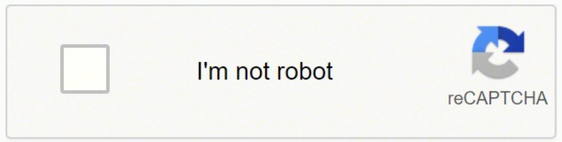

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How to detect nmap

Do you want to detect an nmap scan as an academic exercise, or are you trying to actually detect attackers who are performing a port scan? The latter can be extremely difficult, since an attacker can slow down the scan and/or distribute the scan across a number of clients in order to defeat any heuristics that you might implement. So, be aware that if this is your goal you're going "down the rabbit hole" :-\ Secondly, And are you simply interested in having the capability of detecting a scan or are you interested in the underlying details of how that can be accomplished? In other words, do you just want to get this done or are you studying this topic? For the former, there are various IDS tools that you can install such as Snort and Bro, and numerous commercial offerings. Understand however that they will likely only be able to detect certain types of scans, such as a scan of monotonically increasing TCP port numbers, for example. For the latter, if you want to understand what network traffic is generated by typical nmap scans so that you can then look for those patterns, then I suggest running nmap - perhaps over a small number of ports - and examining the traffic that it generates using a sniffer such as tcpdump. You can then implement signatures/rules within whatever system you're building. Hope this helps! Suricata is an excellent open-source threat detection engine that combines functions from intrusion detection (IDS), intrusion prevention (IPS), network security monitoring (NSM), and PCAP processing. The best thing about it is that you can customize your own rules to achieve your security goals. For this article I'll be presenting a study case that I implemented a couple of years ago to detect post exploitations activities, although the topic is huge, I'll be focusing on analyzing Nmap scans PCAPs and using that information to create Suricata Rules which detect and trigger the malicious action. LAB Scenario C2S-VPN-Network = 172.17.100.0/2 Suricata in detection mode = 172.17.19.58 VLAN_SERVIDORES = 172.17.19.0/26 nmap -sS (TCP SYN scan)SYN Stealth Scan is the most popular network port scanner, it abuses the TCP 3Whandshake, where the host only transmits SYN flags and does not respond to the SYN/ACK from the destination. If the destination sends a response it means that the port is open, otherwise, a .RST flag is received from the destination indicating that the port is closed.Looking into the PCAP below, we can see a large number of SYN requests from 172.17.100.153, our attacker machine, to 172.17.19.59 which is our destination server.Diving deeper into the TCP stack of the PCAP we can see that the flag SYN is set to 1 (which means active) and the flag FIN is not set, which causes a not establishment of the TCP connection.With that in mind, I created the following rule on Suricata:alert tcp $VPN_NET any -> $HOME_NET any (msg:"SYNSTEALTH SCAN DETECTED" flow:stateless; flags:S,12; reference:arachnids,198; classtype:attempted-recon;sid:2100624; priority:5; rev:8; threshold:type threshold, track by_src, count 50, seconds1;) I told Suricata the CIDR of my VPN into the $VPN_NET variable and set the rule to alert if it notices 50 SYN requests (without FIN) due the period of 1 second and here is the result: From VPN_NET I launched sudo nmap- sS -Pn 172.17.19.58 which targets the host on $HOME_NET variable.Immediately a rule that was configured before was triggered: nmap -sT (TCP connect scan)Different from the Syn Stealth scan that resets the 3W Handshake, the nmap -sT completes the whole connection, establishing communication with the scanned port, which takes a lot of time.As the -sT also sends a lot of SYN connections in a short period of time, we can use the same logic above to capture the scan and avoid false positives since many real connections will complete the 3W handshake.Here is our trigger for -sT scan:nmap -sU (UDP scans)The nmap -sU scan send an empty UDP header for each destination port, if the port returns ICMP unreachable (type 3) means that the port is closed. Another type of ICMP error such as 1,2,9,10 or 13 sets the destination port as filtered. If any service responds with a UDP package, it means that the port is open. Also if no responses are received after the retransmissions, the port is classified as open|filtered.Knowing that the UDP Header is empty, we created the following rule on Suricata:Lauching our map -sU scan: And again, rule triggered: nmap - sN ; -sF ; -sX (TCP NULL, FIN, and Xmas scans)Xmass scans are known as Christmas tree because it enables all flags from the TCP stack, appearing like a tree. This type of scan is known to be very noisy on the network.In this example, the PCAP of XMAS scan has only 3 flags FIN PSH and URG enabled:To detect this type of scan, we used the following Suricata rule:Lauching our map -sX scan:And voilà!.. nmap -sI [:] (idle scan)Nmap zombie probe scan is the most sophisticated type of scan. It uses a "zombie" machine to intercept the scan and tunneled it to a destination host, which confuses the IDS regarding the source of the attack. Since our network lab are behind a firewall, I wasn't able to reproduce the attack trying to use a zombie host to forward my scan:Even tho the attack was not successful, Suricata warned us about an invalid timestamp package:Conclusion:With all the evidence above we can be sure that we are alerting and logging the most popular NMAP scans to advanced techniques. This does not mean that we are 100% complete on our detection, it will require continuous study and analysis of your network behavior to detect abnormal patterns.The same variable RULES contained in $VPN_NET was also applied to another variable which contains our private network $HOME_NET. Each subnet should be carefully mapped on Suricata to extract the best level of detection. Some people believe that detecting port scans is a waste of time. They are so common that any organization connected to the Internet will be regularly scanned. Very few of these represent targeted attacks. Many are Internet worms endlessly pounding away seeking some Windows vulnerability or other. Some scans come from Internet research projects, others from curious or bored individuals exploring the Internet. I scanned tens of thousands of IPs seeking good examples and empirical data for this book. Other scans actually are malicious. Script kiddies regularly scan huge ranges for systems susceptible to their exploit du jour. While these folks have bad intentions, they are likely to move along on their own after finding no vulnerable services on your network. The biggest threat are attackers specifically targeting your organization, though those represent such a small percentage of detected scans that they are extremely tough to distinguish. So many administrators do not even bother recording port scans.Other administrators take a different view. They contend that port scans are often precursors to attacks, and should at least be logged if not responded to. They often place detection systems on internal networks to reduce the flood of Internet port scan activity. The logs are sometimes analyzed for trends, or submitted to 3rd parties such as Dshield for world-wide correlation and analysis. Sometimes extensive logs and scary graphs measuring attacks are submitted to management to justify adequate budgets.System logs alone are rarely sufficient for detecting port scans. Usually only scan types that establish full TCP connections are logged, while the default Nmap SYN scan sneaks through. Even full TCP connections are only logged if the particular application explicitly does so. Such error messages, when available, are often cryptic. However, a bunch of different services spouting error messages at the same time is a common indicator of scanning activity. Intrusive scans, particularly those using Nmap version detection, can often be detected this way. But only if the administrators actually read the system logs regularly. The vast majority of log messages go forever unread. Log monitoring tools such as Logwatch and Swatch can certainly help, but the reality is that system logs are only marginally effective at detecting Nmap activity.Special purpose port scan detectors are a more effective approach to detecting Nmap activity. Two common examples are PortSentry and Scanlogd. Scanlogd has been around since 1998 and was carefully designed for security. No vulnerabilities have been reported during its lifetime. PortSentry offers similar features, as well as a reactive capability that blocks the source IP of suspected scanners. Note that this reactive technique can be dangerous, as demonstrated in the section called “Reactive Port Scan Detection”.Despite being subject to threshold-based attacks discussed in the section called “Avoiding Intrusion Detection Systems”, these port scan detection tools work pretty well. Yet the type of administrator who cares enough to keep tabs on port scans will also want to know about more serious attacks such as exploit attempts and installed backdoors. For this reason, intrusion detection systems that alert on a wide range of suspicious behavior are more popular than these special-purpose tools.Many vendors now sell intrusion detection systems, but Nmap users gravitate to an open-source lightweight IDS named Snort. It ranked as the third most popular security tool among a survey group of 3,243 Nmap users ( ). Like Nmap, Snort is improved by a global community of developers. It supports more than two thousand rules for detecting all sorts of suspicious activity, including port scans.A properly installed and monitored IDS can be a tremendous security asset, but do not forget the risks discussed in the section called “Subverting Intrusion Detection Systems”. Snort has had multiple remotely exploitable vulnerabilities, and so have many of its commercial competitors. Additionally, a skilled attacker can defeat most IDS rules, so do not let your guard down. IDSs too often lead to a false sense of security.

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