Understand The Anatomy of Attacks to Stay One Step Ahead

OpenDNS

Network (firewall) and endpoint (antivirus) defenses react to malicious communications and code after attacks have launched. OpenDNS observes Internet infrastructure before attacks are launched and can prevent malicious Internet connections. Learning all the steps of an attack is key to understanding how OpenDNS can bolster your existing defenses.

Network Rescue

Each step of the attacker's operation provides an opportunity for security providers to observe its presence and defend its intrusion. On the next page, four detailed example attacks are laid out using a seven-step framework.

Here is a high-level summary of the details:

1. **RECON:** Many reconnaissance activities are used to learn about the attack target.
2. **STAGE:** Multiple kits or custom code is used to build payloads. And multiple networks and systems are staged to host initial payloads, malware drop hosts, and botnet controllers.
3. **LAUNCH:** Various Web and email techniques are used to launch the attack.
4. **EXPLOIT:** Both zero-day and known vulnerabilities are exploited or users are tricked.
5. **INSTALL:** Usually the initial payload connects to another host to install specific malware.
6. **CALLBACK:** Nearly every time the compromised system callbacks to a botnet server.
7. **PERSIST:** Finally, a variety of techniques are used to repeat steps 4 through 7.

It is not necessary to understand each tool and technique that attackers develop. The takeaway is to understand how multiple, and often repeated, steps are necessary for attackers to achieve their objectives.

Words of Wisdom

Compromises happen in seconds. Breaches start minutes later and continue undetected for months. Operating in a state of continuous compromise may be the new normal, but we cannot accept a state of persistent breach.

"Advanced targeted attacks are easily bypassing traditional firewalls and signature-based prevention mechanisms. All organizations should now assume that they are in a state of continuous compromise."

— Neil MacDonald & Peter Firstbrook, Designing an Adaptive Security Architecture for Protection From Advanced Attacks

Gartner

Example Attacks (Framework is based on Lockheed Martin's "Kill Chain")

TARGET

COMPROMISE

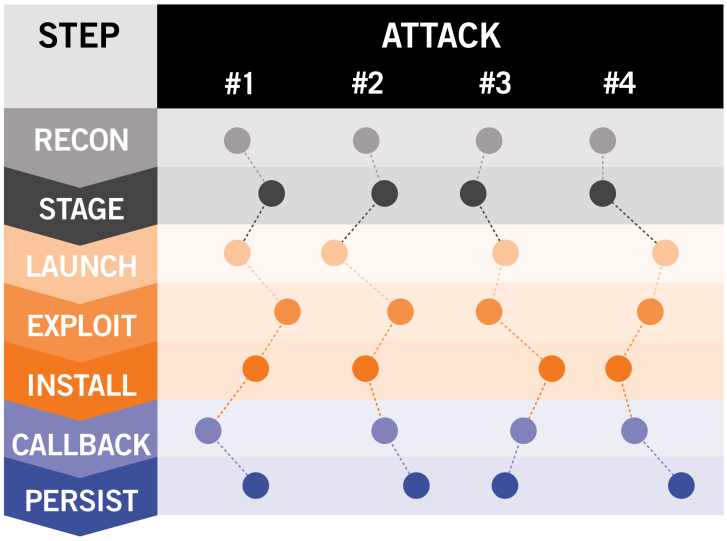
BREACH

STEP	ATTACK #1 steal credit card data from point-of-sale systems	ATTACK #2 manipulate customer data to impact stock value	ATTACK #3 deface website due to geopolitical remarks in the press	ATTACK #4 steal product designs to resell on blackmarket
RECON Attacker discovers trusted email & website addresses; also probes networks and systems for weaknesses	**Social Networks & Engineering** harvest friends' emails and profile social activities	**Bash Shellshock** [CVE-2014-6271] webshell gathers email addresses and password files	**Exposure Maps** Nmap, Nessus, ping IPs, port scan, app fingerprinting, Google dorking	**Surveillance** capture CEO's DNS requests by pharming on hotel's guest wi-fi
STAGE Attacker builds payload or acquires tools for exploit, install and callback steps	**Zeus Build Kit** w/0-day exploit & domain generation algorithm (DGA)	**Custom Coded** w/known exploit & domain generation algorithm (DGA)	**SpyEye Build Kit** w/0-day exploit & double fast flux P2P callbacks	**Nuclear Build Kit** w/0-day exploit & 256 bit encrypted P2P callacks
Attacker builds or shares infrastructure for launch, install and callback steps	**4.2.55.0/24** w/No-IP.com to host DNS records	**23.88.2.0/28** w/DynDns.org to host DNS records	**32.13.31.0/26** infected devices are nameservers	**42.18.31.0/24** own nameservers host DNS records
LAUNCH Attacker sends or spoofs emails, or injects malicious ads or scripts into websites	**Spear Phishing** pal@gmail.com Subject: Hilarious check out this pic! facebookpic.com	**Spear Phishing** ceo@acme.de Subject: Important new stock options email attachment	**Malvertising** ads.yahoo.com ad's javascript redirects to asdfaa.com	**Watering Hole** https://news.com [malicious iframe code planted] java-se.com
EXPLOIT Vulnerable software executes code or user is tricked to excute code	**Flash "Shellcode" Vulnerability** CVE-2014-1776 animated.swf	**Old PowerPoint Vulnerability** CVE-2014-6352 stock.ppt	**Social Engineering** [Fake AV Popup] avast.exe	**Heartbleed Vulnerability** CVE-2014-0160 …
INSTALL Code infects system, modifies privileges, scans environment then connects to malware drop host	**Windows Trojan** C:\...\IEUpd.exe [polymorphic] add to Windows startup folder	**Keylogger** C:\...\random.exe [salesforce login] user: cfo@acme.de pw: 123456789	**Mac Trojan** C:\...\hi.jpg.exe [polymorphic] installs as a service	**Rootkit** C:\...\fsm32.exe [polymorphic] installs as a WIndows service
CALLBACK Attacker gains command and control channel to receive new instructions, or if target data is acquired, steal it	**HTTP Connection over Port 443** sdsdffil.ru y5asf3s.cn erasdf2ds.us	**IRC Connection over Port 1440** gm234mal.de yyys22sjks.biz ijsdfaa.us	**P2P Connection over Port 5455** 12323.btt.com 32231.btt.com 24222.btt.com	**P2P Connection over Port 6441** stock.wwxls.com
PERSIST Attacker maintains persistence until actions on their objectives are fully achieved. **Repeat steps EXPLOIT –> PERSIST**	**Hidden Backdoor** valid VPN or PKI credential allow the attacker to disguise as a legitimate user	**Lateral Movement** Bash Shellshock [CVE-2014-6271] to takeover an internal server	**Internal Recon** gather org charts, network maps, business calendars on wiki or portal	**More Footholds** install more RATs (remote access trojan) onto other systems

Your Challenge: Existing defenses cannot block all attacks.

Firewalls and antivirus stop many attacks during several steps of the "kill chain", but the velocity and volume of new attack tools and techniques enable some to go undetected for minutes or even months.

Firewall/Antivirus View of Attacks



Without visibility of where attacks are staged, each step is unique and isolated.

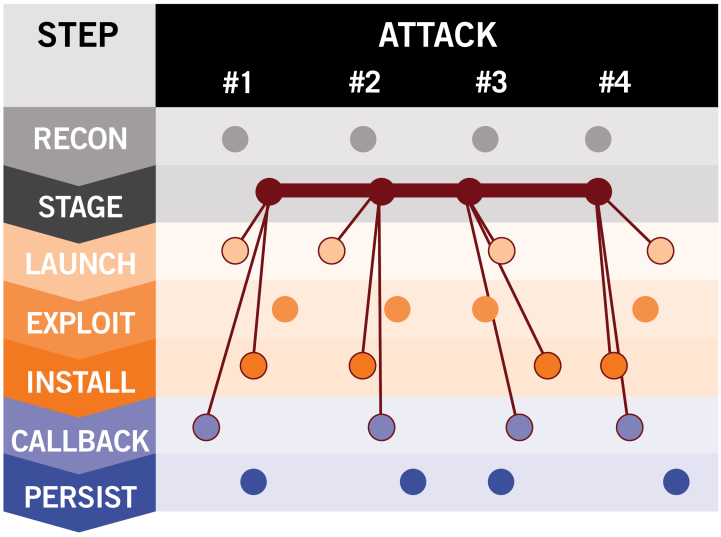
- Firewalls know whether the IP of a network connection matches a blacklist or reputation feed. Yet providers must wait until an attack is launched before collecting and analyzing a copy of the traffic. Then, the provider will gain intelligence of the infrastructure used.
- Antivirus solutions know whether the hash of the payload matches a signature database or heuristic. Yet providers must wait until a system is exploited before collecting and analyzing a sample of the code. Then, the provider will gain intelligence about the payload used.

> *"The reality is that no one security technology is enough. Hackers are always working to defeat the latest defense. So you have to invest in defenses for the latest threat as well as every threat experienced in the past."*
>
> — Lawrence Pingree (Gartner analyst), New York Times, "Tech Security Upstarts Enter Fray"

Our Solution: Stop 50 to 98 percent more attacks than firewalls and antivirus alone by pointing your DNS traffic to OpenDNS.

OpenDNS does not wait until after attacks launch, malware install, or infected systems callback to learn how to defend against attack. By analyzing a cross-section of the world's Internet activity, we continuously observe new relationships forming between domain names, IP addresses, and autonomous system numbers (ASNs). This visibility enables us to discover, and often predict, where attacks are staged and will emerge before they even launch.

OpenDNS View of Attacks



Observe Internet infrastructure as attacks are staged to stay ahead of the subsequent launch, install and callback steps.

- We see that the IP prefixes (4.2.55.0/24, 23.88.2.0/28, 32.13.31.0/26, 42.18.31.0/24) of all four attacks are related to the same **Internet infrastructure (AS32442)**.
- Web redirects or email links use domains (facebookpic.com, asdfaa.com, java-se.com) that all have DNS records mapping back to these IP prefixes.
- Many callback connections use domains (123.btt.com, 321.btt.com, 222.btt.com, stck.wwxls.com) that have DNS records mapping back to these IP prefixes.
- But other callback connections use domains (sdfil.ru, y53s.cn, er2ds.us, gmmal.ru, …) that are generated by a common algorithm. This is discovered by observing co-occurrences over short time intervals, matching authoritative nameservers or WHOIS information.used.

Your Challenge:
Why keep firewalls and antivirus at all?

Once we prove our effectiveness, we are often asked: “can we get rid of our firewall or antivirus solutions?” While these existing defenses cannot stop every attack, they are still useful—if not critical—in defending against multi-step attacks. A big reason is threats never expire—every piece of malware ever created is still circulating online or offline. Signature-based solutions are still effective at preventing most known threats from infecting your systems no matter which vector it arrives: email, website, or thumbdrive. And firewalls are effective at defending both within and at the perimeter of your network. They can detect recon activities such as IP or port scans, deny lateral movements by segmenting the network, and enforce access control lists.

> *“One of AV’s biggest downfalls is the fact that it is reactive in nature; accuracy is heavily dependent on whether the vendor has already seen the threat in the past. Heuristics or behavioral analysis can sometimes identify new malware, but this is still not adequate because even the very best engines are still not able to catch all zero-day malware.”*
>
> — Chris Sherman, Prepare For The Post-AV Era
>
> FORRESTER®

Your Solution:
Rebalance investment of existing versus new defenses.

Here are a couple examples of how many customers free up budget for new defenses.

- Site-based Microsoft licenses entitle customers to signature-based protection at no extra cost. Microsoft may not be the #1 ranked product, but it offers good protection against known threats. OpenDNS defends against both known and emergent threats.
- NSS Labs reports that SSL decryption degrades network performance by 80%, on average. OpenDNS blocks malicious HTTPS-based connections by defending against attacks over any port or protocol. By avoiding decryption, appliance lifespans can be greatly extended.

About OpenDNS

OpenDNS provides a cloud-delivered network security service that blocks advanced attacks, as well as malware, botnets and phishing threats regardless of port, protocol or application. Our predictive intelligence uses machine learning to automate protection against emergent threats before your organization is attacked. OpenDNS protects all your devices globally without hardware to install or software to maintain.

Contact Us

Have a question?

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