



# Global Information Assurance Certification Paper

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**Intrusion Detection in Depth**  
**GCIA Practical Assignment, v3.0**

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Assignment 1

**The Current State of Open Source Network Intrusion Detection**

Four Microsoft websites get defaced in one hour. Ford.com gets defaced. NASA, NATO, and .MIL sites get hacked. Does this happen often? In fact, Alldas.de, a website that tracks hackers, states that their mirror alone has 23163 registered defacements.<sup>i</sup>

Former Assistant Secretary of Defense Arthur Money stated "the Department of Defense (DOD) has been victimized 22,124 times by hackers in 1999, costing the department \$25 billion".<sup>ii</sup>

Our National private and military infrastructure is centered on our communications networks. Network defenses are needed now more than ever. One of the main tools used in detecting network attacks, are Intrusion Detection Systems (IDS).

In the Intrusion Detection arena today, we can separate tools into three main categories: network, host, and application layer intrusion detection systems. Host and application intrusion detection systems are still relatively new, and not as widely deployed as Network Intrusion Detection Systems (NIDS).

Network intrusion detection is the science of analyzing network traffic for known attacks and anomalous

events. Network intrusion detection is still a young science, but engineers have built sophisticated detection engines in order to deal with the ever increasing flood of network attacks.

There are many NIDS in the commercial space today. ISS, Cisco, NFR, Enterasys, and NAI all have NIDS on the market. Some of the premier software packages cost over eight thousand dollars per license. This figure does not include hardware, or the analysts needed to examine the data.

In this paper, I will present the current state of open source network Intrusion Detection. The time has come for open source network intrusion detection in the enterprise. The current economic indices coupled with the high rate of cyber-attacks against private, government and military networks indicate that Intrusion Detection and Prevention are necessary to protect our networks. The open source tools Snort, Demarc, SnortSnarf, and tcpdump have evolved into robust workhorses ready to tackle the task of protecting our electronic assets.

Open source software has almost as many definitions as it does advocates. In its purest form, open source software can be defined as software that includes the source code in its precompiled form. The philosophy behind open source software stems from military and classified networks needing to review every line of code running on their systems to ensure safety and stability. Most definitions of open source software also include the right to modify, customize, and redistribute the source code. These definitions have evolved into many open source distribution licenses, the most popular of which is the Gnu Public License (GPL).

Open source software has made enormous contributions to the IDS arena. One of the original open source network analysis tools is tcpdump, which along with libpcap, allows users to capture (sniff) and analyze network traffic. SHADOW, a military project (open source) does extensive traffic analysis bases on tcpdump captures.

Snort, also an open source software package, began its life as a packet sniffer. Engineered by Marty Roesch, Snort has evolved into the premier open source IDS tool on the net.

The first version of Snort, developed to watch Marty's home traffic, was written in November of 1998. Snort is now on its 1.8.2 Release and can be downloaded for free, at [www.Snort.org](http://www.Snort.org)

Snort is currently widely used in academic circles, corporate America, government and military installations. Currently there are more than 2500 downloads of Snort a week, with more than 18000 hits per day on Snort.org.<sup>iii</sup>

Snort is very popular mainly because its free and very effective. It is a very popular tool, well engineered, and highly portable. Snort currently runs on over 25 operating systems, including Linux, Solaris, BSD, HP-UX, Tru64, Windows, and MacOS X.

Since Snort is open source, it is relatively easy to write plugins, preprocessors, and rules for Snort. Snort is available on the Snort website in various different formats: RPM's, Sun Packages, source tarballs, and even Win32 versions. There are log management scripts, web-based front ends to Snort, and even IDSCenter, a graphic user interface front end for Win32 Snort. Once downloaded, unpacked, and installed, Snort is easy to run and is well documented.

Snort has three basic modes of operation: sniffer, logger, and NIDS. In sniffer mode, Snort pulls the packets off the wire, and prints them to the console or a file. In logger mode, Snort logs all packets. NIDS mode has become Snort's raison d'être (reason for living).

In NIDS mode, Snort analyzes your network traffic for hostile activity. It does this by examining the packets on your network and looking for strings of known attacks. As packets are pulled off the wire by libpcap, Snort's preprocessors and decoders prepare the data for the detection engine. The detection engine will examine every packet for patterns based on the rules file loaded at runtime. If it finds a match of a known attack, Snort will fire an alert specific to the rule that was tripped by the packet.

Snort has been called a lightweight Intrusion Detection System. This primarily refers to the fact that Snort can impose little on the use of your systems

resources. Most of the performance tuning can be done through turning off unnecessary rules, and by logging in binary mode. The configuration file allows users to impose memory caps on preprocessors. As of this writing, the Snort distribution is only 1.8 Megabytes in size in a source tarball compressed format.

Snort's configuration file allows you to configure preprocessors, output plugins, and rules set. Through Snorts preprocessors and plugins, one can detect network attack patterns far beyond ordinary pattern matching. Stateful Inspection, for instance, coupled with IP defragmentation, will detect many of the attacks that could easily bypass normal IDS technology by using fragrouter or similar tools. SPADE will pick up unusually slow port scans and other anomalous network traffic. The preprocessors that currently ship with Snort 1.8.1 are listed in the figure below.

1.IP defragmentation	6.back orifice preprocessors
2.TCP Stream Reassembly	7.telnet decode
3.Stateful inspection	8.portscan preprocessor
4.http decode	9.SPADE - Statistical Packed
5.rpc decode	Anomaly Detection Engine

Table: Snort Preprocessors

The output plugins for Snort allow Alert Data to be parsed to a myriad of different formats. Snort supports most databases, XML, tcpdump format, comma and tab separated values (for import into Excel and other programs), and the Snort unified binary format. The latter spools data to be used with Snort's sister program, Barnyard. This allows most high overhead (resource hogs) data processing to be done at a lower priority process, freeing up resources for Snort.

The rule set a list of rules files that will be included into Snort's detection engine at run time. Snort comes loaded with a standard set of rules files. These files are ASCII text files organized by type of attack. The current rules files that come with Snort 1.8.1 are listed in the table below.

1.exploit.rules	15.web-
2. scan.rules	coldfusion.rules
3. finger.rules	16. web-
4. ftp.rules	frontpage.rules
5. telnet.rules	17. web-iis.rules
6. smtp.rules	18. web-misc.rules
7. rpc.rules	19. sql.rules
8. rservices.rules	20. x11.rules
9. backdoor.rules	21. icmp.rules
10. dos.rules	22.
11. ddos.rules	shellcode.rules
12. dns.rules	23. misc.rules
13. netbios.rules	24. policy.rules
14. web-cgi.rules	25. info.rules
	26. icmp-
	info.rules
	27. virus.rules
	28. local.rules

Snort Rules Files for Snort 1.8.1

Designed to be simple and highly customizable, Snort's open rule language is one of its most powerful features. Since the language for writing the rules is open, analysts can quickly learn to write rules for Snort. When new attacks are detected on the net, there are usually new rules to detect them on [www.Snort.org](http://www.Snort.org) within hours.

Rules are usually protocol, operating system, or application specific. This way, if you are not running Apache web server, you can turn off (not include) the Apache rules, and save system resources. Following this example we can tune Snort's performance so that it is optimized for the network it is monitoring. It is through this heuristic process that an analyst will begin to eliminate a large number of false positive alerts that are present at the onset of deploying a network intrusion detection system.

Rules consist of two parts: the Rule Header and the Rule options (see figure below) The rule header defines the network identification parameters of the attack. It examines 'who' is the attacker, and 'who' is the host receiving the attack. The Rule Header defines the protocol used, the source IP address and port, and the destination IP address and port. Rule Options tells the detection engine what to look for in the packet (e.g. The SYN flag and the FIN flag are set on the same packet), and what the

alert message says (e.g. SYN-FIN scan). Newer options in Snort also include priority, classification, and tagging.

Rule Header	Rule Options
alert tcp !192.168.1.0/24 any->192.168.1.0/24 any	(flags: SF: msg: "SYN-FIN scan");

Snort's detection engine has many modes for alerts: fast, full, console, none, unsock (UNIX socket), syslog, and WinPopup. In fast alert mode, Snort will write an alert to its main alert file, located by default in /var/log/Snort. A sample alert can be seen in the figure below. In full alert mode, Snort will also create a directory for the offending IP address and place in it the packets that tripped the alert. Performance issues should be considered when choosing an alert format. Fast and full alert modes will give you the fastest alert time and the most data respectively. As with all network intrusion detection systems, the amount of alert data that is generated on even medium sized networks is phenomenal. There is usually so much alert data, that we frequently see Analyst Overload.

Sample Snort Alert
<pre> [**] [1:527:1] MISC same SRC/DST [**] [Classification: Potentially Bad Traffic] [Priority: 2] 09/28-23:17:08.870447 192.168.1.5:4587 -&gt; 192.168.1.5:80 TCP TTL:112 TOS:0x0 ID:45122 IpLen:20 DgmLen:44 DF *****S* Seq: 0xAC98FD39 Ack: 0x0 Win: 0x2000 TcpLen: 24 TCP Options (1) =&gt; MSS: 1460 </pre>

The above alert sample was triggered due to the fact that both the source IP address and the destination IP address are the same. This is an indication of potentially bad traffic, and is cause for further investigation. The following rule, from the misc.rule file, triggered the alert.

Snort rule that triggered the Alert
<pre> alert ip any any -&gt; any any (msg:"MISC same SRC/DST"; sameip; classtype:bad-unknown; sid:527; rev:1;) </pre>

As we can see, the rule is set to fire, when traffic from any source IP address is going to a destination IP address with the same address as its source.

Snorts detection engine uses a pattern-matching algorithm to detect attacks. When traffic matches a known attack signature, an alert is generated. One of the flaws of pattern matching Intrusion detection is it is relatively easy to change the pattern of the attack, and evade the IDS. Snort's preprocessors are extremely advanced and configurable. These preprocessors and plugins are highly extensible and configurable. It is through these plugins that we can extend Snorts functionality in detecting a wide range of attacks. By adding TCP stream reassembly, stateful inspection, and IP defragmentation as modular plugins, we can detect attacks that normally would go undetected in a pattern matching IDS. It is through Snorts use of preprocessors and plugins that Snort has truly evolved to the point at which it can be a fully functional enterprise wide IDS.

The factors that kept many enterprises from using Snort included a lack of technical support and decent management consoles. Many groups have put out Snort management consoles and support services for Snort. CERT's ACID (Analysis Console for Intrusion Databases) set the stage for Snort Analysis consoles.

ACID offers the analyst a myriad of tools to analyze and parse Snort alert data. You can view individual alerts, search for specific alerts, and graph alert data to obtain visual statistical reports.

Silicon Defense, a company that conducts a lot of DARPA and government funded research projects in the electronic defense field, created SnortSnarf. SnortSnarf is a collection of Perl Scripts that parse Snort alert data into HTML. The alert data can be viewed by type of attack, quantity of attacks, Source IP's, Destination IP's. For each alert, there are informative links to CVE (Mitre's Common Vulnerabilities and Exposures database) or to Whitehats.com.

In my opinion, one of the best open source management consoles for Snort is the Demarc console. Demarc is a web based console that analysts can use to monitor Snort



alerts, manage Snort sensors, monitor the status of a variety of hosts, and check file integrity through MD5 checksums.

The console data is transmitted cryptographically over the web via openSSL (Secure Socket Layer). User authentication is required to access to the monitor. From the main console, an analyst can quickly view the latest alerts and unique events over specified periods of time, as well as maintain file integrity checks and monitor whether hosts are live or down.

It is important to note that Demarc is open source, but not free for every use. Check the license carefully before deploying it on your network.

There have been many organizations that have had problems utilizing open source software. Their main objections to using open source packages lie mainly in the lack of support and concern over the continued development and life span of the product. Some of the examples of open source projects that have defied these objections are UNIX, Linux, the Gnome Project, and the Mozilla web browser.

Earlier this year Snort's engineer Marty Roesch, founded Sourcefire. Sourcefire is offering commercial Network Intrusion Detection Systems based on the open source Snort sensor. Sourcefire is offering both an appliance and a Snort management console. Sourcefire's management console, pictured below, allows full monitoring and configuration of multiple Snort sensors. The web-based console offers cryptographically secure remote administration for your Snort sensors. Sourcefire is the commercial alternative for deploying open source NIDS.

Silicon Defense, Sourcefire and Farm9 all offer different levels of commercial support for Snort. Silicon Defense offers full commercial support for all types of Snort installations. Farm9 uses and supports Snort installations as part of their Managed Security Services. Sourcefire sells and supports commercial versions of the Snort sensor, management consoles, and appliances.

There are many community resources for Snort support. One of the main free resources for Snort users is the snort-users mailing list, maintained by [www.snort.org](http://www.snort.org). This mailing list offers general discussion about Snort

usage, from beginner questions to advanced snorting. Snort itself is fully documented, and has an enormous amount of knowledge base articles found throughout the net.

One of the major benefits of deploying open source sensors on the net, is the emerging Internet Storm Center. Through the use of software, IDS and firewall logs are sent directly to Internet Storm Center analysis and coordination centers (SACCs). These centers analyze the event data, and send their analyses to the Global Analysis and Coordination Center. The Internet Storm Center is the early warning system for network infrastructure defense. Through the analysis of attack data from thousands of sensors around the globe, the Internet Storm Center can warn the community of major security events, as well as provide assistance in avoiding the attacks. This capability was recently tested with great success in the Leaves, Code Red and Nimda worm attacks.

Incidents.org (<http://www.incidents.org>) provides information about recent security developments and network attacks. Top attackers and the top ports scanned on the net are constantly monitored. Incidents.org also provides security alerts, worm detection and removal tools, and developing security news stories.

The bottom line items for deploying IDS across the enterprise are effectiveness and cost. In examining the cost of deploying an enterprise wide NIDS, we must take into account the need for trained analysts. Security Analysts are the most essential tool in protecting an enterprises electronic data assets.

In preparing the cost analysis for deploying network intrusion detection systems, I selected a top-of-the-line server from Penguin Computing. I choose the Altus 1240 Server, which is a rack mounted machine with dual 1.2 GHz AMD Athlon MP processors. Penguin Computing was chosen as being a premier Linux hardware provider. The cost for each server is a fixed \$4198. For a detailed summary of system components, check Appendix A.

I based the cost for employing a Security Administrator as an analyst on Sans Salary Survey 2000. Sans states that the average salary for a Security Administrator is \$63, 598.<sup>iv</sup>

The three top NIDS on the market, according to a recent Neohapsis study, are Dragon, Cisco Secure, and Snort. The average cost for one license for the Dragon sensor software is \$8,097.00. Cisco Secure starts at \$8000.00. Snort is free. I choose to illustrate the cost of deploying five sensors on a network, to fully compare the differences in prices between these top network intrusion detection systems.

Type of Sensor	Cost
5 <b>Dragon</b> Sensors + Analyst	5 * (8097 + 4198) = \$73,770 + Analyst @ 63, 598 = <b>137,368</b>
5 <b>Cisco Secure</b> Sensors + Analyst	5 * (8000 + 4198) = 60, 990 + Analyst @ 63, 598 = <b>124,588</b>
5 <b>Snort</b> Sensors + Analyst	5 * (0 + 4198) = 20,990 + Analyst @ 63, 598 = <b>84,588</b>

We can clearly see that deploying multiple Snort Sensors across the corporate network can be both highly effective, and financially beneficial. The large amount of money saved, can be placed towards other network defense technologies such as firewalls.

Deploying any network intrusion detection system requires constant tuning. It is important to have a trained security analyst on staff to analyze not only the events generated by the NIDS, but to make security recommendations for securing the network and safeguarding the enterprises electronic data assets.

The time for deploying open source network intrusion detection in the enterprise has arrived. Whether choosing a plug-n-play Sourcefire appliance or piecing together an advanced Snort based system, the resources and software are available and enterprise ready. The obvious benefits of using open source NIDS include cost, flexibility, and rapid response to vulnerabilities and the release of attack signatures and rules for Snort. By deploying open source network intrusion detection tools, we take the initial necessary steps to defend and protect our network infrastructure.

## Assignment 2- Network Detects

**Trace #1 WEB-IIS ISAPI .ida attempt**

**Basic Information**

<i>Signature</i>	<i>SID</i>	<i>CID</i>	<i>TimeStamp</i>
WEB-IIS ISAPI .ida attempt	1 - (MY.NET.1.2)	155849	2001-09-20 00:29:27

**Port Information**

<i>IP Src</i>	<i>Src Port</i>	<i>Src Service</i>	<i>IP Dst</i>	<i>Dst Port</i>	<i>Dst Service</i>
64.50.116.114	2352	[NA]	MY.NET.1.8	80	http www www-http

**IP Information**

Ver	Hlen	TOS	Length	ID	Flags	Offset	Chksum	TTL
	4	5	1500	21834	[NA]	[NA]	13181	118

**TCP Information**

Seq	Ack	Urp	Res	Win	Flags	Offset	Chksum
2520096815	127255849	[NA]	[NA]	17520		16	5 45372

**Event Payload**

**Payload with Hex**

47 45 54 20 2F 64 65 66 61 75 6C 74 2E 69 64 61 GET/default.ida  
3F 58 58 58 58 58 58 58 58 58 58 58 58 58 58 58 ?XXXXXXXXXXXXXXXXXX  
58 58 58 58 58 58 58 58 58 58 58 58 58 58 58 58 XXXXXXXXXXXXXXXXXXXXX  
58 58 58 58 58 58 58 58 58 58 58 58 58 58 58 58 XXXXXXXXXXXXXXXXXXXXX  
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58 25 75 39 30 39 30 25 75 36 38 35 38 25 75 63 X%u9090%u6858%uc  
62 64 33 25 75 37 38 30 31 25 75 39 30 39 30 25 bd3%u7801%u9090%  
75 36 38 35 38 25 75 63 62 64 33 25 75 37 38 30 u6858%ucbd3%u780  
31 25 75 39 30 39 30 25 75 36 38 35 38 25 75 63 1%u9090%u6858%uc  
62 64 33 25 75 37 38 30 31 25 75 39 30 39 30 25 bd3%u7801%u9090%  
75 39 30 39 30 25 75 38 31 39 30 25 75 30 30 63 u9090%u8190%u00c  
33 25 75 30 30 30 33 25 75 38 62 30 30 25 75 35 3%u0003%u8b00%u5  
33 31 62 25 75 35 33 66 66 25 75 30 30 37 38 25 31b%u53ff%u0078%  
75 30 30 30 30 25 75 30 30 3D 61 20 20 48 54 54 u0000%u00=a HTT  
50 2F 31 2E 30 0D 0A 43 6F 6E 74 65 6E 74 2D 74 P/1.0..Content-t  
79 70 65 3A 20 74 65 78 74 2F 78 6D 6C 0A 43 6F ype: text/xml.Co  
6E 74 65 6E 74 2D 6C 65 6E 67 74 68 3A 20 33 33 ntent-length: 33  
37 39 20 0D 0A 0D 0A C8 C8 01 00 60 E8 03 00 00 79 .....` ....  
00 CC EB FE 64 67 FF 36 00 00 64 67 89 26 00 00 ....dg.6.dg.&..  
E8 DF 02 00 00 68 04 01 00 00 8D 85 5C FE FF FF .....h.....\...  
50 FF 55 9C 8D 85 5C FE FF FF 50 FF 55 98 8B 40 P.U...\..P.U..@  
10 8B 08 89 8D 58 FE FF FF FF 55 E4 3D 04 04 00 .....X...U.=...  
00 0F 94 C1 3D 04 08 00 00 0F 94 C5 0A CD 0F B6 ....=.....  
C9 89 8D 54 FE FF FF 8B 75 08 81 7E 30 9A 02 00 ...T...u..~0...  
00 0F 84 C4 00 00 00 C7 46 30 9A 02 00 00 E8 0A .....F0.....  
00 00 00 5F 5F 5F 5F 5F 5F 5F 5F 5F 00 8B 1C 24 ...\_\_\_\_\_...\$  
FF 55 D8 66 0B C0 0F 95 85 38 FE FF FF C7 85 50 .U.f....8....P  
FE FF FF 01 00 00 00 6A 00 8D 85 50 FE FF FF 50 .....j...P...P  
8D 85 38 FE FF FF 50 8B 45 08 FF 70 08 FF 90 84 ..8...P.E..p....  
00 00 00 80 BD 38 FE FF FF 01 74 68 53 FF 55 D4 .....8....thS.U.  
FF 55 EC 01 45 84 69 BD 54 FE FF FF 2C 01 00 00 .U..E.i.T...,...  
81 C7 2C 01 00 00 E8 D2 04 00 00 F7 D0 0F AF C7 ..,.....  
89 46 34 8D 45 88 50 6A 00 FF 75 08 E8 05 00 00 .F4.E.Pj..u.....  
00 E9 01 FF FF FF 6A 00 6A 00 FF 55 F0 50 FF 55 .....j..j..U.P.U  
D0 4F 75 D2 E8 3B 05 00 00 69 BD 54 FE FF FF 00 .Ou...;...i.T....  
5C 26 05 81 C7 00 5C 26 05 57 FF 55 E8 6A 00 6A \&....\&.W.U.j.j  
16 FF 55 8C 6A FF FF 55 E8 EB F9 8B 46 34 29 45 ..U.j..U....F4)E  
84 6A 64 FF 55 E8 8D 85 3C FE FF FF 50 FF 55 C0 .jd.U...<...P.U.  
0F B7 85 3C FE FF FF 3D D2 07 00 00 73 CF 0F B7 ...<...=....s...  
85 3E FE FF FF 83 F8 0A 73 C3 66 C7 85 70 FF FF .>.....s.f..p..  
FF 02 00 66 C7 85 72 FF FF FF 00 50 E8 64 04 00 ...f..r....P.d..  
00 89 9D 74 FF FF FF 6A 00 6A 01 6A 02 FF 55 B8 ...t...j..j..U.  
83 F8 FF 74 F2 89 45 80 6A 01 54 68 7E 66 04 80 ...t..E.j.Th~f..  
FF 75 80 FF 55 A4 59 6A 10 8D 85 70 FF FF FF 50 .u..U.Yj...p...P  
FF 75 80 FF 55 B0 BB 01 00 00 00 0B C0 74 4B 33 .u..U.....tK3  
DB FF 55 94 3D 33 27 00 00 75 3F C7 85 68 FF FF ..U.=3'.u?...h..  
FF 0A 00 00 00 C7 85 6C FF FF FF 00 00 00 00 C7 .....l.....  
85 60 FF FF FF 01 00 00 00 8B 45 80 89 85 64 FF `.....E...d..  
FF FF 8D 85 68 FF FF FF 50 6A 00 8D 85 60 FF FF ....h...Pj...`..  
FF 50 6A 00 6A 01 FF 55 A0 93 6A 00 54 68 7E 66 .Pj..U..j.Th~f  
04 80 FF 75 80 FF 55 A4 59 83 FB 01 75 31 E8 00 ...u..U.Y...u1..



```
.....F4.E.Pj..u.....j.j.U.P.U.Ou.;...i.T... \&... \&.W.U.j.j.U.j.U...F4)E.jd.U
..<...P.U...<...=...s...>.....s.f.p....f.r...P.d....t...j.j.U...t..E.j.Th~f...u..U.Yj...p...P.u.
U.....tK3..U.=3'..u?...h.....l.....`.....E...d....h...Pj...`...Pj.j.U..j.Th~f...u..U.Y...u1..
...X-
...j.h...P.u.U.=...u.j.j...\...P.u.U..u.U.....w.....xu.....`.....d$.dg...Xa..dg.6..dg.&
..f.;MZu..K<<.PE..u..T.x...B..<.KERNu..|.EL32u.3.I.r
...A.<.GetPu..|.rocAu..J.I...J$......J.....D$$dg...Xa..Q...|.E.....LoadLibraryA..u..U
..E.....CreateThread..u..U..E.....GetTickCount..u..U..E.....Sleep..u..U..E.....GetSyste
mDefaultLangID..u..U..E.....GetSystemDirectoryA..u..U..E.....CopyFileA..u..U..E.....
.GlobalFindAtomA..u..U..E.....GlobalAddAtomA
```

**End of trace**

**Source of Trace:**

**MY.NET.1.2** is a Snort Sensor located on my home network. My .NET is hybrid network composed of 4 RedHat 7.1 Linux machines, and 2 Windows 2000 Professional machines 1 NT-4.0, and 1 OpenBSD 2.9 machine. **MY.NET.1.2** is a Pentium 450 machine, with 386MB in memory, Running RedHat 7.1 Linux with a 2.4.2 kernel.

The Detect was seen by Michael Poor, using the Demarc, Version 1.04-02 front end for Snort.

**Detect was generated by:**

Snort Network Detection System v. 1.8.1-beta7 (Build 68), with a current, full rules set. The Detect was viewed using the Demarc, Version 1.04-02 front end for Snort. For ease of analysis, trace elements are labeled on every trace.

**Probability the source address was spoofed:**

It is not likely that the source address was spoofed, as the packet that triggered this event was part of an established TCP session. The attacker is expecting a response from this attack, as this attack would allow the attacker to gain full access to the compromised machine.





### The rule that tripped this alert was:

```
alert TCP $EXTERNAL any -> $INTERNAL 80 (msg: " WEB-IIS ISAPI .ida attempt"; dsize: >239; flags: A+; uricontent: ".ida?"; classtype: system-or-info-attempt; reference: arachnids,552;)
```

### Correlation:

This attack was first discovered by eEye Digital Security, and released on July 17, 2001. Microsoft released a patch the following day.

Examining our web logs, we can find that the same IP attempted this attack 3 separate times that day:

```
01:01:16 64.50.116.114 GET /default.ida 404
09:24:28 64.50.116.114 GET /default.ida 404
16:20:25 64.50.116.114 GET /default.ida 404
```

It is important to note that all requests returned a 404 error (which is File not Found).

We see here, in the logs for the same server, on the same day, three separate machines scanning for the same vulnerable service.

```
00:28:16 64.50.32.90 GET /default.ida 404
00:41:42 64.217.80.169 GET /default.ida 404
01:01:16 64.50.116.114 GET /default.ida 404
```

Note that the logs are in NT 4.0 format, which is as follows:

```
Time | Source IP | http command | http code
```

### Evidence of active targeting:

These attacks have been an ongoing threat since the discovery of the ISAPI buffer overflow. It is not likely that the source IP is focusing its attack on MY.NET. It is much more likely that this is part of a much larger attack/scan.

### Severity:

$$\text{Severity} = (5 + 5) - (5 + 2) = 3$$

The server in question (MY.NET.1.8) is an IIS-4.0 production webserver, so it is highly critical. The attack would allow the attacker to gain full access to the machine, so Lethality is also rated at 5. System Countermeasures had been taken as soon as the patch was released by Microsoft, resulting in a 5. As per Network Countermeasures, we block the IP's of repeat attackers, but do not have a content based packet filtering device that could drop all requests for .ida.

### Defensive Recommendation:

The principal defensive recommendations for this class of attack are:

- 1.If you don't need the service, disable it or remove it all together from the system.
- 2.If you need the service, patch the system immediately and reboot the machine for the patch install to be complete.
- 3.Test the patched system to insure that you are still not vulnerable to the attack.
- 4.If you have a content based packet filtering firewall, block all requests to .ida.

### Multiple choice question:

If you indeed need to run Microsoft's indexing service, what is the best way to defend the server from the ISAPI Buffer Overflow:

- A. Keep your Server in your DMZ
- B. Block port all incoming requests to 80
- C. Keep your server up to date with the latest security patches and service packs.
- D. Set up Snort with Active response to actively shoot down (snipe) sessions attempting to exploit the ISAPI Buffer overflow.

Answer C. Although D sounds like it might be a good idea, but since Snort does not block the initial packet, when

Snort fires the Reset packet, the attack has potentially already compromised the machine.

## Trace #2 Squid Scan

```
[**] [1:618:1] INFO - Possible Squid Scan [**]  
[Classification: Attempted Information Leak] [Priority: 2]  
11/03-12:51:05.947180 210.200.248.50:4031 -> MY.NET.1.16:3128  
TCP TTL:46 TOS:0x0 ID:62611 IpLen:20 DgmLen:60 DF  
*****S* Seq: 0x502CBEBE Ack: 0x0 Win: 0x4000 TcpLen: 40  
TCP Options (6) => MSS: 1460 NOP WS: 0 NOP NOP TS: 237797424 0
```

## End of Trace

### Source of Trace:

MY.NET.1.2 is a Snort Sensor located on my home network. My .NET is hybrid network composed of 4 RedHat 7.1 Linux machines, and 2 Windows 2000 Professional machines 1 NT-4.0, and 1 OpenBSD 2.9 machine. MY.NET.1.2 is a Pentium 450 machine, with 386MB in memory, Running RedHat 7.1 Linux with a 2.4.2 kernel.

The Detect was seen by Michael Poor, while parsing out alert data, using a simple grep/sort/uniq -c shell script.

### Detect was generated by:

Snort Network Detection System v. 1.8.2 with a current, full rules set. The Format for the Trace is as follows:

[Sensor ID:Signature ID:Rule Revision #	Snort Alert Message
<b>**] [1:618:1]</b>	<b>INFO - Possible Squid Scan [**]</b>

Snort Classification	Alert Priority
<b>[Classification: Attempted</b>	<b>[Priority: 2]</b>

Snort Classification	Alert Priority
<b>Information Leak]</b>	

Time Stamp	Source IP/Port	Destination IP/Port
<b>11/03-12:51:05.947180)</b>	<b>210.200.248.50:4031</b>	<b>MY.NET.1.16:3128</b>

Protocol	Time to live	Type of Service	ID #	Ip header length	Datagram Length	Dont Fragment Bit
<b>TCP</b>	<b>TTL: 46</b>	<b>TOS: 0x0</b>	<b>ID: 62611</b>	<b>IpLen: 20</b>	<b>DgmLen: 60</b>	<b>DF</b>

Flags	Sequence #	Ack #	Window Size	Length of tcp data
<b>*****S*</b>	<b>Seq: 0x502CBEBE</b>	<b>Ack: 0x0</b>	<b>Win: 0x4000</b>	<b>TcpLen: 40</b>

TCP Options
<b>TCP Options (6) =&gt; MSS: 1460 NOP WS: 0 NOP NOP TS: 237797424 0</b>

**Probability the source address was spoofed:**

The source address is probably not spoofed in this case, as this is a reconnaissance technique used to discover open Squid Proxies. The attacker is expecting a response to this technique. It is possible however that the attacker is bouncing this scan off of another open proxy. This technique is often used to cover the attackers tracks.

The rule that tripped the alert was:

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 3128 (msg:"INFO - Possible Squid Scan"; flags:S; classtype:attempted-recon; sid:618; rev:1;)
```

**Description of attack:**

The attacker is scanning for open proxies, to use at a later time. Presumably he is collecting the response data from these initial probes, so that he can, at a later time, use only the IP's with open or improperly configured

proxies.

#### Attack mechanism:

Squid is a web proxy for UNIX machines. In this case, the attacker attempts to initiate a TCP connection by sending a SYN to MY.NET.1.16 at port 3128, which is the default port for Squid Proxy. The attacker tried to connect to my block of 10 consecutive IP's, which leads me to believe that this was a wide scan.

An example would be the attacker sends a request to MY.NET.1.16.3128 "Get <http://www.cnn.com> HTTP/1.1", if he gets to cnn.com, the proxy is open and he can use it to forward web attacks.

#### Correlation:

The attacking IP in question scanned my entire address range. Below are some sample traces of the scan.

The following traces are in tcpdump format, which follow the following template:

**Time | Source IP/port | Destination IP/port | Flag Set | Sequence Number | (bytes in packet) | Window Size | < maximum segment size & tcp options) | Don't Fragment bit | (Time to live, ID #, length)**

Here are a few more example traces

```
12:53:30.795246 210.200.248.50.4019 > MY.NET.1.4.squid: S
1343888554:1343888554(0) win 16384 <mss 1460,nop,wscale
0,nop,nop,timestamp[|tcp]> (DF) (ttl 46, id 62599, len 60)
```

```
12:53:30.795246 210.200.248.50.4020 > MY.NET.1.5.squid: S
1343972832:1343972832(0) win 16384 <mss 1460,nop,wscale
0,nop,nop,timestamp[|tcp]> (DF) (ttl 46, id 62600, len 60)
```

```
12:53:30.805246 210.200.248.50.4022 > MY.NET.1.7.squid: S
1344187999:1344187999(0) win 16384 <mss 1460,nop,wscale
0,nop,nop,timestamp[|tcp]> (DF) (ttl 46, id 62602, len 60)
```

```
12:53:30.805246 210.200.248.50.4023 > MY.NET.1.8.squid: S
1344296506:1344296506(0) win 16384 <mss 1460,nop,wscale
0,nop,nop,timestamp[|tcp]> (DF) (ttl 46, id 62603, len 60)
```

```
12:53:30.815246 210.200.248.50.4024 > MY.NET.1.9.squid: S
1344422064:1344422064(0) win 16384 <mss 1460,nop,wscale
0,nop,nop,timestamp[|tcp]> (DF) (ttl 46, id 62604, len 60)
```

```
12:53:30.815246 210.200.248.50.4025 > MY.NET.1.10.squid: S
1344546754:1344546754(0) win 16384 <mss 1460,nop,wscale
0,nop,nop,timestamp[|tcp]> (DF) (ttl 46, id 62605, len 60)
```

```
12:53:30.845246 210.200.248.50.4031 > MY.NET.1.16.squid: S
1345109694:1345109694(0) win 16384 <mss 1460,nop,wscale
0,nop,nop,timestamp[|tcp]> (DF) (ttl 46, id 62611, len 60)
```

#### Evidence of active targeting:

This appears to be part of a larger Squid Proxy scan, as mentioned in the Correlation section (see above). Given the large amount of Scans that come out of Asia, and that this IP is registered to a Taiwanese business, it is most likely an attacker scanning a large amount of ip's for open Squid Proxies to use in future attacks.

```
inetnum          210.200.248.0 - 210.200.249.255
netname          YJI-HT-AP
descr            Yaw Jene International Co., Ltd.
country          TW
admin-c          JND, inverse
tech-c           LOL, inverse
mnt-by           MAINT-TW-APOL, inverse
changed          adm@ht.net.tw 20010503
source           APNIC
```

I ran a traceroute to attempt to guess at the operating system of the attacker. Given that the TTL is 46, and a traceroute to 210.200.248.50 took an unusually long 206 hops, I am guessing that the attacker's operating system is a Solaris box (see <http://www.incidents.org/detect/Zscan.php> for information on initial TTL values). This could also be someone using a script to modify the initial TTL values, but I find that unlikely.

## Severity:

As per the Severity of the attack, the following rationale was applied:

Criticality of the system: 5

Lethality of the attack: 1 (although this is misleading, as if my systems were used to attack other systems, this would certainly bring about major consequences.

System Countermeasures: 5 (I am not running a web proxy on the system).

Network Countermeasures: 5 (I do not allow incoming traffic to use my web proxy.)

$$(5 + 1) - (5 + 5) = -4$$

Severity = -4

Defensive Recommendation:

My main defensive recommendations are as follows:

Set up your Squid Proxy's ACL's to only accept connections from source IP's inside your network.

Example:

```
acl mynetwork src 192.168.1.0/24
```

```
http_access allow mynetwork
```

```
http_access deny !mynetwork
```

You could also block incoming access to port 3128, 1080, and 8080 from outside your network.

## Multiple choice question:

Which of the following ports is another example of of a web proxy:

- A. 9080
- B. 1080
- C. 10080

D. 808

Answer: B 1080 is the port for socks proxy server

### Trace #3 WEB-FRONTPAGE fourdots request

#### Basic Information

<i>Signature</i>	<i>SID</i>	<i>CID</i>	<i>TimeStamp</i>
WEB-FRONTPAGE fourdots request	1 - (MY.NET.1.2)	55835	2001-09-16 17:11:46

#### Port Information

<i>IP Src</i>	<i>Src Port</i>	<i>Src Service</i>	<i>IP Dst</i>	<i>Dst Port</i>	<i>Dst Service</i>
61.139.42.107	52573	[NA]	MY.NET.1.10	80	http www www-http

#### IP Information

Ver	Hlen	TOS	Length	ID	Flags	Offset	Chksum	TTL
4	5	[NA]	135	51207	[NA]	[NA]	39104	240

#### TCP Information

Seq	Ack	Urp	Res	Win	Flags	Offset	Chksum
4008287343	38447902	[NA]	[NA]	8760	24	5	28538

### Event Payload

#### Payload with Hex

```
47 45 54 20 2F 6D 73 61 64 63 2F 2E 2E 25 65 30  GET /msadc/..%e0
2E 2E 2F 2E 2E 66 2E 2E 2E 2E 2F 2E 2E 30 25 38  ../.f.../..0%8
2E 2E 2F 77 69 6E 6E 74 2F 73 79 73 74 65 6D 33  ../winnt/system3
32 2F 63 6D 64 2E 65 78 65 3F 2F 63 2B 64 69 72  2/cmd.exe?/c+dir
20 33 32 2F 63 6D 64 2E 65 78 65 3F 2F          32/cmd.exe?/
```



## Alt-255 Decoded Payload

**GET**

```
/msadc/..%e0../..f...../..0%8../winnt/system32/cmd.exe?/c+dir 32/cmd.exe?/
```

### Source of Trace:

MY.NET.1.2 is a Snort Sensor located on my home network. My .NET is hybrid network composed of 4 RedHat 7.1 Linux machines, and 2 Windows 2000 Professional machines 1 NT-4.0, and 1 OpenBSD 2.9 machine. MY.NET.1.2 is a Pentium 450 machine, with 386MB in memory, Running RedHat 7.1 Linux with a 2.4.2 kernel.

The Detect was seen by Michael Poor, using the Demarc, Version 1.04-02 front end for Snort.

### Detect was generated by:

Snort Network Detection System v. 1.8.1-beta7 (Build 68) with a current, full rules set with a current, full rules set. The Detect was viewed using the Demarc, Version 1.04-02 front end for Snort. For ease of analysis, trace elements are labeled on every trace.

### Probability the source address was spoofed:

There is very little probability that the source address for this attack is spoofed. The attack, most likely is part of an established TCP connection.

A whois at [www.arin.net](http://www.arin.net) quickly shows that the netblock is controlled by apnic (Asia Pacific Network Information Center).

A whois at [www.apnic.net](http://www.apnic.net) returned:

Search results for '61.139.42.107'

inetnum	61.139.0.0 - 61.139.127.255
netname	CHINANET-SC
descr	CHINANET Sichuan province network
descr	Data Communication Division

descr China Telecom  
country CN  
admin-c CH93-AP, inverse  
tech-c XS16-AP, inverse  
mnt-by MAINT-CHINANET, inverse  
mnt-lower MAINT-CHINANET-SC, inverse  
changed hostmaster@ns.chinanet.cn.net 20000601  
source APNIC

person Chinanet Hostmaster, inverse  
address A12,Xin-Jie-Kou-Wai Street  
country CN  
phone +86-10-62370437  
fax-no +86-10-62053995  
e-mail hostmaster@ns.chinanet.cn.net, inverse  
nic-hdl CH93-AP, inverse  
mnt-by MAINT-CHINANET, inverse  
changed hostmaster@ns.chinanet.cn.net 20000101  
source APNIC

person Xiaodong Shi, inverse  
address No.72,Wen Miao Qian Str.  
address Data Communication Bureau Of Sichuan  
Province  
address Chengdu  
address PR China  
country CN  
phone +86-28-6130055  
fax-no +86-28-6151287  
e-mail sxdong@mail.sc.cninfo.net, inverse  
nic-hdl XS16-AP, inverse  
mnt-by MAINT-CHINANET-SC, inverse  
changed sxdong@mail.sc.cninfo.net 19990811  
source APNIC

#### Description of attack:

The attacker uses the following Get request: **GET**  
**/msadc/..%e0../..f..../..0%8../winnt/system32/cmd.exe?/c+di**  
**r 32/cmd.exe?/**

to try and traverse the directories on the drive where the webcontent is located, to gain access to cmd.exe which is a

windows shell prompt

In the first place, the url appears to be mangled and malformed, as the usual request would look more like:

```
/. . ./. . ./. . ./.winnt/system32/cmd.exe?/c+dir
```

If the above url successfully exploited the vulnerability it would list the contents of the C: drive.

#### Attack mechanism:

This attack is just another version of the Directory Transversal attack, which exploits a flaw in Microsoft's Personal Webserver and Front Page Personal Webserver. In this attack, the attacker issues a GET request as follows

```
http://target/.../directory/filename.ext (from http://www.securityfocus.com/cgi-bin/vulns-item.pl?section=exploit&id=989 ).
```

An unpatched version of Microsoft's Front Page Personal Webserver or Personal Webserver will follow the request, giving the attacker unauthorized access to files and directories located on the same drive as the web content.

#### Correlation:

This attack is described well on Bugtraq (id 989), and on Whitehats.com (IDS 248). We had never observed this attack as shown, on our network before. We have however, observed thousands of directory transversal attempts before.

#### Evidence of active targeting:

MY.NET.1.10 is a NT 4.0 server, with Front Page extensions, and we did not see this attack being fired at any of our other UNIX servers, so I would consider this to be active targeting. Whether this attacker was trying something specifically on our machine, or if he had a list of front page enabled servers that he was trying to exploit, I don't

know.

#### Severity:

Criticality: 5  
Lethality: 2  
System Countermeasures: 5  
Network Countermeasures: 1

$$(5 + 2) - (5 + 1) = 1$$

Severity = 1

The system is a production webserver, so the Criticality of the system is set at 5. The Lethality of the attack is set at 2 as it is an information gathering attack. System Countermeasures is set at 5, as the NT Server is patched against the Directory Transversal attacks. Network Countermeasures is set at 1, as we have no Network Countermeasures in place to guard against this type of attack.

#### Defensive Recommendation:

My first Defensive Recommendation is to run Apache or other non Microsoft server. Even though this seems like a religious statement, we can see given the amount of vulnerabilities found in Microsoft's servers, that it would be in our own best interest to run a non-Microsoft server.

As per defending the Microsoft server from these attacks, the simplest way is to download and install the following patches:

**Personal Web Server:**

<http://support.microsoft.com/download/support/mslfiles/Pwssecup.exe>

**Front Page 98:**

<http://officeupdate.microsoft.com/downloadDetails/fppws98.htm>

**Front Page 97:**

Upgrade to PWS4.0, available at:  
[/http://www.microsoft.com/windows/ie/pws/default.htm](http://www.microsoft.com/windows/ie/pws/default.htm)  
Then apply the patch at

<http://support.microsoft.com/download/support/mslfiles/Pwssecup.exe>

Multiple choice question:

The following Server is not vulnerable to the directory transversal attack:

- A. Microsoft's Personal Web Server 3.0
- B. Microsoft's IIS-4.0 Service Pack 6 installed
- C. Microsoft's Front Page Personal WebServer
- D. Microsoft's IIS-5.0 Service Pack 2 installed.

Answer D. Microsoft's IIS-5.0, with Service Pack 2 installed, is not vulnerable to the directory transversal attack.

Trace #4 Virus - SnowWhite Trojan Incoming

Basic Information

<i>Signature</i>	<i>SID</i>	<i>CID</i>	<i>TimeStamp</i>
Virus - SnowWhite Trojan Incoming	1 - (192.168.1.2)	54460	2001-09-14 23:06:05

Port Information

<i>IP Src</i>	<i>Src Port</i>	<i>Src Service</i>	<i>IP Dst</i>	<i>Dst Port</i>	<i>Dst Service</i>
MY.NET.1.5	110	pop-3	64.50.191.175	58377	[NA]

IP Information

Ver	Hlen	TOS	Length	ID	Flags	Offset	Chksum	TTL
4	5	[NA]	1500	32221	[NA]	[NA]	46511	128

TCP Information

Seq	Ack	Urp	Res	Win	Flags	Offset	Chksum
34193342	2564181504	[NA]	[NA]	8692	24	5	21691

## Event Payload

### Payload with Hex

52 65 63 65 69 76 65 64 3A 20 62 79 20 63 6F 6D Received: by com  
70 75 67 65 6E 78 2E 63 6F 6D 20 28 20 49 41 20 pugenix.com ( IA  
4D 61 69 6C 20 53 65 72 76 65 72 20 56 65 72 73 Mail Server Vers  
69 6F 6E 3A 20 33 2E 32 2E 34 2E 20 42 75 69 6C ion: 3.2.4. Buil  
64 3A 20 31 30 39 36 20 29 20 29 20 3B 20 46 72 d: 1096 ) ); Fr  
69 2C 20 31 34 20 53 65 70 20 32 30 30 31 20 31 i, 14 Sep 2001 1  
32 3A 34 39 3A 31 36 20 2D 30 34 30 30 0D 0A 52 2:49:16 -0400..R  
65 63 65 69 76 65 64 3A 20 66 72 6F 6D 20 6D 69 eceived: from mi  
63 72 6F 20 28 64 36 70 31 33 2E 61 6D 63 68 61 cro (d6p13.amcha  
6D 2E 63 6F 6D 2E 62 72 20 5B 32 30 30 2E 31 39 m.com.br [200.19  
32 2E 31 36 36 2E 32 30 35 5D 29 0D 0A 09 62 79 2.166.205)]...by  
20 61 6D 68 6F 73 74 34 2E 61 6D 63 68 61 6D 2E amhost4.amcham.  
63 6F 6D 2E 62 72 20 28 38 2E 38 2E 36 2F 38 2E com.br (8.8.6/8.  
38 2E 36 29 20 77 69 74 68 20 53 4D 54 50 20 69 8.6) with SMTP i  
64 20 4E 41 41 32 38 35 31 37 0D 0A 09 66 6F 72 d NAA28517...for  
20 3C 61 6C 6C 40 63 6F 6D 70 75 67 65 6E 78 2E <all@compugenix.  
63 6F 6D 3E 3B 20 46 72 69 2C 20 31 34 20 53 65 com>; Fri, 14 Se  
70 20 32 30 30 31 20 31 33 3A 34 34 3A 32 30 20 p 2001 13:44:20  
2D 30 33 30 30 20 28 45 53 54 29 0D 0A 44 61 74 -0300 (EST)..Dat  
65 3A 20 46 72 69 2C 20 31 34 20 53 65 70 20 32 e: Fri, 14 Sep 2  
30 30 31 20 31 33 3A 34 34 3A 32 30 20 2D 30 33 001 13:44:20 -03  
30 30 20 28 45 53 54 29 0D 0A 4D 65 73 73 61 67 00 (EST)..Messag  
65 2D 49 64 3A 20 3C 32 30 30 31 30 39 31 34 31 e-Id: <200109141  
36 34 34 2E 4E 41 41 32 38 35 31 37 40 61 6D 68 644.NAA28517@amh  
6F 73 74 34 2E 61 6D 63 68 61 6D 2E 63 6F 6D 2E ost4.amcham.com.  
62 72 3E 0D 0A 46 72 6F 6D 3A 20 48 61 68 61 68 br>..From: Hahah  
61 20 3C 68 61 68 61 68 61 40 73 65 78 79 66 75 a <hahaha@sexyfu  
6E 2E 6E 65 74 3E 0D 0A 53 75 62 6A 65 63 74 3A n.net>..Subject:  
20 53 6E 6F 77 68 69 74 65 20 61 6E 64 20 74 68 Snowwhite and th  
65 20 53 65 76 65 6E 20 44 77 61 72 66 73 20 2D e Seven Dwarfs -  
20 54 68 65 20 52 45 41 4C 20 73 74 6F 72 79 21 The REAL story!  
0D 0A 4D 49 4D 45 2D 56 65 72 73 69 6F 6E 3A 20 ..MIME-Version:  
31 2E 30 0D 0A 43 6F 6E 74 65 6E 74 2D 54 79 70 1.0..Content-Typ  
65 3A 20 6D 75 6C 74 69 70 61 72 74 2F 6D 69 78 e: multipart/mix  
65 64 3B 20 62 6F 75 6E 64 61 72 79 3D 22 2D 2D ed; boundary="--  
56 45 45 56 4F 4C 41 4A 57 50 51 42 53 35 49 37 VEEVOLAJWPQBS5I7  
4F 35 41 4E 30 4C 36 52 57 39 4D 37 22 0D 0A 0D O5AN0L6RW9M7"....  
0A 2D 2D 2D 2D 56 45 45 56 4F 4C 41 4A 57 50 51 .---VEEVOLAJWPQ  
42 53 35 49 37 4F 35 41 4E 30 4C 36 52 57 39 4D BS5I7O5AN0L6RW9M



41 41 41 41 41 42 41 41 41 41 51 41 41 41 41 41 AAAAAABAAAAQAAAAA  
67 41 41 42 41 41 41 41 41 41 41 41 41 41 45 41 gAABAAAAAAAAAAAAEA  
41 41 41 41 41 41 41 41 41 43 41 41 41 41 41 41 AAAAAAAAAACAAAAAA  
67 41 41 41 41 41 41 41 41 49 41 41 41 41 41 41 gAAAAAAAAAIAAAAAA  
42 41 41 0D 0A 41 42 41 41 41 41 41 41 45 41 41 BAA..ABAAAAAAEAA  
41 45 41 41 41 41 41 41 41 41 42 41 41 41 41 41 AEAAAAAAAAABAAAAA  
41 41 41 41 AAAAA

### Alt-255 Decoded Payload

Received: by compugenx.com ( IA Mail Server Version: 3.2.4.  
Build: 1096 ) ) ; Fri, 14 Sep 2001 12:49:16 -  
0400..Received: from micro (d6p13.amcham.com.br  
[200.192.166.205])...by amhost4.amcham.com.br (8.8.6/8.8.6)  
with SMTP id NAA28517...for <all@compugenx.com>; Fri, 14  
Sep 2001 13:44:20 -0300 (EST)..Date: Fri, 14 Sep 2001  
13:44:20 -0300 (EST)..Message-Id:  
<200109141644.NAA28517@amhost4.amcham.com.br>..From: Hahaha  
<hahaha@sexyfun.net>..Subject: Snowwhite and the Seven  
Dwarfs - The REAL story!..MIME-Version: 1.0..Content-Type:  
multipart/mixed; boundary="--  
VEEVOLAJWPQBS5I7O5AN0L6RW9M7"....-----  
VEEVOLAJWPQBS5I7O5AN0L6RW9M7..Content-Type: text/plain;  
charset="us-ascii"....Today, Snowwhite was turning 18. The 7  
Dwarfs always where very educated and..polite with  
Snowwhite. When they go out work at mornign, they promised  
a ..\*huge\* surprise. Snowwhite was anxious. Suddlently, the  
door open, and the Seven..Dwarfs enter.....-----  
VEEVOLAJWPQBS5I7O5AN0L6RW9M7..Content-Type:  
application/octet-stream; name="midgets.scr"..Content-  
Transfer-Encoding: base64..Content-Disposition: attachment;  
filename="midgets.scr"....TVqQAAMAAAEAAAA//8AALgAAAAAAAAAAQ  
AA..AAAAGAAAALRMzS  
EAAA  
AAA..AAAAAAAAAAAAAAAAABQRQAATAECAAAAAAAAAAAAAAAAAAAOADwELAQ  
AAAFYAAAAAAAAAAAAABAA..AAAQAAAAAAAAABAAAAQAAAAAgAABAAAAAA  
AAAAEAAAAAAAAACAAAAAgAAAAAAAAAIAAAAAABAA..ABAAAAAEAAAEAAA  
AAAAABAAAAAAA

#### Source of Trace:

MY.NET.1.2 is a Snort Sensor located on my home network.  
My .NET is hybrid network composed of 4 RedHat 7.1 Linux  
machines, and 2 Windows 2000 Professional machines 1 NT-



4.0, and 1 OpenBSD 2.9 machine. MY.NET.1.2 is a Pentium 450 machine, with 386MB in memory, Running RedHat 7.1 Linux with a 2.4.2 kernel.

The Detect was seen by Michael Poor, using the Demarc, Version 1.04-02 front end for Snort.

#### Detect was generated by:

Snort Network Detection System v. 1.8.1-beta7 (Build 68) with a current, full rules set. The Detect was viewed using the Demarc, Version 1.04-02 front end for Snort. For ease of analysis, trace elements are labeled on every trace.

The rule that triggered this alert:  
alert tcp any 110 -> any any (msg:"Virus - SnowWhite Trojan Incoming"; content:"Suddlently"; sid:720; classtype:misc-activity; rev:3;)

#### Probability the source address was spoofed:

The source address for this email is most likely spoofed. This is not to say that the source IP in this case is spoofed, as MY.NET.1.5 is an email server. The email virus is send out with a reply address of [HAHAHA@sexyfun.net](mailto:HAHAHA@sexyfun.net). The infected host that actually send the email, on the other hand, was [200109141644.NAA28517@amhost4.amcham.com.br](mailto:200109141644.NAA28517@amhost4.amcham.com.br) (someone at the American chamber of commerce in Brazil).

#### Description of attack:

[200109141644.NAA28517@amhost4.amcham.com.br](mailto:200109141644.NAA28517@amhost4.amcham.com.br) has been infected by the W32.Hybris.gen worm. This worm is listening to the Internet connection, waiting for incoming and outgoing email addresses, which it then uses to spread to new hosts.

The above detect, shows the email message with the attached virus, as it traverses our email server to send itself to [all@compugenx.com](mailto:all@compugenx.com) (an email address used to communicate with all the partners in our company).

#### Attack mechanism:

This is a worm known as W32.Hybris.gen. It usually contains [hahaha@sexyfun.net](mailto:hahaha@sexyfun.net) or Snow White and the Seven dwarves in its message or subject. Once a host has been infected, the worm will sit monitoring the Internet connection for email addresses to which it can send itself to. It can then do any number of things to your computer, including install a rotating spiral on your desktop, and or, change local files on your hard drive.

#### Correlation:

Symantec Security Response has an interesting write up on the W32.Hybris.gen worm at:

<http://securityresponse.symantec.com/avcenter/venc/data/w95.hybris.gen.html>

We had never received the 'Snow White' worm before.

#### Evidence of active targeting:

This email worm was sent directly to our email address, so this is active targeting, albeit by a worm. I contacted the American Chamber of Commerce to let them know that at least one of their machines had been compromised, but never heard back from them.

#### Severity:

Criticality: 5

Lethality: 5

System Countermeasures: 5

Network Countermeasures: 2

$$(5 + 5) - (5 + 2) = 3$$

Severity = 3

Criticality is set at 5, as all of our machines are critical to our infrastructure. The lethality is set at 5, as worms have unpredictable payloads and have been known to

completely wipe out systems. At the very least, an infection of this type would knock a system and its operator offline for at the very least a day. The system countermeasures are set at 5, as Symantec's antivirus quarantined the attachment immediately. Network Countermeasures are set at 2 as Snort alerted us to the presence of the virus, so that we could alert the partners, in case it slipped passed their anti virus tools.

#### Defensive Recommendation:

The number one defensive recommendation is to have an effective antivirus in place with up to date virus definitions. One could also implement an email gateway antivirus tool such as is available from TrendMicro. The other option would be to strip all executable attachments.

#### Multiple choice question:

The rule that triggered this alert was:

```
alert tcp any 110 -> any any (msg:"Virus - SnowWhite Trojan Incoming"; content:"Suddlently"; sid:720; classtype:misc-activity; rev:3;)
```

The following rule could also have picked up on the same attack:

A. 

```
alert tcp any 110 -> any any (msg:"Virus - SnowWhite Trojan Incoming"; content:"Suddenly"; sid:720; classtype:misc-activity; rev:3;)
```

B. 

```
alert tcp any 110 -> any any (msg:"Virus - SnowWhite Trojan Incoming"; content:"hahaha@sexyfun.net"; sid:720; classtype:misc-activity; rev:3;)
```

C. 

```
alert tcp any 110 -> any any (msg:"Virus - SnowWhite Trojan Incoming"; content:"trojan"; sid:720; classtype:misc-activity; rev:3;)
```

D. 

```
alert tcp any 110 -> any any (msg:"Virus - SnowWhite Trojan Incoming"; content:"here comes a virus"; sid:720; classtype:misc-activity; rev:3;)
```

Answer: B. [hahaha@sexyfun.net](mailto:hahaha@sexyfun.net) appears to be the default reply address used in this attack.

### Trace #5 WEB-IIS cmd.exe access

#### Basic Information

<i>Signature</i>	<i>SID</i>	<i>CID</i>	<i>TimeStamp</i>
WEB-IIS cmd.exe access	1 - (MY.NET.1.2)	155986	2001-09-20 00:36:48

#### Port Information

<i>IP Src</i>	<i>Src Port</i>	<i>Src Service</i>	<i>IP Dst</i>	<i>Dst Port</i>	<i>Dst Service</i>
64.50.113.4	1602	[NA]	MY.NET.1.5	80	http www www-http

#### IP Information

Ver	Hlen	TOS	Length	ID	Flags	Offset	Chksum	TTL
4	5	[NA]	136	40166	[NA]	[NA]	63653	114

#### TCP Information

Seq	Ack	Urp	Res	Win	Flags	Offset	Chksum
2701721945	127385759	[NA]	[NA]	8760	24	5	25504

#### Event Payload

#### Payload with Hex

```
47 45 54 20 2F 73 63 72 69 70 74 73 2F 2E 2E 25 GET /scripts/..%
32 66 2E 2E 2F 77 69 6E 6E 74 2F 73 79 73 74 65 2f../winnt/syste
6D 33 32 2F 63 6D 64 2E 65 78 65 3F 2F 63 2B 64 m32/cmd.exe?/c+d
69 72 20 72 20 48 54 54 50 2F 31 2E 30 0D 0A 48 ir r HTTP/1.0..H
6F 73 74 3A 20 77 77 77 0D 0A 43 6F 6E 6E 6E 65 ost: www..Connne
63 74 69 6F 6E 3A 20 63 6C 6F 73 65 0D 0A ction: close..
```

### Alt-255 Decoded Payload

**GET /scripts/..%2f../winnt/system32/cmd.exe?/c+dir r HTTP/1.0..Host: www..Connection: close..**

#### Source of Trace:

MY.NET.1.2 is a Snort Sensor located on my home network. My .NET is hybrid network composed of 4 RedHat 7.1 Linux machines, and 2 Windows 2000 Professional machines 1 NT-4.0, and 1 OpenBSD 2.9 machine. MY.NET.1.2 is a Pentium 450 machine, with 386MB in memory, Running RedHat 7.1 Linux with a 2.4.2 kernel.

The Detect was seen by Michael Poor, using the Demarc, Version 1.04-02 front end for Snort.

#### Detect was generated by:

Snort Network Detection System v. 1.8.1-beta7 (Build 68) with a current, full rules set. The Detect was viewed using the Demarc, Version 1.04-02 front end for Snort. For ease of analysis, trace elements are labeled on every trace.

#### The rule that generated the alert was:

```
alert tcp $EXTERNAL_NET any -> $HTTP_SERVERS 80 (msg:"WEB-IIS cmd.exe access"; flags: A+; content:"cmd.exe"; nocase; classtype:web-application-attack; sid:1002; rev:2;)
```

#### Probability the source address was spoofed:

The probability that the source address is spoofed is very low as the attacker wishes to receive the information that he is requesting. In this case, the most likely thing is that the attacking machine is a compromised host that is attempting to compromise other hosts.

#### Description of attack:

This particular attack send the request: **GET /scripts/..%2f../winnt/system32/cmd.exe?/c+dir r HTTP/1.0** to attempt to traverse the directories into the winnt/system32 directory to then execute cmd (windows shell prompt) with the command dir to display the contents of the c directory.

The attacking IP address: 64.50.113.4 does not have a webserver running at this time. There is currently no domain name bound to this address. I have a feeling that this is just another machine that has been compromised by one of the many worms we have seen this year, and it is actively scanning the Internet for vulnerable machines.

NEXTLINK Communications (NETBLK-NXLK-BLK2) NXLK-BLK2  
64.50.0.0 - 64.50.127.255  
Diamond Flower Electric Instrument Co. (NETBLK-NXLK-BLK2-113-0) NXLK-BLK2-113-0  
64.50.113.0 -  
64.50.113.127

#### Attack mechanism:

The attack uses unicode characters to fool the operating system on the victim to allow the attacker to follow the url out of the directory containing webcontent, eventually leading into the directory containing cmd.exe (in this case winnt/system32, which is where you would find cmd.exe on NT and Win2K boxes). The %2f actually corresponds to "/", and is used here just to fool servers that had previously been patched against the normal directory transversal attack.

<http://target/scripts/..%2f../winnt/system32/cmd.exe>

#### Correlation:

Our small network sees approximately 10,000 of these attacks a week. It ends up giving our IDS a real work out, and gives me, our analyst, a bit of the boy who cried worm syndrome.

This is from our web logs (NT 4.0 log format, the time being off by a few milliseconds):

```
00:36:37 64.50.113.4
GET/scripts/..%2f../winnt/system32/cmd.exe 404
```

The format is as follows:

```
Time stamp | Source IP | HTTP command | http server code
```

Note that the server returned a 404 (file not found) in all of these cases, indicating that the attacker was unsuccessful.

Here are a few earlier attempts, showing the versatility of the unicode encoding:

```
00:19:34 64.50.113.4 GET
/scripts/..%5c../winnt/system32/cmd.exe 404
00:19:34 64.50.113.4 GET
/_vti_bin/..%5c../..%5c../..%5c../winnt/system32/cmd.exe
404
00:19:34 64.50.113.4 GET
/_mem_bin/..%5c../..%5c../..%5c../winnt/system32/cmd.exe
404
00:19:34 64.50.113.4 GET
/msadc/..%5c../..%5c../..%5c/..Á^\\../..Á^\\../..Á^\\../winnt/
system32/cmd.exe 404
00:19:35 64.50.113.4 GET
/scripts/..Á^\\../winnt/system32/cmd.exe 404
00:19:35 64.50.113.4 GET /scripts/winnt/system32/cmd.exe
404
00:19:35 64.50.113.4 GET /winnt/system32/cmd.exe 404
```

This rule:

```
alert tcp $EXTERNAL_NET any -> $HTTP_SERVERS 80 (msg:"WEB-
IIS cmd.exe access"; flags: A+; content:"cmd.exe"; nocase;
classtype:web-application-attack; sid:1002; rev:2;)
```

ends up catching tons of different attacks, as it is looking for the string cmd.exe. What you certainly do not want is a positive response back from this request i.e. .

#### Evidence of active targeting:

As per active targeting for this attack, I think this attack is part of a much greater number of Internet wide attacks, that use the directory transversal attack in its

many forms to execute code on remote systems.

#### Severity:

Criticality: 5  
Lethality: 5  
System Countermeasures: 5  
Network Countermeasures: 1

$$(5 + 5) - (5 + 1) = 4$$

Severity = 4

Criticality is set at 5 as this an NT 4.0 production server, and all of our systems are critical to our infrastructure. Lethality of the attack is rated at 5, as if successfully employed, it could give the attacker the information necessary to exploit the machine to gain full access to the system. System Countermeasures are rated at 5 as all known patches for unicode and directory transversal attacks are applied. Network Countermeasures are rated at 1, as we have no content filtering firewall in place to block all requests for cmd.exe. This is certainly something that I will be looking at as soon as I am done with this practical; as it seems that this simple and effective tool could stop a lot of noisy attacks.

#### Defensive Recommendation:

The following are the recommended defensive measures:

- 1.If you are running any form of Microsoft's servers, keep them up to date and seriously patched.
- 2.Change the location of your scripts file, as this will foil most of the attacks if find a new form of encoding that you are not protected against.
- 3.Use a content filtering firewall that will block any requests for cmd.exe.

#### Multiple choice question:

Which of the following http codes would we rather see, when one of our servers is issued the following request?

```
00:19:34 64.50.113.4 GET  
/msadc/...%5c../...%5c../...%5c/..Á^\.../..Á^\.../..Á^\.../winnt/
```



system32/cmd.exe

- A. 200
- B. 202
- C. 404
- D. 304

Answer: C. 404 is the File not Found, indicating that the attack was not successfully completed. A 200 is an 'OK' code from the server, indicating that the attack was successfully completed. A 304 code is 'Not Modified', and 202 is 'Accepted'.

### **Assignment 3- Analyze This Scenario**

#### **Security Audit and Analysis of UMBC Data**

**Analysis Table of Contents:**  
**Introduction to the Analysis**

**Explanations of the Top Ten Events**

WEB-MISC Attempt to execute cmd  
connect to 515 from inside  
IDS552/web-iis\_IIS ISAPI Overflow ida nosize  
ICMP Echo Request  
spp\_http\_decode: IIS Unicode attack detected  
MISC Large UDP Packet  
Watchlist 000220 IL-ISDNNET-990517  
INFO MSN IM Chat data  
ICMP Echo Request Nmap or HPING2  
WEB-MISC prefix-get //

**Top Ten Talkers in MY.NET**

**Top Source IP's**  
**Top Destination IP's**  
**Top Destination Ports + Explanation of Ports**  
**Top Out of Spec Source IP's**  
**Top Out of Spec Destination IP's**  
**Top Out of Spec Destination Ports**  
**Summary of Alerts**  
**5 Selected External Sources were chosen for further analysis**  
200.36.46.3  
211.167.93.115

212.179.58.19

64.219.131.70

66.33.117.144

## Description of the Analysis Process

### References

## Introduction to the Analysis

The analyst has been asked to analyze snort log data from a University. The analyst will provide a summary of alerts, top 10 talkers, scans, and out of spec alerts. The analyst will also try to provide indications of machines that may have been compromised.

The analyst will provide an analysis of the top events, and include in these suggestions for improving the defense of the Universities network.

**Time Span for all Events: 09.15.01- 09.27.01**

**Total Alerts: 1,723,982**

**Total Out of Spec: 24,526**

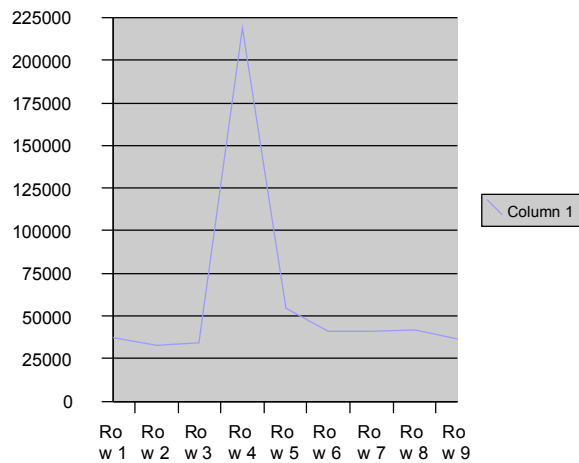
**Total Scans: 1,845,016**

### List of files that were used for Analysis

Alert Files	Scan Files	Out of Spec Files
alert.010915	scans.010915	oos_Aug.15.2001
alert.010916	scans.010916	oos_Aug.16.2001
alert.010917	scans.010917	oos_Aug.17.2001
alert.010918	scans.010918	oos_Aug.18.2001
alert.010919	scans.010919	oos_Aug.19.2001
alert.010920	scans.010920	oos_Aug.20.2001
alert.010921	scans.010921	oos_Aug.21.2001
alert.010922	scans.010922	oos_Aug.22.2001
alert.010923	scans.010923	oos_Aug.23.2001
alert.010924	scans.010924	oos_Aug.25.2000
alert.010925	scans.010925	oos_Aug.26.2000
alert.010926	scans.010926	oos_Aug.27.2000
alert.010927	scans.010927	

## Explanations of the Top Ten Events

## cmd.exe attacks over time



### Top Ten Events

Count	Address
538513	WEB-MISC Attempt to execute cmd
358508	connect to 515 from inside
225532	IDS552/web-iis_IIS ISAPI Overflow ida nosize
163524	ICMP Echo Request
149623	spp_http_decode: IIS Unicode attack detected
98452	MISC Large UDP Packet
27640	Watchlist 000220 IL-ISDNNET-990517
16779	INFO MSN IM Chat data
14928	ICMP Echo Request Nmap or HPING2
11843	WEB-MISC prefix-get //

### WEB-MISC Attempt to execute cmd

WEB-MISC Attempt to execute cmd is a rule that will fire when it recognizes the string cmd.exe in any form, present in an http request. cmd.exe is the windows command prompt (shell). This alert refers to a class of web vulnerabilities that affect Microsoft web servers.

In the first days of data, the WEB-MISC Attempt to execute cmd alerts were most likely part of Code Red I and II scanning activity. As of the 18<sup>th</sup>, NIMDA appears on the scene. NIMDA was a phenomenally virulent worm, that spread vertically across the internet.

Just on the 18<sup>th</sup> there were: 218,913 attempts to execute cmd. That accounts for just less than half of all the attempts to execute cmd for the analyzed period. See the chart below.

As we can see in the above chart that we have an enormous spike in cmd.exe attacks on the 18<sup>th</sup>, which is the 3<sup>rd</sup> day of observed traffic. This was the day that Nimda began its

propagation throughout the internet.

The top talkers for this event were:

<b>Count</b>	<b>Address</b>
<b>20707</b>	211.90.176.59
<b>6333</b>	195.46.229.103
<b>5662</b>	216.77.79.132
<b>4980</b>	211.90.88.43
<b>4783</b>	211.167.93.115
<b>4263</b>	200.221.112.202
<b>3380</b>	211.90.188.34
<b>3356</b>	216.107.79.23
<b>3241</b>	164.124.116.26
<b>3195</b>	192.46.4.152

A sample alert trace from the snort logs:

```
09/15-01:55:42.390721  [**] WEB-MISC Attempt to execute cmd
[**] 202.167.115.250:1229 -> MY.NET.246.84:80
09/15-01:55:50.067797  [**] WEB-MISC Attempt to execute cmd
[**] 195.226.230.36:40697 -> MY.NET.142.22:80
09/15-01:55:51.269009  [**] WEB-MISC Attempt to execute cmd
[**] 195.226.230.36:40697 -> MY.NET.142.22:80
09/15-01:55:53.505066  [**] WEB-MISC Attempt to execute cmd
[**] 210.183.67.48:3356 -> MY.NET.18.161:80
09/15-01:55:55.651923  [**] WEB-MISC Attempt to execute cmd
[**] 211.90.176.59:19500 -> MY.NET.202.201:80
09/15-01:55:57.578184  [**] WEB-MISC Attempt to execute cmd
[**] 66.108.64.223:3963 -> MY.NET.222.135:80
09/15-01:55:58.869644  [**] WEB-MISC Attempt to execute cmd
[**] 130.70.150.32:2831 -> MY.NET.84.198:80
09/15-01:56:00.292961  [**] WEB-MISC Attempt to execute cmd
[**] 200.161.65.101:3041 -> MY.NET.146.49:80
```

```
09/18-00:00:04.608731  [**] WEB-MISC Attempt to execute cmd
[**] 202.96.193.106:3066 -> MY.NET.105.198:80
09/18-00:00:05.774018  [**] WEB-MISC Attempt to execute cmd
[**] 164.124.116.26:3587 -> MY.NET.244.162:80
09/18-00:00:07.927810  [**] WEB-MISC Attempt to execute cmd
[**] 130.240.132.153:3015 -> MY.NET.82.109:80
09/18-00:00:08.174161  [**] WEB-MISC Attempt to execute cmd
[**] 211.90.176.59:64513 -> MY.NET.146.83:80
09/18-00:00:12.351172  [**] WEB-MISC Attempt to execute cmd
[**] 211.90.176.59:64513 -> MY.NET.146.83:80
09/18-00:00:13.461863  [**] WEB-MISC Attempt to execute cmd
```

```
[**] 200.176.36.147:31872 -> MY.NET.139.92:80
09/18-00:00:13.790762  [**] WEB-MISC Attempt to execute cmd
[**] 211.97.144.25:58695 -> MY.NET.184.151:80
```

### connect to 515 from inside

Port 515 is the printer spooler on most Unix flavors. There are numerous exploits against the LPR Service in Linux, BSD, and Unix. Dshield.org registered an enormous spike on September 16, registered by Dshield.org ([http://www1.dshield.org/port\\_report.php?port=515](http://www1.dshield.org/port_report.php?port=515))

LPRng has a potential vulnerability which may allow the execution of arbitrary code and possibly lead to root compromise from local and remote users. LPRng is vulnerable because of missing format strings in the syslog(3) function.

The majority of the alerts come from one attacker: **MY.NET.60.39**, who on September 21 Scanned for port 515 a total of : **41,339 times**. MY.NET.60.39 is definitely a box that I would investigate for possible compromisation.

Example trace:

```
09/21-21:47:50.957639  [**] connect to 515 from inside [**]
MY.NET.60.39:3013 -> 216.216.141.128:515

09/21-21:47:50.957691  [**] connect to 515 from inside [**]
MY.NET.60.39:3020 -> 216.216.141.135:515

09/21-21:47:50.957764  [**] connect to 515 from inside [**]
MY.NET.60.39:3028 -> 216.216.141.143:515

09/21-21:47:50.957818  [**] connect to 515 from inside [**]
MY.NET.60.39:3034 -> 216.216.141.149:515

09/21-21:47:50.957871  [**] connect to 515 from inside [**]
MY.NET.60.39:3043 -> 216.216.141.158:515

09/21-21:47:50.957923  [**] connect to 515 from inside [**]
MY.NET.60.39:3052 -> 216.216.141.167:515

09/21-21:47:50.957975  [**] connect to 515 from inside [**]
```

MY.NET.60.39:3061 -> 216.216.141.176:515

09/21-21:47:50.958026 [\*\*] connect to 515 from inside [\*\*]  
MY.NET.60.39:3068 -> 216.216.141.183:515

09/21-21:47:50.977872 [\*\*] connect to 515 from inside [\*\*]  
MY.NET.60.39:3204 -> 216.216.142.64:515

### **IDS552/web-iis\_IIS ISAPI Overflow ida**

Microsoft's IIS Indexing Server is vulnerable to a buffer overflow. The attacker attempts to overflow the Indexing Server's buffer in order to execute arbitrary code on the Server, possibly attaining Administrator privilege on the machine. This attack specific to Microsoft's IIS Webservers.

The rule that most likely tripped this alert was:  
alert TCP \$EXTERNAL any -> \$INTERNAL 80 (msg:  
"IDS552/web-iis\_IIS ISAPI Overflow ida"; dsize: >239;  
flags: A+; content: ".ida?";)

An example alert trace from the data:

09/16-00:00:22.228215 [\*\*] IDS552/web-iis\_IIS ISAPI  
Overflow ida nosize [\*\*] 192.105.49.21:2455 ->  
MY.NET.9.104:80

09/16-00:00:23.324461 [\*\*] IDS552/web-iis\_IIS ISAPI  
Overflow ida nosize [\*\*] 217.83.172.226:3661 ->  
MY.NET.236.103:80

09/16-00:00:23.530802 [\*\*] IDS552/web-iis\_IIS ISAPI  
Overflow ida nosize [\*\*] 61.74.176.24:2165 ->  
MY.NET.86.187:80

### **ICMP Echo Request speedera**

ICMP Echo Request is part of the lightweight Protocol ICMP. These tools were initially designed for network troubleshooting. More specifically, ICMP Echo Request (Type 8, Code 0) is part of Ping, a program written by Mike Muus, used to test whether a host is reachable. ICMP Echo Request can be used for network reconnaissance seen in Ofir Arkin's paper ICMP Usage in Scanning (found at:

<http://www.sys-security.com/archive/papers/ICMP Scanning v3.0.pdf>

).

ICMP Echo Request speedera alerts get triggered by the following rule:

```
alert ICMP any any -> any any (msg:"PING speedera";
content: "|3839 3a3b 3c3d
3e3f|"; depth: 100; itype: 8; )
```

The source of these ping floods may at first glance be linked Speedera.net's "Global Traffic Management" system as pointed to by Joe Stewart (<http://www.sans.org/y2k/121100-1200.htm>), but i think that if it is so, then the two MY.NET machines are using an automated tool to flood their victims with pings.

Example alert trace:

```
09/18-00:38:21.717392  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:21.927225  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:22.067183  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:22.282271  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:22.527122  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:22.982118  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:23.216968  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:23.806999  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:23.821969  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:24.001759  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:24.116911  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:24.156897  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:24.921641  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:25.041733  [**] ICMP Echo Request speedera [**]
```

```
MY.NET.205.234 -> 172.143.129.222
09/18-00:38:25.361845  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 172.143.129.222
```

The decision on whether to silence ICMP on the network must be taken seriously. While attackers can gain valuable information about the network through the use of ICMP, System Administrators are reluctant to give up the troubleshooting properties of ICMP.

My recommendation is that ICMP messages should be blocked at the border from entering or leaving the Universities network. This would still allow for internal troubleshooting, while restricting remote ICMP-based probes.

The interesting thing about the data for this alert is that there were only two talkers for this alert:

Count	Address
158656	MY.NET.205.234
4868	MY.NET.212.86

These are both machines that I would check for possible compromise, or misconduct by the individuals who operate these machines, especially **MY.NET.205.234**, as it was responsible for the vast majority of the scans. The scans were mainly going to outside the network, to these three hosts:

Count	Address
119384	64.219.131.70
37623	66.33.117.144

The first host, **64.219.131.70**, is a dsl line (adsl-64-219-131-70.dsl.kscymo.sw bell.net.), with no apparent live web server.

The second host, **66.33.117.144**, (144.117.33.66.in-addr.arpa. domain name pointer voyweiser.net), is running a web server. The site calls itself voyweiser, which appears to be a former hacker tools or warez site, but as of the writing of this analysis only its entrance page remains.

#### **spp\_http\_decode: IIS Unicode attack detected**

This alert is generated by snort's pre-processor http\_decode. This decoder was written to catch Unicode and other attacks directed at the the way Microsofts Internet



Information Servers (IIS) translate Unicode characters in http requests. All unpatched versions of IIS 4.0 and 5.0 are affected by this vulnerability

Remote attackers can use the Unicode character set to send crafted URL's to vulnerable IIS web servers, which could enable them to list directory contents, view and delete files, and execute arbitrary code.

Example alert traces from the spp\_http\_decode:

```
09/18-10:05:49.141850  [**] spp_http_decode: IIS Unicode
attack detected [**] 211.228.165.34:3409 ->
MY.NET.208.10:80
09/18-10:05:50.026586  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.91.75.71:1597 -> MY.NET.110.11:80
09/18-10:05:50.026586  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.91.75.71:1597 -> MY.NET.110.11:80
09/18-10:05:50.026586  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.91.75.71:1597 -> MY.NET.110.11:80
09/18-10:05:50.424485  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.34.98.45:4304 -> MY.NET.106.21:80
09/18-10:05:50.602852  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.219.216.50:1140 ->
MY.NET.214.169:80
09/18-10:05:50.679877  [**] spp_http_decode: IIS Unicode
attack detected [**] 209.123.95.97:3515 -> MY.NET.85.212:80
09/18-10:05:50.959492  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.199.4.11:2818 -> MY.NET.202.32:80
09/18-10:05:50.959492  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.199.4.11:2818 -> MY.NET.202.32:80
09/18-10:05:50.959492  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.199.4.11:2818 -> MY.NET.202.32:80
09/18-10:05:51.045968  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.91.117.129:2214 ->
MY.NET.226.49:80
09/18-10:05:51.045968  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.91.117.129:2214 ->
MY.NET.226.49:80
09/18-10:05:51.045968  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.91.117.129:2214 ->
MY.NET.226.49:80
09/18-10:05:51.759923  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.102.131.9:4549 -> MY.NET.228.5:80
09/18-10:05:52.490126  [**] spp_http_decode: IIS Unicode
attack detected [**] 130.191.41.53:3386 -> MY.NET.205.42:80
09/18-10:05:52.490126  [**] spp_http_decode: IIS Unicode
```

attack detected [\*\*] 130.191.41.53:3386 -> MY.NET.205.42:80  
09/18-10:05:52.490126 [\*\*] spp\_http\_decode: IIS Unicode  
attack detected [\*\*] 130.191.41.53:3386 -> MY.NET.205.42:80

**The principle attackers for this alert were:**

**Count Address**

**2436** 211.167.93.115  
**2172** 200.221.112.202

The both of these attackers IP addresses are coming out of the Asia Pacific Network (APNIC).

Asia Pacific Network Information Center (NETBLK-APNIC-CIDR-BLK)

These addresses have been further assigned to Asia-Pacific users.

Contact info can be found in the APNIC database, at WHOIS.APNIC.NET or <http://www.apnic.net/>  
Please do not send spam complaints to APNIC.  
AU

Netname: APNIC-CIDR-BLK2  
Netblock: 210.0.0.0 - 211.255.255.255

Coordinator:  
Administrator, System (SA90-ARIN) [No mailbox]  
+61-7-3367-0490

Domain System inverse mapping provided by:

NS.APNIC.NET	203.37.255.97
SVC00.APNIC.NET	202.12.28.131
NS.TELSTRA.NET	203.50.0.137
NS.RIPE.NET	193.0.0.193

Regional Internet Registry for the Asia-Pacific Region.

\*\*\* Use whois -h [whois.apnic.net](http://whois.apnic.net)

A whois search on 211.167.93.115 at [www.apnic.net](http://www.apnic.net) gives us the information on the network:

```
Search results for '211.167.93.115' inetnum
211.167.93.112 - 211.167.93.127
netname          ZHONGQINGZAIXIAN
descr           China youth on line
descr           ICP
```

```
descr          BeiJing
country        CN
admin-c        LL212-AP, inverse
tech-c         LL212-AP, inverse
mnt-by         MAINT-CNNIC-AP, inverse
changed        llz@srit.com.cn 20010921
source         APNIC
```

```
person         lizhang li, inverse
address        No.225 Chaonei Street Dongcheng
District Beijing China
country        CN
phone          +86-10-65230603
fax-no         +86-10-65276366
e-mail         llz@srit.com.cn, inverse
nic-hdl        LL212-AP, inverse
mnt-by         MAINT-CNNIC-AP, inverse
changed        llz@srit.com.cn 20010103
source         APNIC
```

The second major attacker 200.221.112.202, turns up no results at [www.apnic.net](http://www.apnic.net), indicating that the IP does not have a registered domain name through APNIC. This is possibly an IP assigned to an ISP for dialup or highspeed access.

### **MISC Large UDP Packet**

The Snort rule that triggered the alert from the misc.rules file:

```
alert udp $EXTERNAL_NET any -> $HOME_NET any
(msg:"MISC Large UDP Packet"; dsize: >4000;
reference:arachnids,247; classtype:bad-unknown;
sid:521; rev:1;)
```

The most unusual portion of these alerts is that the vast majority of attacks, 77977 to be exact, are directed at port 0. Port 0 sometimes is picked up during ICMP traffic, as it is not directed at ports. This is different, as it carries a large UDP packet payload.

This appears to be an automated attack. Stacheldraht has an option for sending large UDP packets, as do many other attack tools.

**The top 5 source hosts for this alert:**

Count	Address
16575	61.134.9.88
16534	209.190.237.123
13760	61.153.17.244
8419	61.153.17.188
7884	61.150.5.19

**The top 5 destination hosts for this alert:**

Count	Address
25428	MY.NET.111.221
16534	MY.NET.70.134
8076	MY.NET.111.142
6740	MY.NET.153.193
3937	MY.NET.153.149

**The top 5 destination ports for this alert:**

Count	Address
77977	0
609	3298
604	4921
377	4525
312	1171

One of the main interesting points here is that the principle port these UDP packets were sent to is Port 0.

**Watchlist 000220 IL-ISDNNET-990517**

Many institutions create Watchlists. As seen in Chris Bakers GCIA paper (located at: [http://www.sans.org/y2k/practical/Chris Baker GCIA.zip](http://www.sans.org/y2k/practical/Chris%20Baker%20GCIA.zip)), and in our data, that the IP's belonging to ISDN.NET.IL initiate an enormous amounts of attacks into MY.NET. This netblock belongs to an Israeli ISP.

The primary source IP's for this alert are:

Count	Address
14572	212.179.58.194
2921	212.179.29.218
2600	212.179.67.34
1238	212.179.18.3
947	212.179.83.35

The primary talker for this alert is: 212.179.58.19. Picturevision is not currently running a webserver bound to that IP address.

By running a whois query at [www.arin.net](http://www.arin.net), I was pointed to RIPE, the European and Middle eastern Registry for Internet Numbers. A whois query at [www.ripe.net](http://www.ripe.net) resulted in the following information:

% This is the RIPE Whois server.  
% The objects are in RPSL format.  
% Please visit <http://www.ripe.net/rpsl> for more information.  
% Rights restricted by copyright.  
% See <http://www.ripe.net/ripencc/pub-services/db/copyright.html>

inetnum: 212.179.58.0 - 212.179.58.255  
netname: NV-PICTUREVISION  
descr: network  
country: IL  
admin-c: NP469-RIPE  
tech-c: NP469-RIPE  
status: ASSIGNED PA  
notify: hostmaster@isdn.net.il  
mnt-by: RIPE-NCC-NONE-MNT  
changed: hostmaster@isdn.net.il 20000229  
source: RIPE

route: 212.179.0.0/17  
descr: ISDN Net Ltd.  
origin: AS8551  
notify: hostmaster@isdn.net.il  
mnt-by: AS8551-MNT  
changed: hostmaster@isdn.net.il 19990610  
source: RIPE

person: Nati Pinko  
address: Bezeq International  
address: 40 Hashacham St.  
address: Petach Tikvah Israel  
phone: +972 3 9257761  
e-mail: hostmaster@isdn.net.il  
nic-hdl: NP469-RIPE  
changed: registrar@ns.il 19990902  
source: RIPE

The top destination IP's for this alert:

Count	Address
14476	MY.NET.218.74
2558	MY.NET.202.142
1573	MY.NET.97.207
1346	MY.NET.97.160
1238	MY.NET.209.242

I would especially be interested in examining: MY.NET.218.74 as a possible warez or music server, or even the possibility that it might be a compromised machine serving up warez and music files. The most likely scenario is that this is a student that is sharing files over the gnutella protocol(see below).

The top destination ports for this alert were:

Count	Address
17929	6346
4526	1214
778	4671
675	3381
521	2797

By examining the destination ports against Neohapsis' Port list, looking for trojan or other troublesome ports, yields somethings of interest. Port 6346 is a gnutella-svc port. Gnutella is a peer to peer file sharing service similar to napster, though without a centralized server. Port 1214 is KAZAA, another popular file sharing peer to peer network. One of the principle clients is Morpheus.

A source trace for this alert:

```
09/23-07:02:53.814099  [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:02:54.168616  [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:02:57.324264  [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:02:58.741845  [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:02:59.196141  [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:02:59.641468  [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:02:59.915958  [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:03:00.474533  [**] Watchlist 000220 IL-ISDNNET-
```

```
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:03:00.674602 [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
09/23-07:03:06.743348 [**] Watchlist 000220 IL-ISDNNET-
990517 [**] 212.179.58.194:2013 -> MY.NET.218.74:6346
```

### **INFO MSN IM Chat data**

This is an alert that is turned on to catch MSN instant messenger traffic. As our client is a University, it is most likely that Instant Messenger is viable traffic.

It is my recommendation that the University check its acceptable use policy, and if it finds that it allows Instant Messenger communications, then the INFO MSN IM Chat rule should be turned off. The Snort rule that applies is from the policy.rules file (see following rule).

```
alert tcp $HOME_NET any -> $EXTERNAL_NET 1863
(msg:"INFO MSN IM Chat data";flags:A+;
content:"|746578742F706C61696E|";depth:100;
classtype:not-suspicious;sid:540;rev:1;)
```

If the University wishes to block MSN IM, they should block any traffic to any external host on port 1863. This could be accomplished using a access control list rule (this is Cisco's format):

```
access-list 1863 deny ip any any log
```

### **ICMP Echo Request Nmap or HPING2**

Both Nmap and HPING2 are tools that can be used for reconnaissance, mapping and packet crafting. Both of these tools are free, widely available and have legitimate uses (Nmap more than HPING2). My recommendation is that the University examines the actual packet payload for these events, as well as correlating these events to other attacks.

#### **The top talkers for this event:**

```
8891 MY.NET.226.18
2231 MY.NET.218.174
1760 MY.NET.204.150
292 MY.NET.212.230
94 MY.NET.98.125
```

I would certainly recommend that the following machines be analyzed for the possibility that these hosts are compromised:

```
8891 MY.NET.226.18
2231 MY.NET.218.174
```

Sample Alert traces for this event:

```
09/15-00:20:29.848386  [**] ICMP Echo Request Nmap or
HPING2 [**] MY.NET.226.18 -> 206.79.171.51
09/15-00:20:56.347605  [**] ICMP Echo Request Nmap or
HPING2 [**] MY.NET.226.18 -> 206.79.171.51
09/15-00:21:22.346872  [**] ICMP Echo Request Nmap or
HPING2 [**] MY.NET.226.18 -> 206.79.171.51
09/15-00:22:44.859459  [**] ICMP Echo Request Nmap or
HPING2 [**] MY.NET.226.18 -> 204.152.190.70
09/15-00:24:03.360476  [**] ICMP Echo Request Nmap or
HPING2 [**] MY.NET.226.18 -> 204.71.200.75
09/15-00:25:00.871113  [**] ICMP Echo Request Nmap or
HPING2 [**] MY.NET.226.18 -> 204.152.190.70
```

#### **WEB-MISC prefix-get //**

This is part of an attack against webservers, in particular to Microsofts IIS webservers that are vulnerable to the directory transversal attack. By exploiting this vulnerability, an attacker can view directory contents, access and delete files, and as a result even execute arbitrary code on the server.

The snort rule, from the web-misc.rules file, that triggered this alert is:

```
web-misc.rules:alert tcp $EXTERNAL_NET any -> $HTTP_SERVERS
80 (msg:"WEB-MISC prefix-get //"; flags: A+; content:"get
//"; nocase; classtype:attempted-recon; sid:1114; rev:1;)
```

The top five source IP's for this event were:

<b>Count</b>	<b>Address</b>
61	204.126.132.27
57	208.199.82.216
55	207.87.58.194
52	64.26.98.90
44	24.4.252.28



None of these individual addresses individually contribute to the majority of events.

**The destination IP's are:**

<b>Count</b>	<b>Address</b>
11770	MY.NET.253.114
57	MY.NET.253.115
15	MY.NET.99.85
1	MY.NET.179.77

I would definitely recommend examining MY.NET.253.114 as a possibly compromised machine. Principally since the vast majority of alerts were pointed directly at this machine. An example of this machine being targeted follows:

```
09/15-19:47:48.699587  [**] WEB-MISC prefix-get // [**]
131.158.7.137:1793 -> MY.NET.253.114:80
09/15-19:47:49.604353  [**] WEB-MISC prefix-get // [**]
65.9.210.137:1575 -> MY.NET.253.114:80
09/15-19:48:00.838751  [**] WEB-MISC prefix-get // [**]
131.158.7.137:1809 -> MY.NET.253.114:80
09/15-19:51:02.208926  [**] WEB-MISC prefix-get // [**]
64.12.96.139:20815 -> MY.NET.253.114:80
09/15-19:52:09.199554  [**] WEB-MISC prefix-get // [**]
64.12.96.138:27083 -> MY.NET.253.114:80
09/15-19:52:38.105769  [**] WEB-MISC prefix-get // [**]
131.158.7.136:1896 -> MY.NET.253.114:80
09/15-19:52:40.970983  [**] WEB-MISC prefix-get // [**]
129.110.44.166:1535 -> MY.NET.253.114:80
09/15-19:54:35.591185  [**] WEB-MISC prefix-get // [**]
64.12.96.136:1608 -> MY.NET.253.114:80
```

**Top Ten Talkers in MY.NET**

<b>Count</b>	<b>Address</b>
<b>317168</b>	MY.NET.60.38
<b>158659</b>	MY.NET.205.234
<b>41384</b>	MY.NET.60.39
<b>10515</b>	MY.NET.14.1
<b>8891</b>	MY.NET.226.18
<b>4878</b>	MY.NET.212.86
<b>4345</b>	MY.NET.30.2
<b>2235</b>	MY.NET.218.174

```
1760 MY.NET.204.150
1248 MY.NET.253.53
```

I would recommend that all of these machines be examined for the possibility that they are compromised, while paying very close attention to the top two MY.NET.60.38, and MY.NET.205.234.

#### Top Source IP's

```
Count Address
23498 200.36.46.3
 316 128.46.156.155
 65 24.3.16.121
 53 62.41.32.27
 23 216.9.192.65
 18 198.110.76.242
 17 208.178.176.216
 14 24.28.134.6
 13 212.175.67.246
 13 200.48.82.21
```

#### Top Destination IP's

```
Count Address
119384 64.219.131.70
37623 66.33.117.144
25457 MY.NET.111.221
16565 MY.NET.70.134
14511 MY.NET.218.74
11825 MY.NET.253.114
 9009 MY.NET.140.9
 8136 MY.NET.111.142
 6782 MY.NET.153.193
 6064 MY.NET.100.165
```

#### Top Destination Ports + Explanation of Ports

```
Count Port/Explanation
932920 80
      80 tcp AckCmd [trojan] AckCmd
      80 tcp http World Wide Web HTTP
      80 tcp www World Wide Web HTTP
      80 udp http World Wide Web HTTP
      80 udp www World Wide Web HTTP

358562 515
```

```

        515 tcp printer spooler
        515 udp printer spooler
18412 6346
        6346 tcp gnutella-svc gnutella-svc
        6346 udp gnutella-svc gnutella-svc
11968 1863
        1863 tcp msnp MSN Messenger Protocol
        1863 udp msnp MSN Messenger Protocol
9604 53
        53 tcp domain Domain Name Server
        53 udp domain Domain Name Server
9120 137
        137 tcp netbios-ns NETBIOS Name Service
        137udp netbios-ns NETBIOS Name Service
5035 1214
        1214 tcp kazaa KAZAA 1
        1214 udp kazaa KAZAA

3038 8888
        8888 tcp ddi-tcp-1 NewsEDGE server TCP (TCP 1)
        8888 tcp Sun Answerbook HTTP server
        8888 udp ddi-udp-1 NewsEDGE server UDP (UDP 1)
2678 69
        69 tcp tftp Trivial File Transfer
        69 udp tftp Trivial File Transfer
2151 21
        21 tcp BackConstruction [trojan] Back
Construction
        21 tcp ftp File Transfer [Control]
        21 udp ftp File Transfer [Control]

```

The list of top Destination ports yields information of interest. First of all, the top attacked port, port 80, is mainly used for web servers.

The first thing to examine is the Universities policy towards hosting websites from local addresses. If the policy allows this, then I would recommend, if policy allows, scanning those hosts for known web server vulnerabilities. Then, the University IT department could issue reports on how to secure internal web servers.

If the Universities policy denies the right to serve websites from MY.NET, then a access control list rule can be added to block all requests inbound to MY.NET for port 80.

### Top Out of Spec Source IP's

Count	Address
23498	200.36.46.3
316	128.46.156.155
65	24.3.16.121
53	62.41.32.27
23	216.9.192.65
18	198.110.76.242
17	208.178.176.216
14	24.28.134.6
13	212.175.67.246
13	200.48.82.21

### Top Out of Spec Destination IP's

Count	Address
317	MY.NET.99.85
89	MY.NET.6.7
78	MY.NET.100.165
60	MY.NET.145.9
37	MY.NET.253.125
36	MY.NET.69.225
19	MY.NET.181.144
15	MY.NET.60.14
14	MY.NET.85.97
14	MY.NET.218.50

### Top Out of Spec Destination Ports

Count	Port/Explanation
23515	21
	21 tcp BackConstruction [trojan] Back Construction
	21 tcp ftp File Transfer [Control]
	21 udp ftp File Transfer [Control]
549	80
	80 tcp AckCmd [trojan] AckCmd
	80 tcp http World Wide Web HTTP
	80 tcp www World Wide Web HTTP
	80 udp http World Wide Web HTTP
	80 udp www World Wide Web HTTP
102	6346
	6346 tcp gnutella-svc gnutella-svc
	6346 udp gnutella-svc gnutella-svc
60	11
	11 tcp systat Active Users

```

11 udp sysstat Active Users
42 121
121 tcp JammerKillah [trojan] JammerKillah
121 tcp erpc Encore Expedited Remote Pro.Call
121 udp erpc Encore Expedited Remote Pro.Call
19 25
25 tcp MBTMailBombingTrojan [trojan] MBT (Mail
Bombing Trojan)
25 tcp smtp Simple Mail Transfer
25 udp smtp Simple Mail Transfer
15 40 ?
10 6347
6347 tcp gnutella-rtr gnutella-rtr
6347 udp gnutella-trt gnutella-rtr
9 21536 ?
8 113 6347 tcp gnutella-rtr gnutella-rtr
6347 udp gnutella-trt gnutella-rtr

```

### Summary of Alerts

Count	Alert Message
538513	WEB-MISC Attempt to execute cmd
358508	connect to 515 from inside
225532	IDS552/web-iis_IIS ISAPI Overflow ida nosize
163524	ICMP Echo Request speedera
149623	spp_http_decode: IIS Unicode attack detected
98452	MISC Large UDP Packet
27640	Watchlist 000220 IL-ISDNNET-990517
16779	INFO MSN IM Chat data
14928	ICMP Echo Request Nmap or HPING2
11843	WEB-MISC prefix-get //
11441	ICMP Destination Unreachable (Communication Administratively Prohibited)
9430	MISC source port 53 to <1024
8270	MISC traceroute
5806	CS WEBSERVER - external web traffic
5660	SMB Name Wildcard
4506	INFO Napster Client Data
4348	ICMP Destination Unreachable (Network Unreachable)
4222	TFTP - Internal TCP connection to external tftp server
3602	UDP SRC and DST outside network
3037	INFO napster login
2969	INFO Inbound GNUTella Connect accept
2941	SMTP relaying denied
2186	ICMP Destination Unreachable (Host Unreachable)

2062 ICMP traceroute  
 1848 TCP SRC and DST outside network  
 1845 ICMP Fragment Reassembly Time Exceeded  
 1673 Null scan!  
 1472 FTP DoS ftpd globbing  
 1350 BACKDOOR NetMetro Incoming Traffic  
 1297 Port 55850 tcp - Possible myserver activity -  
     ref. 010313-1  
 1255 Incomplete Packet Fragments Discarded  
 1249 High port 65535 tcp - possible Red Worm -  
 traffic  
 1201 Possible trojan server activity  
 1122 SUNRPC highport access!  
 1046 WEB-MISC 403 Forbidden  
     862 ICMP Echo Request L3retriever Ping  
     809 Tiny Fragments - Possible Hostile Activity  
     798 INFO Outbound GNUTella Connect accept  
     671 Watchlist 000222 NET-NCFC  
     640 ICMP Echo Request CyberKit 2.2 Windows  
     588 ICMP Echo Request BSDtype  
     556 ICMP Echo Request Windows  
     546 Back Orifice  
     541 INFO Possible IRC Access  
     522 EXPLOIT x86 NOOP  
     392 INFO FTP anonymous FTP  
     362 ICMP Echo Request Sun Solaris  
     320 RPC tcp traffic contains bin\_sh  
     271 Queso fingerprint  
     255 beetle.ucs  
     251 SCAN Proxy attempt  
     243 WEB-IIS Unauthorized IP Access Attempt  
     203 TELNET login incorrect  
     198 ICMP SRC and DST outside network  
     177 x86 NOOP - unicode BUFFER OVERFLOW ATTACK  
     163 High port 65535 udp - possible Red Worm -  
 traffic  
     161 TFTP - Internal UDP connection to external tftp  
         server  
     135 INFO napster upload request  
     129 EXPLOIT x86 setuid 0  
     127 WEB-MISC http directory traversal  
     127 ICMP Source Quench  
     123 ICMP Destination Unreachable (Protocol  
 Unreachable)  
     117 External RPC call  
     109 MISC Large ICMP Packet  
     105 BACKDOOR NetMetro File List

91 WEB-IIS File permission  
90 FTP CWD / - possible warez site  
67 WEB-MISC count.cgi access  
66 WEB-FRONTPAGE \_vti\_rpc access  
61 NMAP TCP ping!  
59 ICMP Echo Request Delphi-Piette Windows  
56 EXPLOIT x86 setgid 0  
54 connect to 515 from outside  
48 WinGate 1080 Attempt  
46 ICMP Destination Unreachable (Fragmentation  
Needed and DF bit was set)  
46 FTP CWD / - possible warez site  
44 WEB-IIS \_vti\_inf access  
41 FTP CWD / - possible warez site  
38 CS WEBSERVER - external ftp traffic  
33 WEB-MISC compaq nsight directory traversal  
32 INFO - Web Cmd completed  
31 WEB-FRONTPAGE fpcount.exe access  
30 SCAN FIN  
29 WEB-CGI redirect access  
28 WEB-MISC L3retriever HTTP Probe  
26 Port 55850 udp - Possible myserver activity -  
ref. 010313-1  
24 WEB-CGI scriptalias access  
24 Russia Dynamo - SANS Flash 28-jul-00  
22 TFTP - External TCP connection to internal tftp  
server  
22 SCAN Synscan Portscan ID 19104  
21 WEB-IIS view source via translate header  
21 FTP CWD / - possible warez site  
20 EXPLOIT x86 NOPS  
19 FTP MKD . - possible warez site  
19 EXPLOIT x86 stealth noop  
17 WEB-CGI csh access  
16 X11 outgoing  
15 Virus - Possible pif Worm  
14 INFO Inbound GNUTella Connect request  
13 Virus - Possible scr Worm  
12 FTP CWD / - possible warez site  
11 WEB-FRONTPAGE shtml.dll  
11 WEB-FRONTPAGE fourdots request  
11 SMTP chameleon overflow  
10 spp\_http\_decode: CGI Null Byte attack detected  
7 WEB-MISC whisker head  
7 WEB-MISC guestbook.cgi access  
7 WEB-CGI cvsweb.cgi access  
7 INFO - Possible Squid Scan

```

6 WEB-MISC Lotus Domino directory traversal
6 WEB-FRONTPAGE shtml.exe
6 WEB-CGI tsch access
6 IDS50/trojan_trojan-active-subseven
5 WEB-CGI ksh access
5 Virus - Possible MyRomeo Worm
5 TCP SMTP Source Port traffic
5 ICMP Echo Request Broadscan Smurf Scanner
4 FTP CWD - possible warez site
4 X11 xopen
4 WEB-CGI rsh access
4 WEB-CGI formmail access
4 Traffic from port 53 to port 123
4 TELNET access
4 SYN-FIN scan!
4 SNMP public access
3 WEB-IIS encoding access
3 TFTP-External UDP connection to internal tftp
server
3 SCAN XMAS
3 RFB - Possible WinVNC - 010708-1
3 MISC PCAnywhere Startup
3 INFO Outbound GNUTella Connect request
3 ICMP Redirect (Network)
3 FTP CWD / - possible warez site
2 Virus - Possible NAIL Worm
2 INFO - Web Dir listing
2 FTP CWD - possible warez site
2 DNS zone transfer
2 Attempted Sun RPC high port access
1 WEB-MISC whisker splice attack
1 WEB-IIS showcode access
1 WEB-IIS scripts-browse
1 WEB-CGI phf access
1 WEB-CGI glimpse access
1 WEB-CGI files.pl access
1 WEB-CGI calendar access
1 Probable NMAP fingerprint attempt
1 MISC Source Port 20 to <1024
1 INFO napster new user login
1 ICMP Unassigned! (Type 7) (Undefined Code!)
1 ICMP Source Quench (Undefined Code!)
1 ICMP Router Selection (Undefined Code!)
1 ICMP Mobile Host Redirect (Undefined Code!)
1 ICMP Destination Unreachable (Communication with
Destination Network is Administratively
Prohibited)

```



```
1      FTP STOR 1MB possible warez site
1      FTP .forward
1      DDOS shaft client to handler
```

## 5 Selected External Sources were chosen for further analysis

### 200.36.46.3

200.36.46.3 was the top external talker. All of the alerts generated by this IP are out of spec alerts. For this reason it was chosen as the first external source to be examined.

A whois query at [www.arin.net](http://www.arin.net) results in the following results:

MEXnet - Network Information Center Mexico (NETBLK-NIC-36-MEXICO) NIC-36-MEXICO

200.36.0.0 - 200.36.255.255

UniNet S.A. de C.V. (NETBLK-UNINET-NETBLK4-2) UNINET-NETBLK4-2

200.36.32.0 - 200.36.63.255

SANBORNS S.A. de C.V. (NETBLK-SANBORNS) SANBORNS

200.36.46.0 - 200.36.46.255

A host command returned the following information:

3.46.36.200.in-addr.arpa. domain name pointer  
tlacaelel.sanborns.com.mx.

Sanborns is a Mexican department store. There is no web server running at this alert.

This IP address is scanning for port 21 (ftp). It is using an automated tool, and is setting the source port at 21, which generates the Out of Spec alerts as opposed to scan alerts.

```
08/25-08:11:32.339723 200.36.46.3:21 -> MY.NET.1.9:21
08/25-08:11:32.360162 200.36.46.3:21 -> MY.NET.1.10:21
08/25-08:11:32.380446 200.36.46.3:21 -> MY.NET.1.11:21
08/25-08:11:32.399979 200.36.46.3:21 -> MY.NET.1.12:21
08/25-08:11:32.419970 200.36.46.3:21 -> MY.NET.1.13:21
08/25-08:11:32.440367 200.36.46.3:21 -> MY.NET.1.14:21
08/25-08:11:32.460908 200.36.46.3:21 -> MY.NET.1.15:21
```

```
08/25-08:11:32.480153 200.36.46.3:21 -> MY.NET.1.16:21
08/25-08:11:32.502069 200.36.46.3:21 -> MY.NET.1.17:21
08/25-08:11:32.520293 200.36.46.3:21 -> MY.NET.1.18:21
08/25-08:11:32.539915 200.36.46.3:21 -> MY.NET.1.19:21
08/25-08:11:32.562095 200.36.46.3:21 -> MY.NET.1.20:21
08/25-08:11:32.589021 200.36.46.3:21 -> MY.NET.1.21:21
08/25-08:11:32.600050 200.36.46.3:21 -> MY.NET.1.22:21
08/25-08:11:32.620205 200.36.46.3:21 -> MY.NET.1.23:21
08/25-08:11:32.640851 200.36.46.3:21 -> MY.NET.1.24:21
```

## **211.167.93.115**

This IP was responsible for the vast majority of :  
spp\_http\_decode: IIS Unicode attack detected events.

This IP is registered through APNIC, and a whois query at [www.apnic.net](http://www.apnic.net) results in the following information:

```
Search results for '211.167.93.115' inetnum
211.167.93.112 - 211.167.93.127
netname          ZHONGQINGZAIXIAN
descr            China youth on line
descr            ICP
descr            BeiJing
country          CN
admin-c          LL212-AP, inverse
tech-c           LL212-AP, inverse
mnt-by          MAINT-CNNIC-AP, inverse
changed         llz@srit.com.cn 20010921
source          APNIC
```

```
person          lizhang li, inverse
address         No.225 Chaonei Street Dongcheng
District Beijing China
country         CN
phone          +86-10-65230603
fax-no         +86-10-65276366
e-mail         llz@srit.com.cn, inverse
nic-hdl        LL212-AP, inverse
mnt-by         MAINT-CNNIC-AP, inverse
changed         llz@srit.com.cn 20010103
source         APNIC
```

## **212.179.58.19**

This IP was chosen because it was the primary talker from

the Watchlist 000220 IL-ISDNNET-990517.

By running a whois query at [www.arin.net](http://www.arin.net), I was pointed to RIPE, the European and Middle eastern Registry for Internet Numbers. A whois query at [www.ripe.net](http://www.ripe.net) resulted in the following information:

```
% This is the RIPE Whois server.
% The objects are in RPSL format.
% Please visit http://www.ripe.net/rpsl for more
information.
% Rights restricted by copyright.
% See http://www.ripe.net/ripenncc/pub-
services/db/copyright.html
```

```
inetnum:      212.179.58.0 - 212.179.58.255
netname:      NV-PICTUREVISION
descr:        network
country:      IL
admin-c:      NP469-RIPE
tech-c:       NP469-RIPE
status:       ASSIGNED PA
notify:       hostmaster@isdn.net.il
mnt-by:       RIPE-NCC-NONE-MNT
changed:      hostmaster@isdn.net.il 20000229
source:       RIPE
```

```
route:        212.179.0.0/17
descr:        ISDN Net Ltd.
origin:       AS8551
notify:       hostmaster@isdn.net.il
mnt-by:       AS8551-MNT
changed:      hostmaster@isdn.net.il 19990610
source:       RIPE
```

```
person:       Nati Pinko
address:      Bezeq International
address:      40 Hashacham St.
address:      Petach Tikvah Israel
phone:        +972 3 9257761
e-mail:       hostmaster@isdn.net.il
nic-hdl:      NP469-RIPE
changed:      registrar@ns.il 19990902
source:       RIPE
```

**64.219.131.70**

64.219.131.70 was chosen for examination as it was the top destination in the alerts. There is no webserver currently running at this address.

A whois query at [www.arin.net](http://www.arin.net) yeilds the following results:

Southwestern Bell Internet Services (NETBLK-SBIS-3BL) SBIS-3BL

64.216.0.0 - 64.219.255.255  
PPPoX Pool Rback1 (NETBLK-SBCIS-10113-93831) SBCIS-10113-93831

64.219.130.0 - 64.219.131.255

An example of the alerts from attacks destined to 64.219.131.70:

```
09/18-02:18:59.655793  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:18:59.971232  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:00.562561  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:01.185961  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:01.386649  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:01.580938  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:01.666011  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:01.736041  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:01.884679  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:01.975645  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
09/18-02:19:02.372364  [**] ICMP Echo Request speedera [**]
MY.NET.205.234 -> 64.219.131.70
```

## 66.33.117.144

66.33.117.144 was chosen as it was the second biggest

destination.

Dialtone, Inc. (NETBLK-DIALTONEINTERNET-2)  
4101 SW 47th Ave Suite 101  
Davie, FL 33314  
US

Netname: DIALTONEINTERNET-2  
Netblock: 66.33.0.0 - 66.33.127.255  
Maintainer: DITN

Coordinator:  
Administrator, Network (JC723-ARIN)  
noc@dialtone.com  
954-581-0097 (FAX) 954-581-7629

Domain System inverse mapping provided by:

NS.DIALTONEINTERNET.NET 216.87.222.2  
NS2.DIALTONEINTERNET.NET 216.87.223.253

Reassignment information for this block of addresses can  
be found at [rwhois://rwhois.dialtone.com](http://rwhois://rwhois.dialtone.com)

Record last updated on 13-Mar-2001.  
Database last updated on 9-Oct-2001 23:15:51 EDT.

Note that the attacker is the same as in the above trace.  
A sample of the alerts with attacks destined for  
66.33.117.144:

```
09/18-01:43:11.936013  [**] ICMP Echo Request speedera [**]  
MY.NET.205.234 -> 66.33.117.144  
09/18-01:43:12.615828  [**] ICMP Echo Request speedera [**]  
MY.NET.205.234 -> 66.33.117.144  
09/18-01:43:13.060751  [**] ICMP Echo Request speedera [**]  
MY.NET.205.234 -> 66.33.117.144  
09/18-01:43:13.100336  [**] ICMP Echo Request speedera [**]  
MY.NET.205.234 -> 66.33.117.144  
09/18-01:43:13.250781  [**] ICMP Echo Request speedera [**]  
MY.NET.205.234 -> 66.33.117.144  
09/18-01:43:14.446401  [**] ICMP Echo Request speedera [**]  
MY.NET.205.234 -> 66.33.117.144  
09/18-01:43:14.590613  [**] ICMP Echo Request speedera [**]  
MY.NET.205.234 -> 66.33.117.144
```

## Description of the Analysis Process

The Analysis was conducted entirely by Michael Poor. This data was analyzed on two linux machines. The main analysis was done on a Pentium 450 machine, with 386MB in memory. The analysis stations are located on my home network.

The Analysis process began by acquiring the data for the analysis. The data was downloaded from:

<http://www.research.umbc.edu/~andy>

The files were placed in directories separating the types of data within them. This resulted in three main directories: alerts, oos, and scans.

A back up of all original data to a directory named: copy.

The files were unzipped using gunzip.

The first part of the analysis, was conducted with a series of shell scripts written by Chris Baker (

[http://www.sans.org/y2k/practical/Chris Baker GCIA.zip](http://www.sans.org/y2k/practical/Chris%20Baker%20GCIA.zip)

).

These scripts, with some changes to reflect my files are as follows:

```
#script for tallying each type of alert. Based on a Script  
by Chris Baker
```

```
grep "\[\\*\\*\\]" alerts.txt | grep -v spp_portscan |  
cut -d \] -f 2 | sed s/"\[\\*\\*"//g >>  
alerts.events.log.unsorted  
grep PORTSCAN alerts.txt | cut -d \f -f 1 | cut -d \:  
-f 4 >> alerts.events.log.unsorted  
cat alerts.events.log.unsorted | sort | uniq -c | sort  
-nr > alerts.events.log  
rm alerts.events.log.unsorted
```

```
#script for tallying destination IP's, destination Ports,  
and source IP's for each type of alert. Based on Scripts by  
Chris Baker
```

```
grep "\[\\*\\*\\]" alerts.txt | grep -v spp_portscan |
```

```
cut -d \> -f 2 | cut -d : -f 1 | sed s/\ //g | sort |
uniq -c | sort -nr > alerts.dstips.log
```

```
grep "\[.*\*]" alerts.txt | grep -v spp_portscan |
grep -v Tiny\ Fragments | grep -v ICMP\ SRC | cut -d
\> -f 2 | cut -d : -f 2 | sed s/\ //g | sort | uniq -c
| sort -nr > alerts.dstports.log
```

```
grep "\[.*\*]" alerts.txt | grep -v spp_portscan |
cut -d \] -f 3 | cut -d \- -f 1 | cut -d : -f 1 | sed
s/\ //g >> alerts.srcips.log.unsorted
grep PORTSCAN alerts.txt | cut -d \] -f 2 | cut -d \
-f 6 | sed s/\ //g >> alerts.srcips.log.unsorted
cat alerts.srcips.log.unsorted | sort | uniq -c | sort
-nr > alerts.srcips.log
rm alerts.srcips.log.unsorted
```

```
#scripts for generating tallies of the out of spec
destination IP's. Based on a Script by Chris Baker
grep "..\./..\-..\:..\:" oos.txt | cut -d \> -f 2 |
cut -d \: -f 1 | sed s/\ //g | sort | uniq -c | sort -
nr > oos.dstips.log
```

```
#scripts for generating tallies of the out of spec
destination ports. Based on a Script by Chris Baker
```

```
grep "..\./..\-..\:..\:" oos_all | cut -d \> -f 2 |
cut -d \: -f 2 | sed s/\ //g | sort | uniq -c | sort -
nr > oos.dstports.log
```

```
#scripts for generating tallies of the out of spec source
IP's. Based on a Script by Chris Baker
```

```
grep "..\./..\-..\:..\:" oos_all | cut -d \> -f 1 |
cut -d \ -f 2 | cut -d \: -f 1 | sed s/\ //g | sort |
uniq -c | sort -nr > oos.srcips.log
```

```
#script for gathering the top talkers for each of the
categories of data. Based on a Script by Chris Baker
```

```
#!/bin/sh
grep "..\./..\-..\:..\:" oos_all | cut -d \> -f 1 | cut
-d \ -f 2 | cut -d \: -f 1 | sed s/\ //g >>
top10talkers.log.unsorted
grep "\[.*\*]" alerts_all | grep -v spp_portscan |
```

```

cut -d \] -f 3 | cut -d \- -f 1 | cut -d : -f 1 | sed
s/\ //g >> top10talkers.log.unsorted
grep PORTSCAN alerts_all | cut -d \f -f 1 | cut -d \:
-f 4 >> top10talkers.log.unsorted
cat top10talkers.log.unsorted | sort | uniq -c | sort
-nr > top10talkers.log
rm top10talkers.log.unsorted

```

#shell script example that will gather the information about SRC/DST IP's and dst ports for all INFO MSN IM Chat data alerts. Based on a Script by Chris Baker

```

#!/bin/sh
# information about SRC/DST IP's and dst ports for all
INFO MSN IM Chat data alerts
grep "INFO MSN IM Chat data" alerts_all | cut -d \> -f
2 | cut -d : -f 1 | sed s/\ //g | sort | uniq -c |
sort -nr > alerts.MSNdata.dstips.log
grep "INFO MSN IM Chat data" alerts_all | cut -d \> -f
2 | cut -d : -f 2 | sed s/\ //g | sort | uniq -c |
sort -nr > alerts.MSNdata.dstports.log
grep "INFO MSN IM Chat data" alerts_all | cut -d \] -f
3 | cut -d \- -f 1 | cut -d : -f 1 | sed s/\ //g |
sort | uniq -c | sort -nr >> alerts.MSNdata.srcips.log

```

#perl script designed to sum data in thousands of lines, used for tallying amounts of events, scans and out of spec alerts. Script by Mike Poor

```

#!/usr/bin/perl
$line = 0;
open(NUM, "cmd");
while(<NUM>)
{
    $line++;
    print $line, "\n";
}
close NUM;

```

This simple shell script, also by Mike Poor was used to extract counts per day of the cmd.exe attack:

```

grep 'cmd.exe' alert.all | cut -f | -d \- | sort | uniq -c
> cmd.count

```

The analyst used many UNIX commands, as well as simple perl scripts, to gather traces for top events, top 10



talkers from MY.NET, and other relevant data. This is an interesting point, because the tools provided with standard Unix/BSD/Linux distributions are extremely powerful. I was very familiar with common tools such as grep, sort, cut, and shell scripting. I had a limited amount of knowledge of tools such as gawk and sed. Using these tools has expanded my ability to analyze large amounts of alerts without being dependent on ready made tools. The analyst then began the process of analyzing and trending the data, while cross-referencing other students papers, and searching the web for related information.

## References

The following references were used as reference study guides. Where direct quotes were used, appropriate endnotes, or an immediate reference to the url, have been given.

TCP/IP Illustrated by W. Richard Stevens (pages 85-94 on Ping)

Stevens, W. Richard. TCP/IP Illustrated, Volume 1. Addison Wesley Longman, Inc, 1994. 85-94.

Hall, Eric A.. Internet Core Protocols. O'Reilly Publishing, 2000. 196-222

Arkin, Ofir. ICMP Usage in Scanning. Version 3.0, June 2001

[http://www.sys-security.com/archive/papers/ICMP\\_Scanning\\_v3.0.pdf](http://www.sys-security.com/archive/papers/ICMP_Scanning_v3.0.pdf))

Baker, Chris. GCIA Practical,  
[http://www.sans.org/y2k/practical/Chris\\_Baker\\_GCIA.zip](http://www.sans.org/y2k/practical/Chris_Baker_GCIA.zip)

Hawkins, Scott. Linux Desk Reference. Prentice Hall PTR 2000. 252-253, 256, 259.

The following websites were used for research and information gathering:

Incidents.org  
<http://www.incidents.org>

ARIN American Registry of Internet Numbers  
<http://www.arin.net/whois/index.html>

APNIC Asia Pacific Network Information Center  
<http://www.apnic.net>

Security Focus  
<http://www.securityfocus.com>

Google  
<http://www.google.com>

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<sup>i</sup> Alldas.de defacement archives.  
<http://defaced.alldas.de/?archives=complete>

<sup>ii</sup> <http://www.securitynewsportal.com/article.php?sid=1813>  
Title: Firing (and Hiring) Hackers -:- Uncle Sam wants  
you... maybe? Tuesday, October 02 @ 20:04:25 EDT

<sup>iii</sup> Statistic from Talk given by Marty Roesch at Sans San  
Diego

<sup>iv</sup> <http://www.sans.org/newlook/publications/salary2000.htm>  
Sans 2000 Salary Survey Summary

<sup>v</sup> Steve Ulfelder. IDS Products and Prices July 09 2001,  
[www.computerworld.com/itresource/rcstory/0,4167,KEY73\\_ST062015,00.html](http://www.computerworld.com/itresource/rcstory/0,4167,KEY73_ST062015,00.html)

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Minneapolis 2018 - SEC503: Intrusion Detection In-Depth	Minneapolis, MN	Jun 25, 2018 - Jun 30, 2018	vLive
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SANS Virginia Beach 2018	Virginia Beach, VA	Aug 20, 2018 - Aug 31, 2018	Live Event
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