Cybercriminals Target Online Banking Customers

Use Trojan and Exploit Kits to Steal Funds from Major UK Financial Institution

BACKGROUND

In July 2010, an organized network of cybercriminals launched a complex, multi-level scheme that targeted online customers of a large UK financial institution. Based on information M86 Security Labs found on the malicious Command & Control (C&C) server, we assume that close to £675,000 was stolen from the bank between July 5 and Aug. 4, 2010, and approximately 3,000 customer accounts were compromised. Exact figures are being verified at this time.

The M86 Security Labs malware team detected this illegal operation after discovering a malicious code attack used to infect users' PCs with a Trojan. The team then followed the trail to the Command & Control center. According to our research, these cybercriminals used a combination of the new Zeus v3 Trojan and exploit toolkits to successfully avoid anti-fraud systems while robbing bank accounts.

This indicates a new level of technical sophistication and signals the continuation of a cybercrime trend that has evolved since our last report, URLZone/Bebloh Trojan Banker. Two years ago, M86 Security Labs identified Zeus, which became one of the most popular Trojans used by cybercriminals. Today, the latest iteration, Zeus v3, not only acts a data collector -- it also performs illegal online banking transactions.

In this report, we will expose the architecture, business model, tools and methods used by this cybercriminal organization.

THE ATTACK

Multiple techniques were used to spread malicious code to as many systems as possible within the UK with the ultimate goal of targeting online customers of a specific bank. These techniques included:

- Infecting legitimate websites with malware
- Creating fraudulent online advertisement websites
- Publishing malicious advertisements among legitimate websites

The cybercriminals used the Eleonore Exploit Kit and the Phoenix Exploit Kit (located on the same server), both of which are notorious for efficiently exploiting victim's browsers to install Trojans onto their PCs.

Once the Zeus v3 Trojan successfully installed on victims' PCs and after the victims logged into their online bank accounts, the Trojan initiated the money transfer from their accounts, via money mules, to the cyber-thieves. Using various techniques, the Trojan remained under the radar of common anti-fraud detection systems. It appears that the C&C server was hosted in Eastern Europe.

Figure 1: Flow of the Attack
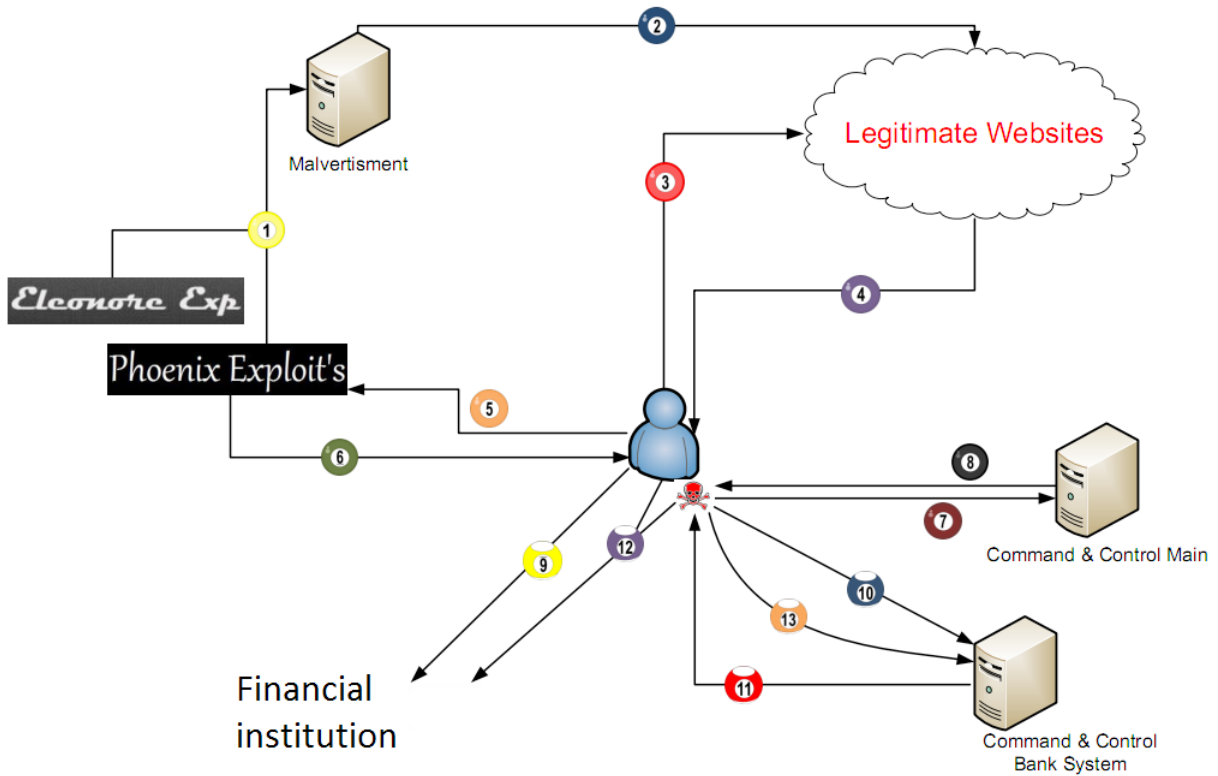
1. Uploads malicious advertisements to legitimate and fraud advertisements servers
2. The malicious advertisements published among the legitimate websites
3. User accesses to an infected website
4. The website content contains redirection to the malicious Exploit Kit
5. The user is redirected to the malicious Exploit Kit
6. The user's PC exploited, the payload was downloaded successfully
7. The Trojan reports for a new bot to the C&C
8. The C&C sends instruction to the Trojan
9. User access to financial institution
10. The Trojan reports for the user activities
11. The C&C sends commands to the Trojan to manipulate user bank transactions
12. Trojan manipulates User's bank transaction
13. Trojan reports the C&C about successful/failed transaction

SPREADING MALWARE: EXPLOIT KITS

An exploit kit is a Web application that serves multiple exploits through browsers (Internet Explorer, Firefox and Safari) or applications (JAVA, Flash and PDF) to a victim's system. The owner of the exploit kit can control what is served to a victim's PC and monitor the results of the attack. Today, cybercriminals can easily buy these kits, including Phoenix Exploit Kit, Siberia Exploit Kit, and the Eleonore Exploit Kit for a few hundred dollars.

In this case, the cybercriminals used the Eleonore Exploit Kit 1.4.1, which M86 Security Labs experts researched a year ago and continue to update regularly.
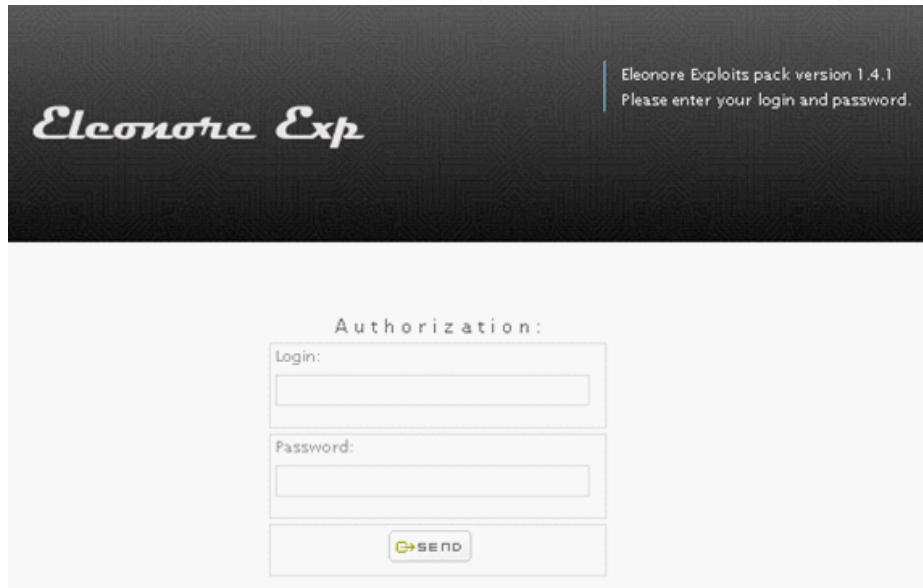

Figure 2: Login panel of the Eleonore exploit kit

The Eleonore Exploit Kit includes exploits for the following vulnerabilities:

- IE MDAC Vulnerability - CVE-2006-0003
- Adobe Reader Collab GetIcon Vulnerability - CVE-2009-0927
- Adobe Reader CollectEmailInfo Vulnerability - CVE-2007-5659
- Adobe Reader newPlayer Vulnerability - CVE-2009-4324
- Java Development Kit Vulnerability - CVE-2008-5353
- Java Web Start Vulnerability - CVE-2010-1423
- Social Engineering Attack – Requires the user to download and execute the payload

Administration Panel

In addition to the included exploits, the author of the toolkit enables his customers to review and analyze incoming traffic.

Operation Systems:	Totals:
Windows XP	121582
Windows Vista	106000
Windows 7	56826
Mac OS	3851
Linux	359
Power PC	312
PlayStation	308
Windows 2000	304
Windows 2003	265
Windows 98	80
Bots	53
Unknown OS :(	27
Symbian OS	22
Nintendo Wii	7
Windows NT 4	2
iPhone OS	1
SunOS	1
Windows ME	1

Sploit:	Loads:
3D3Dmdac	1
3Dmdac	2
	2
_new	53
_geticon	155
_email	259
mdac	1468
_pack	7492
java_gsb	10053
x1YY	17657

Figure 3: Exploit statistics organized by the operating system of the incoming machines and amount of successful exploits divided by the exploit's name

HTTP Referer:	Trafic:	Loads:	Percent:
www. emedia.com	168966	18989	11.24%
ads2.nev .in	34444	4001	11.62%
servedby wer.com	23371	4881	20.88%
cr1.span lessons.net	15808	1742	11.02%
ads.mya m.com	15182	3230	21.28%
cr1.worl live.name	11773	1306	11.09%
ads.sma m	6004	1084	18.05%
ad1.stre tsports.in	5939	749	12.61%
ad.yieldmanager.com	5048	722	14.3%
cr1.worl ve.org	2195	220	10.02%
--	736	158	21.47%
ads.eye .com	223	31	13.9%

Figure 4: Incoming traffic from websites

Typically, the "Referer" column includes a list of infected sites used to redirect users to the exploit kit. In this case, most of the incoming traffic was delivered through malicious advertisements. Fraudulent advertisement sites are marked in red, and legitimate sites that have been infected are marked in blue. For example, "yieldmanager.com" is operated by Yahoo.

Figure 5: Fraud advertisement website used by the cybercriminals

The Eleonore Exploit Kit also enabled the controller to view the source locations of victims' machines. The following screenshot proves that this is a professional cybercriminal network whose goal was to steal money using online banking accounts. The victims' PCs were located in Britain, which was relevant to the next step of the crime.

Country:	Traffic:	Loads:	Percent:
GB	287685	36802	12.79 %
--	2153	307	14.26 %
RU	75	5	6.67 %
US	37	14	37.84 %
IE	22	4	18.18 %
DE	7	5	71.43 %
NL	5	1	20 %
JP	5	3	60 %
CN	4	0	0 %
FR	2	0	0 %
BR	1	0	0 %
PE	1	0	0 %
PS	1	0	0 %
SA	1	0	0 %
SG	1	0	0 %
NG	1	1	100 %

Figure 6: Statistics of incoming traffic divided by country

To generate this much traffic from one country, we can assume, according to the referrer's panel, that the malicious advertisements and infected websites were located within the UK.

Because the infected pages delivered by the Phoenix and Eleonore Exploit Kits are well-obfuscated, it was difficult to detect them through antivirus technology alone. This is evidenced in Figure 7, which shows that only a few anti-virus vendors would have detected the exploit.

File **eleonore.html** received on 2010.07.26 13:46:40 (UTC) Current status: **finished** Result: **1/42 (2.39%)**				File **1.html** received on 2010.07.27 13:35:12 (UTC) Current status: **finished** Result: **6/41 (14.64%)**			
AntiVirus	Version	Last Update	Result	AntiVirus	Version	Last Update	Result
AhnLab-V3	2010.07.27.00	2010.07.26	-	AhnLab-V3	2010.07.27.00	2010.07.26	-
AntiVir	8.2.4.26	2010.07.27	-	AntiVir	8.2.4.26	2010.07.27	JS/Ag.13173
Antiy-AVL	2.0.3.7	2010.07.26	-	Antiy-AVL	2.0.3.7	2010.07.26	-
Authentium	5.2.0.5	2010.07.27	-	Authentium	5.2.0.5	2010.07.27	-
Avast	4.8.1351.0	2010.07.27	-	Avast	4.8.1351.0	2010.07.27	HTML:Downloader-H
Avast5	5.0.332.0	2010.07.27	-	Avast5	5.0.332.0	2010.07.27	HTML:Downloader-H
AVG	9.0.0.851	2010.07.27	JS/Downloader.Agent	AVG	9.0.0.851	2010.07.27	-
BitDefender	7.2	2010.07.27	-	BitDefender	7.2	2010.07.27	-
CAT-QuickHeal	11.00	2010.07.27	-	CAT-QuickHeal	11.00	2010.07.27	-
ClamAV	0.96.0.3-git	2010.07.27	-	ClamAV	0.96.0.3-git	2010.07.27	-
Comodo	5556	2010.07.27	-	Comodo	5556	2010.07.27	-
DrWeb	5.0.2.03300	2010.07.27	-	DrWeb	5.0.2.03300	2010.07.27	-
Emsisoft	5.0.0.34	2010.07.27	-	Emsisoft	5.0.0.34	2010.07.27	-
eSafe	7.0.17.0	2010.07.26	-	eSafe	7.0.17.0	2010.07.26	-
eTrust-Vet	36.1.7742	2010.07.27	-	eTrust-Vet	36.1.7742	2010.07.27	-
F-Prot	4.6.1.107	2010.07.27	-	F-Prot	4.6.1.107	2010.07.27	JS/Crypted.CV.gen
F-Secure	9.0.15370.0	2010.07.27	-	F-Secure	9.0.15370.0	2010.07.27	-
Fortinet	4.1.143.0	2010.07.24	-	Fortinet	4.1.143.0	2010.07.24	-

Figure 7: VirusTotal service displays the low detection rate of the known anti-virus companies

REPORTING: ZEUS v3 TROJAN

After the exploit kit successfully downloaded to the victim's machine, it began to communicate with its C&C server.

Figure 8: Malware starts communicating with its C&C server

The screenshot above shows the Trojan communicating with the C&C. Once the new configuration file was retrieved, the Trojan monitored specific online banking sites and reported to the C&C server. In this attack's configuration file, the cybercriminal targeted one bank.

This Zbot/Zeus v3 version is an evolved mutation of Zbot 2. Unlike the older version, this one focused specifically on online banking. The malware began reporting to a different C&C server once the user accessed the desired bank.

VIRUS TOTAL

File 948E5301008EF14CEAA501CE9E5C5C00A8320DDF.exe received on 2010.07.19 12:52:54 (UTC)

Antivirus	Version	Last Update	Result
a-squared	5.0.0.31	2010.07.19	-
AhnLab-V3	2010.07.19.01	2010.07.19	-
AntiVir	8.2.4.12	2010.07.19	-
Antiy-AVL	2.0.3.7	2010.07.15	-
Authentium	5.2.0.5	2010.07.19	-
Avast	4.8.1351.0	2010.07.19	-
Avast5	5.0.332.0	2010.07.19	-
AVG	9.0.0.836	2010.07.18	-
BitDefender	7.2	2010.07.19	-
CAT-QuickHeal	11.00	2010.07.19	-
ClamAV	0.96.0.3-git	2010.07.19	-
Comodo	5477	2010.07.19	Heur.Packed.Unknown
DrWeb	5.0.2.03300	2010.07.19	-
eSafe	7.0.17.0	2010.07.19	-
eTrust-Vet	36.1.7719	2010.07.19	-
F-Prot	4.6.1.107	2010.07.19	-
F-Secure	9.0.15370.0	2010.07.19	-
Fortinet	4.1.143.0	2010.07.19	-
GData	21	2010.07.19	-
Ikarus	T3.1.1.84.0	2010.07.19	-
Jiangmin	13.0.900	2010.07.19	-
Kaspersky	7.0.0.125	2010.07.19	-
McAfee	5.400.0.1158	2010.07.19	-
McAfee-GW-Edition	2010.1	2010.07.19	-
Microsoft	1.6004	2010.07.19	-
NOD32	5291	2010.07.19	-
Norman	6.05.11	2010.07.19	-
nProtect	2010-07-19.01	2010.07.19	-
Panda	10.0.2.7	2010.07.18	-
PCTools	7.0.3.5	2010.07.19	-
Prevx	3.0	2010.07.19	Medium Risk Malware Dropper
Rising	22.57.00.02	2010.07.19	-
Sophos	4.55.0	2010.07.19	Mal/Zbot-U
Sunbelt	6602	2010.07.19	-
SUPERAntiSpyware	4.40.0.1006	2010.07.19	-
Symantec	20101.1.1.7	2010.07.19	-
TheHacker	6.5.2.1.319	2010.07.19	-
TrendMicro	9.120.0.1004	2010.07.19	Cryp_Zbot-12
TrendMicro-HouseCall	9.120.0.1004	2010.07.19	Cryp_Zbot-12
VBA32	3.12.12.6	2010.07.19	-
ViRobot	2010.6.21.3896	2010.07.19	-
VirusBuster	5.0.27.0	2010.07.19	-

Figure 9: VT results 5/42 -- only three vendors find this malware as Zbot

After the user logged in to his personal banking account, it appears the Trojan transferred the login ID, date of birth, and a security number to the C&C server. The system processed the incoming data and exported it into a log file along with the victim's machine IP:

```
====================
XXX.XXX.XXX.XXX
11-07-10 03:39:31
Log: XXXXXXXXXX MemAnsw: NNNNNNN Psw: MMMMM
====================
====================
XXX.XXX.XXX.XXX
11-07-10 04:02:11
Log: XXXXXXXXXX MemAnsw: NNNNNNN Psw: MMMMM
====================
====================
XXX.XXX.XXX.XXX
11-07-10 09:52:58
Log: XXXXXXXXXX MemAnsw: NNNNNNN Psw: MMMMM
====================
```

Once the user accessed the transactional section of the site, the Trojan reported to the C&C. It then received new JavaScript code to replace the original bank JavaScript that was used for the transaction form.

```php
if (isset($_REQUEST['ini']) && !empty($_REQUEST['ini'])){
    if ($cc=='GB' || $cc=='IE' || $cc=='NL') {
        if($_REQUEST['ini'] == 'd'){
            header("Location: get_dr.php?e=".$_REQUEST['e']);
            exit;
        }
        if($_REQUEST['ini'] == 'i'){
            header("Location: get_inf.php?e=".$_REQUEST['_eexw']);
            exit;
        }
        if(preg_match("/https?:\/\/                    \/..*/i", $referer) ||
            if($_REQUEST['ini'] == 'j'){
                if($browser == 'IE') include("./resour            ");
                if($browser == 'FF') include("./resour        _ _.js");
                exit;
            } else {
                include("404.html");
                exit;
```

Figure 10: The code that sends new JavaScript for the bank transaction form

After the user submitted the transaction form, the relevant data was sent to the C&C system instead of the bank.

```
              - - [14/Jul/2010:00:52:47 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 11378 "https://                        i
              - - [14/Jul/2010:00:53:19 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 7301 "https://           1/2/          i/
              - - [14/Jul/2010:00:53:39 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 7301 "https://          1/2/           s
              - - [14/Jul/2010:00:54:09 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 7301 "https://          '1/2/          s
              - - [14/Jul/2010:00:54:11 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 7301 "https://          '1/2/          e
              - - [14/Jul/2010:00:54:21 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 7301 "https://          /1/2/          e
              - - [14/Jul/2010:00:54:29 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 7301 "https://          /1/2/          s
              - - [14/Jul/2010:00:54:30 +0100] "GET /xf3510/get_for.php?ini                                                        3
              - - [14/Jul/2010:00:54:31 +0100] "GET /xf3510/get_dr.php?e=
              - - [14/Jul/2010:00:54:33 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 7301 "https://          1/2/           3
              - - [14/Jul/2010:00:54:39 +0100] "GET /xf3510/get_for.php?ini=j HTTP/1.1" 200 7301 "https://          '1/2/          3
              - - [14/Jul/2010:00:54:40 +0100] "GET /xf3510/get_for.php?ini=i
              - - [14/Jul/2010:00:54:40 +0100] "GET /xf3510/get_inf.php?e=                                                         3
```

Figure 11: HTTP log -- the requests committed by the Trojan from the victim machine to the C&C system

The Trojan's activity, noted in red in the screenshot, shows encrypted data being sent to the C&C system. The system analyzed and decrypted the information sent by the Trojan.

```php
function hor_decode($str){
    $result = "";
    $str = explode(',',$str);
    foreach($str as $char){
        $result .= chr($char / 3);
    }
    return $result;
}


$str = explode("&",hor_decode($_REQUEST['e']));
```

Figure 12: Decryption algorithm of the data

After analyzing the data, the system determined whether the user had enough money in the account. It selected the most appropriate mule account to retrieve the money, wrapped all the data, and sent it back to the Trojan installed on the victim's machine.

The Trojan then updated the data in the form and sent it to the bank to complete the transaction. The bank received the requested operation and sent back the transaction result as the Trojan continued to listen to the bank response, reporting it to the C&C system.

```
                    - - [14/Jul/2010:00:54:40 +0100] "GET
/xf3510/get_inf.php?e=
```

```
"https://www.
                                          _8j9SPykeeyOxPLRaRsOvMOY_QjsKLN4t3@wfJwRWbxxub4Rc11x.
R56401gROfacd/delta/base64xml/LO1JSWO3dW1DT11KS1PvQSd3QUFNVW6BQOVJTW&2@TVJaKILQSEvNKIKZ1R2b4tK
vafSk3Ei34kLS0tLR4kLf_:12               d=000          LB4 _
(Windows; U; Windows NT 6.0; en-US; rv:1.9.2.6) Gecko/20100625 Firefox/3.6.6"
```

Figure 13: HTTP log -- the Trojan reports the result of the transaction committed by the user

country=YYYY

block=1

content=YYYY::AANNNNNNNNNN::AAAAAAAAAA::XXXXXXXXX::YYYYYYYY::jot::806.04
inf=Firefox

Holder Info: SOMENAME XX-YY-ZZ XXXXXXXX

Figure 14: The system updated the transaction result in the database

COMMAND & CONTROL MANAGEMENT

Stealing money from a major financial institution by exploiting customers' online transactions is a complex operation. It requires a professional cybercrime business model, for which each individual has a specific role. Members operate simultaneously and use money mule accounts to transfer the funds from compromised accounts. Using the administration panel, the operator could manage each team member in the group.
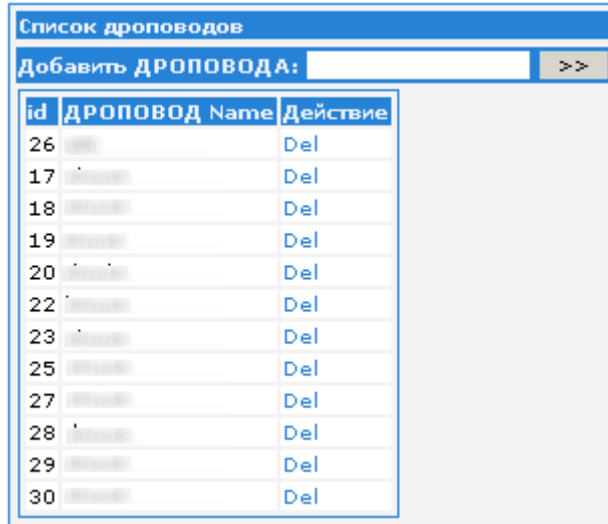
Figure 15: Nicknames of gang members controlled by the manager

Figure 16: A list of the money mule's account, including the money each account holds and the member of the network who stole it

The screenshot above displays the money mule tab, where the manager adds new money mule accounts, including the minimum/maximum amount to transfer to those accounts, and the operator of each money mule.

Настройки			
Условие	K1	K2	Сумма
MIN < Баланс < MAX	6.311	7.21	Sum = Bal*(1-rand(K1,K2)/100)
MAX < Баланс	6.311	7.21	MIN{MAX_SUM;Bal*(1-rand(K1,K2)/100)}
Отмена	Изменить		

Figure 17: The "Robin Hood" algorithm of money amount to transfer from the
victim's account to the money mule's account

The "Robin Hood" system in the screenshot above enabled the manager to define how much money to transfer from the compromised bank accounts to the money mule's account. The system only stole money from accounts that held more than a specified amount of money.

Communication with the Banking Command & Control System

Unlike the older version of Zeus, this new Trojan communicated with HTTP over SSL.

Figure 18: SSL conversation between the bot and the C&C server

MONEY MULES

Money mule accounts are legitimate banking accounts controlled by valid bank users. These users are typically unsuspecting middlemen who transfer stolen money from one country to another to muddle the cybercrime trail. Money mules aren't aware that the money they deliver to cybercriminals is stolen from compromised bank accounts.

Cybercriminals recruit money mules by posing as legitimate companies that hire them as employees. They ask their "employees" to transfer received money from their bank account to a different account which is related to the fraudulent company. And they do not use non-banking transactions, such as Western Union, to transfer money.

To avoid warning signs by anti-fraud systems, the money mule accounts are only used a few times within a certain timeframe. Since banks monitor large transfers, the amount of money deposited in a money mule account is predefined in an effort to elude detection.

TRANSACTIONS

In this case, the controller monitored each transaction performed within the compromised bank accounts, the amount of money delivered to money mules, and the status result reported by the bank.

For example, the controller could see the third transaction result that stated, "Your payment has been sent and will be credited to the beneficiaries account immediately, subject to our normal fraud checks."

Figure 19: The money transaction that sent to the money mules executed by the compromised accounts

CONCLUSION

Because cybercrime is a lucrative business, illegal operations such as the one discussed in this paper are on the rise. These criminals continuously seek new, sophisticated ways to steal information and money without detection. And it's increasingly difficult for security companies to stay ahead of the proliferation of new, dynamic malware.

In this scenario, the M86 Security Labs malware team detected the crime because a potential victim used our secure Web gateway solution, which proactively prevents emerging threats in real time. It's the only effective way to protect users and organizations from today's sophisticated attacks via the Web.

Immediately after the discovery, M86 Security representatives informed the relevant law enforcement agencies of all criminal activities and methods used by the perpetrators.

ABOUT M86 SECURITY

M86 Security is the global expert in real-time threat protection and the industry's leading Secure Web Gateway provider. The company's appliance, software, and Software as a Service (SaaS) solutions for Web and email security protect more than 24,000 customers and over 17 million users worldwide. M86 products use patented real-time code analysis and behavior-based malware detection technologies as well as threat intelligence from M86 Security Labs to protect networks against new and advanced threats, secure confidential information, and ensure regulatory compliance. The company is based in Orange, California with international headquarters in London and development centers in California, Israel, and New Zealand.

ABOUT M86 SECURITY LABS

M86 Security Labs is a specialized global team of security experts and researchers who detect current and emerging Web and email threats and mitigate them quickly. By using data feeds from the Internet security community and internal intelligence gathered from M86 Security customers and products, the team analyzes information and provides comprehensive, always-adapting defense against email and Web threats. In addition, M86 Security Labs provides zero-day protection to its customers, securing them from new exploits the day they're discovered.

TRY BEFORE YOU BUY

M86 Security offers free product trials and evaluations. Simply contact us or visit **www.m86security.com/downloads**

M86™
SECURITY

Corporate Headquarters	**International Headquarters**	**Asia-Pacific**
828 West Taft Avenue	Renaissance 2200	Millennium Centre, Bldg C, Level 1
Orange, CA 92865	Basing View, Basingstoke	600 Great South Road
United States	Hampshire RG21 4EQ	Ellerslie, Auckland, 1051
Phone: +1 (714) 282-6111	United Kingdom	New Zealand
Fax: +1 (714) 282-6116	Phone: +44 (0) 1256 848 080	Phone: +64 (0) 9 984 5700
	Fax: +44 (0) 1256 848 060	Fax: +64 (0) 9 984 5720

Version 08/08/10