

What is post-disclosure coverage?

Virtual patches can also be used to protect organizations after a vulnerability is disclosed and a patch has been created, but before the patch has been applied.


Vulnerability Introduced
Vulnerability Discovered
Vulnerability Privately Disclosed
Patch Available
Vulnerability Publicly Disclosed
Patch Installed
Virtual Patch Created
Trend Micro customers protected ahead of patch
Other security vendors' customers at risk

Variants of an exploited vulnerability may not be protected by traditional exploit signatures from other vendors and may leave their customers susceptible to future attack.

Protecting your organization

Our significant investment in vulnerability research powers all of our products, enabling Trend Micro products to deliver both pre-emptive and post-disclosure coverage to protect your network, servers, and endpoints from known, unknown, and zero-day vulnerabilities:

Network protection

Trend Micro™ TippingPoint provides network-based intrusion prevention against the full range of threats at wire speed anywhere on your network to protect your critical data and reputation. TippingPoint products deliver preemptive protection for vulnerabilities through a virtual patch before the publicly disclosed patch is made available by the affected vendor.

Server protection

Trend Micro Deep Security is a host-based security control product that secures millions of servers across thousands of customers around the world. It can automatically virtually patch vulnerabilities in servers, virtual desktop infrastructure (VDI), and applications to stop attackers and remove the need for emergency patching.

Endpoint protection

Trend Micro™ Vulnerability Protection provides earlier, stronger endpoint protection by supplementing desktop anti-malware and threat security with proactive virtual patching. A high-performance engine monitors traffic for new specific vulnerabilities using host-based intrusion prevention system (IPS) filters as well as zero-day attack monitoring.

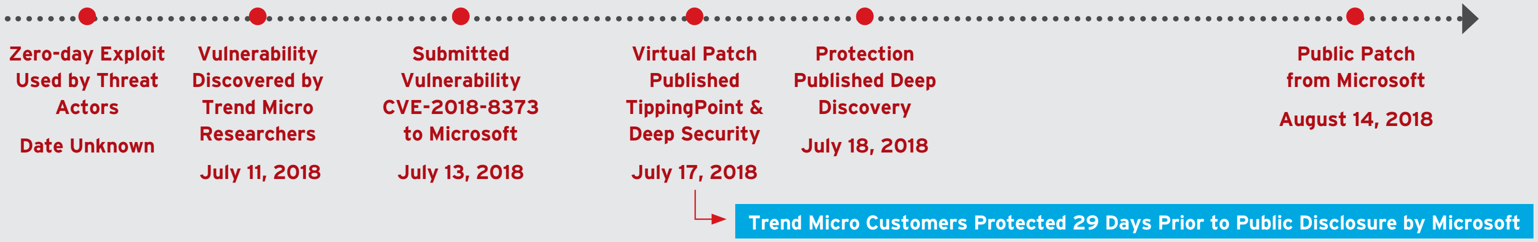
Advanced threat protection

Trend Micro™ Deep Discovery™ is an advanced threat detection platform that blends specialized detection engines, custom sandboxing, and global threat intelligence from the Trend Micro™ Smart Protection Network™ for the highest detection rate possible against attacks that are invisible to standard security products. TippingPoint integrates with Deep Discovery to detect and block targeted attacks through pre-emptive threat prevention, threat insight and prioritization, and real-time enforcement and remediation.

DID YOU KNOW?

Timeline for CVE-2018-8373

Using heuristics and in-depth analysis, Trend Micro Zero Day Initiative discovered a high-risk Internet Explorer vulnerability in the wild. In less than one week's time, Trend Micro delivered pre-emptive protection from the new vulnerability for its customers. Trend Micro customers were protected nearly an entire month (29 days) ahead of the public disclosure by Microsoft and the availability of a Microsoft-provided patch.



Zero-day Exploit Used by Threat Actors — Date Unknown

Vulnerability Discovered by Trend Micro Researchers — July 11, 2018

Submitted Vulnerability CVE-2018-8373 to Microsoft — July 13, 2018

Virtual Patch Published TippingPoint & Deep Security — July 17, 2018

Protection Published Deep Discovery — July 18, 2018

Public Patch from Microsoft — August 14, 2018

Trend Micro Customers Protected 29 Days Prior to Public Disclosure by Microsoft

CHAPTER 7

Greater security for everyone

By combining Trend Micro's industry-leading vulnerability research with its award-winning technology for host, network, and endpoint security, we're helping make the world safe for exchanging digital information. We do that by:

- Identifying unknown vulnerabilities and discouraging their sale on the black market for nefarious purposes.
- Helping vendors of operating systems and applications used by enterprises and organizations to create patches against vulnerabilities ahead of public disclosure.
- Delivering pre-emptive protection to Trend Micro customers ahead of a vendor patch through exclusive access to vulnerability information submitted to the Zero Day Initiative, as well as added protection for legacy, out-of-support software.
- Committing to long-standing relationships with leading software vendors and the research community to influence the importance of security in the product development lifecycle.
- Using insights from newly discovered vulnerabilities to build new heuristics into Trend Micro products to stay ahead of cybercriminals, detect new zero-day exploits, and give customers the best possible protection.

DID YOU KNOW?

Trend Micro customers received:

512
zero-day filters delivered in 2017

42
days average of zero-day predisclosed filter coverage for 2017 Microsoft Bulletins

63
days average of zero-day predisclosed filter coverage for 2017 Adobe Bulletins

72
days average of zero-day predisclosed filter coverage for 2017

Next steps

Through its vulnerability research, Trend Micro helps protect everyone on the internet from potential attacks. We do this by committing significant resources to the hard work of discovering vulnerabilities before the bad guys.

Our findings are put to work in two very important ways. First, responsibly disclosing new vulnerabilities to the vendors of the affected software and systems allows them to proactively provide corresponding patches in a timely manner. Then, for our customers, Trend Micro extends protection to cover the gap between vulnerability discovery and patch availability, as well as out-of-support and unpatchable systems.

Trend Micro is the only vendor that offers the breadth and depth of vulnerability research integrated into its products and solutions to deliver maximum protection through:

- The world's largest vendor-agnostic bug bounty program
- Comprehensive coverage across operating systems, devices, and applications, as well as the IoT and IIoT including ICS/SCADA
- Pre-emptive protection such as virtual patching, filters, and policies
- Extensive research capabilities including: vulnerability analysis, malware and exploit analysis, security product development, and custom research
- A range of products that protect customer networks, servers, and endpoints

Find out more about how Trend Micro can help your company do business safely with solutions for intrusion prevention.

About Trend Micro

Trend Micro Incorporated, a global leader in cybersecurity solutions, helps to make the world safe for exchanging digital information. Our innovative solutions for consumers, businesses, and governments provide layered security for data centers, cloud environments, networks, and endpoints. All our products work together to seamlessly share threat intelligence and provide a connected threat defense with centralized visibility and control, enabling better, faster protection. With more than 6,000 employees in over 50 countries and the world's most advanced global threat intelligence, Trend Micro secures your connected world. For more information, visit www.trendmicro.com.