

“Red October” Diplomatic Cyber Attacks Investigation

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Authors



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Executive Summary

In October 2012, Kaspersky Lab’s Global Research & Analysis Team initiated a new threat research after a series of attacks against computer networks of various international diplomatic service agencies. A large scale cyber-espionage network was revealed and analyzed during the investigation, which we called “Red October” (after famous novel “The Hunt For The Red October”).

This report is based on detailed technical analysis of a series of targeted attacks against diplomatic, governmental and scientific research organizations in different countries, mostly related to the region of Eastern Europe, former USSR members and countries in Central Asia.

The main objective of the attackers was to gather intelligence from the compromised organizations, which included computer systems, personal mobile devices and network equipment.

The earliest evidence indicates that the cyber-espionage campaign was active since 2007 and is still active at the time of writing (January 2013).

Besides that, registration data used for the purchase of several Command & Control (C&C) servers and unique malware filenames related to the current attackers hints at even earlier time of activity dating back to May 2007.

Main Findings

Advanced Cyber-espionage Network: The attackers have been active for at least several years, focusing on diplomatic and governmental agencies of various countries across the world.

Information harvested from infected networks was reused in later attacks. For example, stolen credentials were compiled in a list and used when the attackers needed to guess secret phrase in other locations. To control the network of infected machines, the attackers created more than 60 domain names and several server hosting locations in different countries (mainly Germany and Russia). The C&C infrastructure is actually a chain of servers working as proxies and hiding the location of the 'mothership' control server.

Unique architecture: The attackers created a multi-functional kit which has a capability of quick extension of the features that gather intelligence. The system is resistant to C&C server takeover and allows the attack to recover access to infected machines using alternative communication channels.

Broad variety of targets: Beside traditional attack targets (workstations), the system is capable of stealing data from mobile devices, such as smartphones (iPhone, Nokia, Windows Mobile), enterprise network equipment (Cisco), removable disk drives (including already deleted files via a custom file recovery procedure).

Importation of exploits: The samples we managed to find were using exploit code for vulnerabilities in Microsoft Word and Microsoft Excel that were created by other attackers and employed during different cyber attacks. The attackers left the imported exploit code untouched, perhaps to harden the identification process.

Attacker identification: Basing on registration data of C&C servers and numerous artifacts left in executables of the malware, we strongly believe that the attackers have Russian-speaking origins. Current attackers and executables developed by them have been unknown until recently, they have never related to any other targeted cyberattacks.

Anatomy of the attack

General description

These attacks comprised of the classical scenario of specific targeted attacks, consisting of two major stages:

1. Initial infection
2. Additional modules deployed for intelligence gathering

The malicious code was delivered via e-mail as attachments (Microsoft Excel, Word and, probably PDF documents) which were rigged with exploit code for known security vulnerabilities in the mentioned applications. In addition to Office documents (CVE-2009-3129, CVE-2010-3333, CVE-2012-0158), it appears that the attackers also infiltrated victim network(s) via Java exploitation (known as the 'Rhino' exploit (CVE-2011-3544)).

Right after the victim opened the malicious document or visit malicious URL on a vulnerable system, the embedded malicious code initiated the setup of the main component which in turn handled further communication with the C&C servers.

Next, the system receives a number of additional spy modules from the C&C server, including modules to handle infection of smartphones.

The main purpose of the spying modules is to steal information. This includes files from different cryptographic systems, such as "Acid Cryptofiler", (see https://fr.wikipedia.org/wiki/Acid_Cryptofiler) which is known to be used in organizations of European Union/European Parliament/European Commission since the summer of 2011. All gathered information is packed, encrypted and only then transferred to the C&C server.

Step-by-step description (1st stage)

During our investigation we couldn't find any e-mails used in the attacks, only top level dropper documents. Nevertheless, based on indirect evidence, we know that the e-mails can be sent using one of the following methods:

- Using an anonymous mailbox from a free public email service provider
- Using mailboxes from already infected organizations

E-mail subject lines as well as the text in e-mail bodies varied depending on the target (recipient). The attached file contained the exploit code which activated a Trojan dropper in the system.

We have observed the use of at least three different exploits for previously known vulnerabilities: CVE-2009-3129 (MS Excel), CVE-2010-3333 (MS Word) and CVE-2012-0158 (MS Word). The first attacks that used the exploit for MS Excel started in 2010, while attacks targeting the MS Word vulnerabilities appeared in the summer of 2012.

As a notable fact, the attackers used exploit code that was made public and originally came from a previously known targeted attack campaign with Chinese origins. The only thing that was changed is the executable which was embedded in the document; the attackers replaced it with their own code.

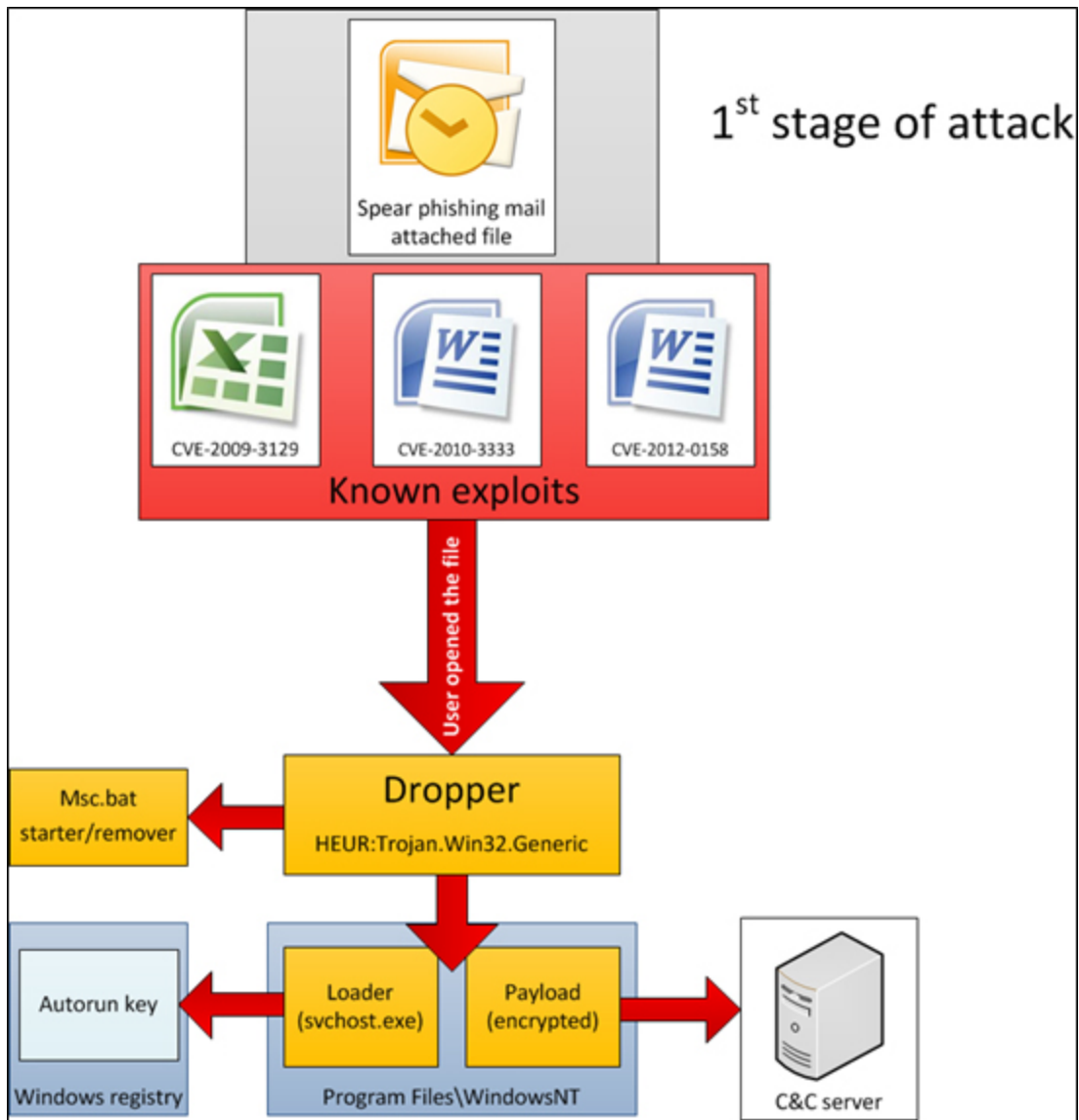
The embedded executable is a file-dropper, which extracts and runs three additional files.

```
%TEMP%MSC.BAT
%ProgramFiles%WINDOWS NTLHAFD.GCP (<- This file name varies)
%ProgramFiles%WINDOWS NTSVCHOST.EXE
```

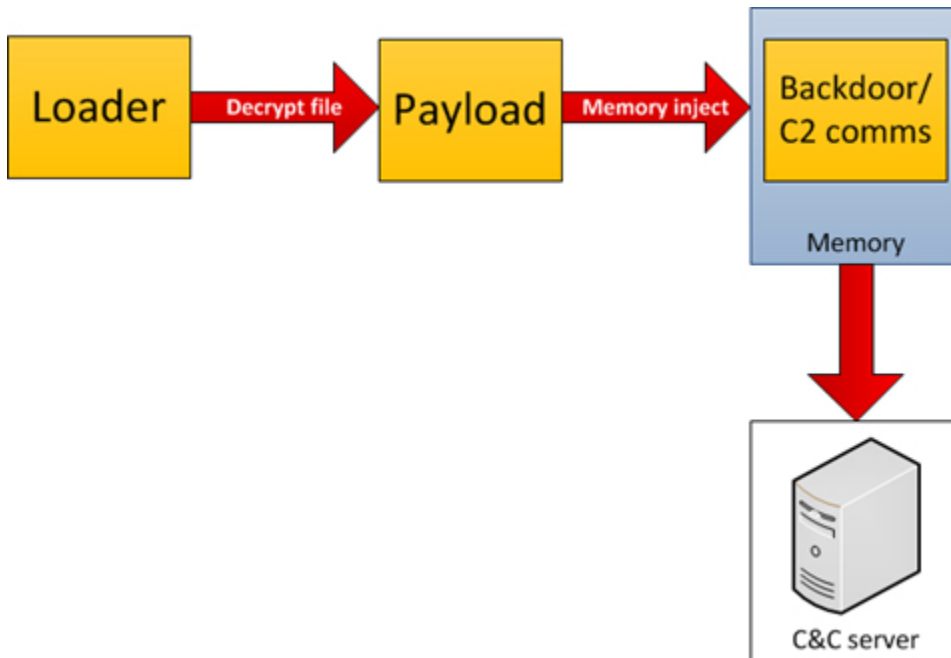
MSC.BAT file has the following contents:

```
chcp 1251
:Repeat
attrib -a -s -h -r "%DROPPER_FILE%"
del "%DROPPER_FILE%"
if exist "%DROPPER_FILE%" goto Repeat
del "%TEMP%msc.bat"
```

Another noteworthy fact is in the first line of this file, which is a command to switch the codepage of an infected system to 1251. This is required to address files and directories that contain Cyrillic characters in their names.



The "LHAFD.GCP" file is encrypted with RC4 and compressed with the "Zlib" library. This file is essentially a backdoor, which is decoded by the loader module (svchost.exe). The decrypted file is injected into system memory and is responsible for communication with the C&C server.



On any infected system, every major task is performed by the main backdoor component. The main component is started only after its loader (“svchost.exe”) checks if the internet connection is available. It does so by connecting to three Microsoft hosts:

- update.microsoft.com
- www.microsoft.com
- support.microsoft.com

```

s NT\CurrentVersion\Winlogon Lha Software\Microsoft\Windows\CurrentVersion\Run
3497888hf8943hf89j389fj8934jf9843jf983j489fjj43ghkjnsdfjh8f8374 34
97888hf8943hf89i389fi8934jf9843jf983j489fjj43ghkjnsdfjh8f8374 /
update.microsoft.com GET http://%s%s HTTP/1.1
Host: %s
Connection: close

/ www.microsoft.com GET http://%s%s HTTP/1.1
Host: %s
Connection: close

/ support.microsoft.com GET http://%s%s HTTP/1.1
Host: %s
Connection: close

```

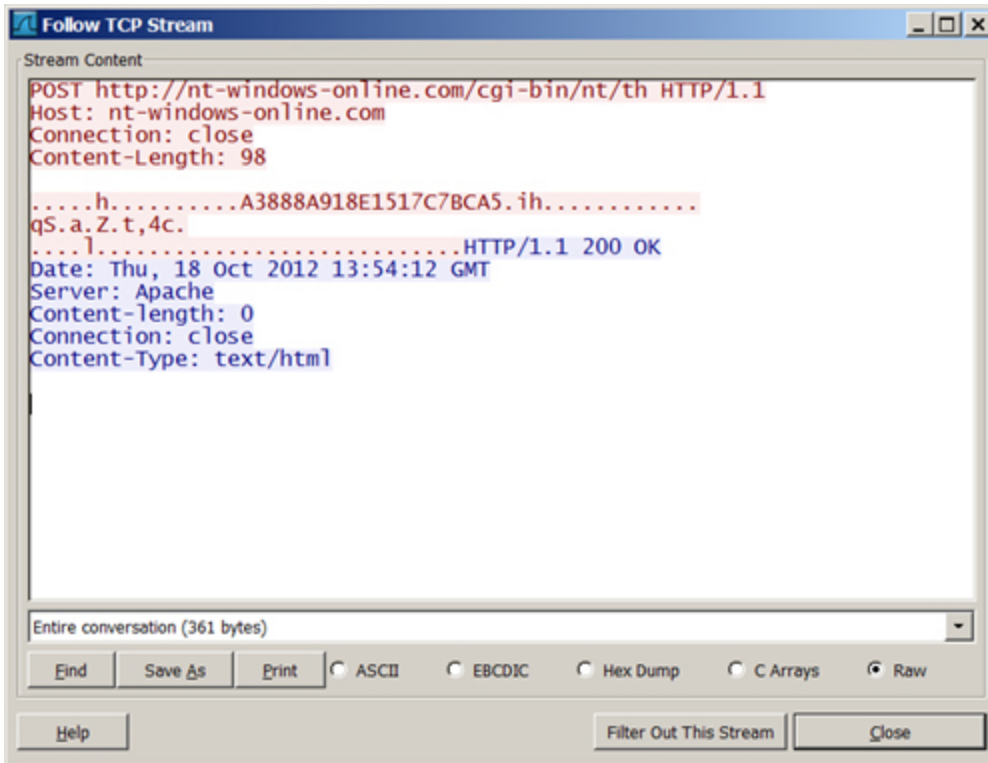
Figure – Hosts used to validate internet connection

After the Internet connection is validated, the loader executes the main backdoor component that connects to its C&C servers:

123	178.63.208.49	TCP	62 fpo-fns > http [SYN] Seq=0 Win=65535 Len=0 MSS=1
124		TCP	58 http > fpo-fns [SYN, ACK] Seq=0 Ack=1 Win=65535
125		TCP	60 fpo-fns > http [ACK] Seq=1 Ack=1 Win=65535 Len=0
126		TCP	182 [TCP segment of a reassembled PDU]
127		TCP	54 http > fpo-fns [ACK] Seq=1 Ack=129 Win=65535 Len=
128		HTTP	152 POST http://nt-windows-online.com/cgi-bin/nt/th
129		TCP	54 http > fpo-fns [ACK] Seq=1 Ack=227 Win=65535 Len=
130	178.63.208.49	HTTP	189 HTTP/1.1 200 OK
131		TCP	54 http > fpo-fns [FIN, ACK] Seq=136 Ack=227 Win=65
132		TCP	60 fpo-fns > http [ACK] Seq=227 Ack=137 Win=65400 L
133		TCP	60 fpo-fns > http [FIN, ACK] Seq=227 Ack=137 Win=65
134		TCP	54 http > fpo-fns [ACK] Seq=137 Ack=228 Win=65535 L
135		ARP	
136		ARP	

Capture of malware's communication with the C2

The connections with the C&C are encrypted – different encryption algorithms are used to send and receive data.



Encrypted communication with the C2

During our investigation, we found more than 60 different command-and-control domains. Each malware sample contains three such domains, which are hardcoded inside the main backdoor component:

```

"EO |EO 1EO ÄEO OEO æEO oEO
F0 $F0 ->0 .>0 >>0 L>0 d>0 t>0 .>0 ">0 ç>0 ,>0 Æ>0 Ú>0 i>0 _>0 +?0 (?0 >?0 T
?0 b?0 r?0 ,?0 Z?0 o?0 ã?0 1?0 E?0 0?0 ä?0 ú?0 Í0 $0 80 R0 @ 10 10 ?0 z
0 ?0 E0 00 i0 A0 J0 A0 -A0 ,A0 :A0 B0 P0 A0 b0 p0 ,A0 -A0 A0 °A0 ¼A0 IA0 0
A0 æA0 ôA0 J0 B0 $0 B0 T0 B0 n0 B0 s0 B0 r0 B0 _B0 I0 B0 Û0 B0 ô0 B0 ô0 B0 Ç0 B0 "C0 0C0 F
C0 UC0 dC0 rC0 SC0 PC0 %C0 ÖC0 iC0 ãD0 ID0 ^D0 8D0 RD0 dD0 xD0 -D0 ãD0 ãD0 ED0 0
D0 äD0 dD0 oD0 0EO ↑EO (EO 2EO 0EO REO bEO vEO +EO FFO `FO jFO lFO ZFO
oFO ♦ ?v ?t ?? ?! ?ç ?4 ? ?s ?o ?Q ?!! ? 4FO
·l0?20É0Nl0o'0Gz0 xI0F+0 hz0 bestcrypt_update
nt-windows-online.com;nt-windows-update.com;nt-windows-check.com
START DATA
BEGIN DATA
END OF DATA /cgi-bin/nt/th kernel32.dll RegisterServiceProcess \ \
.exe wb wb dll wb BestCrypt Software\Microsoft\Windows\CurrentVersion
n\Run \ %c:\ %c:\ %c:\ %I64u . Trun ProgramFilesDir Soft
ware\Microsoft\Windows\CurrentVersion CommonFilesDir Software\Microsoft\Windo
ws\CurrentVersion AppData SystemDrive Software\Microsoft\Windows\CurrentVersio
n\Explorer\Shell Folders ALLUSERSPROFILE SystemRoot ProgramFiles UserProf
ile Temp \Windows NT \Windows NT\Accessories \Windows NT\Pinball \Windows Med
ia Player \Web Publish \Outlook Express \Microsoft Office\Office10\Data
\Microsoft Office\Office10 \Microsoft Frontpage \Internet Explorer \ComPlus
Applications \Microsoft Shared\MeInfo \Microsoft Shared\Office10 \Proof

```

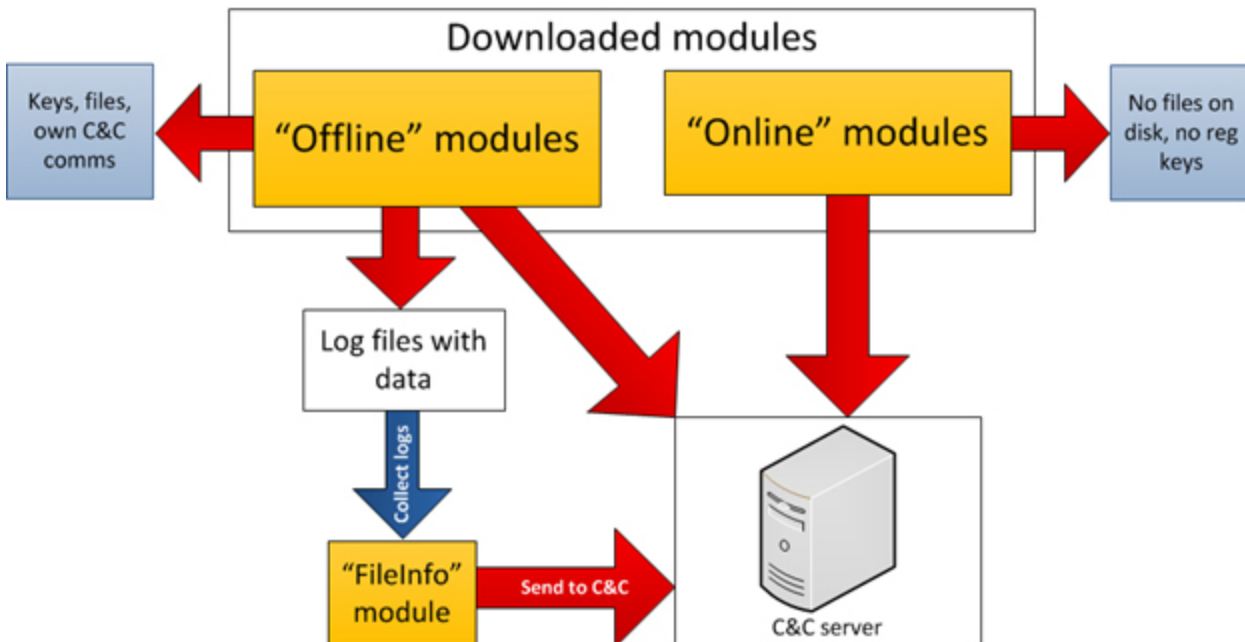
Hardcoded C2 domains inside backdoor

Step-by-step description (2nd stage)

After a connection with the C&C server is established, the backdoor starts the communication process, which leads to the loading of additional modules. These modules can be split into two categories: “offline” and “online”.

The main difference between these categories is their behavior on the infected system:

- “Offline”: exists as files on local disk, capable of creating its own system registry keys, local disk log files, and may communicate with C&C servers on their own.
- “Online”: exists only in system memory and is never saved to local disk, do not create registry keys, all logs are also kept in memory instead of local disk and sends the result of work to the C&C server using own code.



There is a notable module among all others, which is essentially created to be embedded into Adobe Reader and Microsoft Office applications. The main purpose of its code is to create a foolproof way to regain access to the target system. The module expects a specially crafted document with attached executable code and special tags. The document may be sent to the victim via e-mail. It will not have an exploit code and will safely pass all security checks. However, like with exploit case, the document will be instantly processed by the module and the module will start a malicious application attached to the document.

This trick can be used to regain access to the infected machines in case of unexpected C&C servers shutdown/takeover.

Timeline

We have identified over 1000 different malicious files related to over 30 modules of this Trojan kit. Most of them were created between May 2010 and October 2012.

There were 115 file-creation dates identified which are related to these campaigns via emails during the last two and a half years. Concentration of file creation dates around a particular day may indicate date of the massive attacks (which was also confirmed by some of our side observations):

Year 2010

- 19.05.2010
- 21.07.2010
- 04.09.2010

Year 2011

- 05.01.2011
- 14.03.2011
- 05.04.2011
- 23.06.2011
- 06.09.2011
- 21.09.2011

Year 2012

12.01.2012

Below is a list of sample attachment filenames that were sent to some of the victims:

File name:

Katyn_-_opinia_Rosjan.xls

FIEO contacts update.xls
spisok sotrudnikov.xls
List of shahids.xls
Spravochnik.xls
Telephone.xls
BMAC Attache List – At 11 Oct_v1[1].XLS
MERCOSUR_Imports.xls
Cópia de guia de telefonos (2).xls
Programme de fetes 2011.xls
12 05 2011 updated.xls
telefonebi.xls

Targets

We used two approaches to identify targets for these attacks. First, we used the Kaspersky Security Network (KSN) and then we set up our own sinkhole server. The data received using two independent ways was correlating and this confirmed objective findings.

KSN statistics

The attackers used already detected exploit codes and because of this, in the beginning of the research we already had some statistics of detections with our anti-malware software. We searched for similar detections for the period of 2011-2012.

That is how we discovered more than 300 unique systems, which had detected at least one module of this Trojan kit.

RUSSIAN FEDERATION	35
KAZAKHSTAN	21
AZERBAIJAN	15
BELGIUM	15
INDIA	15
AFGHANISTAN	10

ARMENIA	10
IRAN	7
TURKMENISTAN	7
UKRAINE	6
UNITED STATES	6
VIET NAM	6
BELARUS	5
GREECE	5
ITALY	5
MOROCCO	5
PAKISTAN	5
SWITZERLAND	5
UGANDA	5
UNITED ARAB EMIRATES	5
BRAZIL	4
FRANCE	4
GEORGIA	4
GERMANY	4
JORDAN	4
MOLDOVA	4
SOUTH AFRICA	4
TAJIKISTAN	4
TURKEY	4
UZBEKISTAN	4
AUSTRIA	3
CYPRUS	3

KYRGYZSTAN	3
LEBANON	3
MALAYSIA	3
QATAR	3
SAUDI ARABIA	3
CONGO	2
INDONESIA	2
KENYA	2
LITHUANIA	2
OMAN	2
TANZANIA	2

Countries with more than one infections

Once again, this is based on data from Kaspersky AV products. Apparently, real number and list of victim names is much larger than mentioned above.

Sinkhole statistics

During our analysis, we uncovered more than 60 different domains used by different variants of the malware.

Out of the list of domains, several were expired so we registered them to evaluate the number of victims connecting to them.

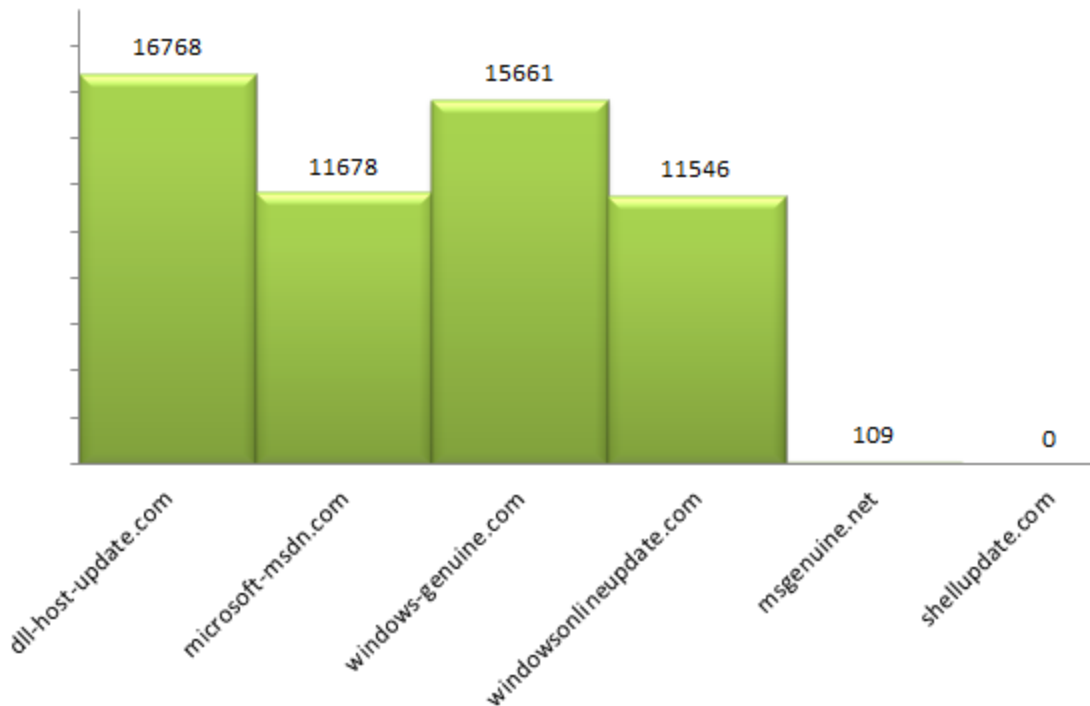
The following domains have been registered and sinkholed by Kaspersky Lab:

Domain	Date sinkholed
shellupdate.com	5-Dec-2012
msgenuine.net	19-Nov-2012
microsoft-msdn.com	5-Nov-2012
windowsonlineupdate.com dll-host-update.com windows-genuine.com	2-Nov-2012

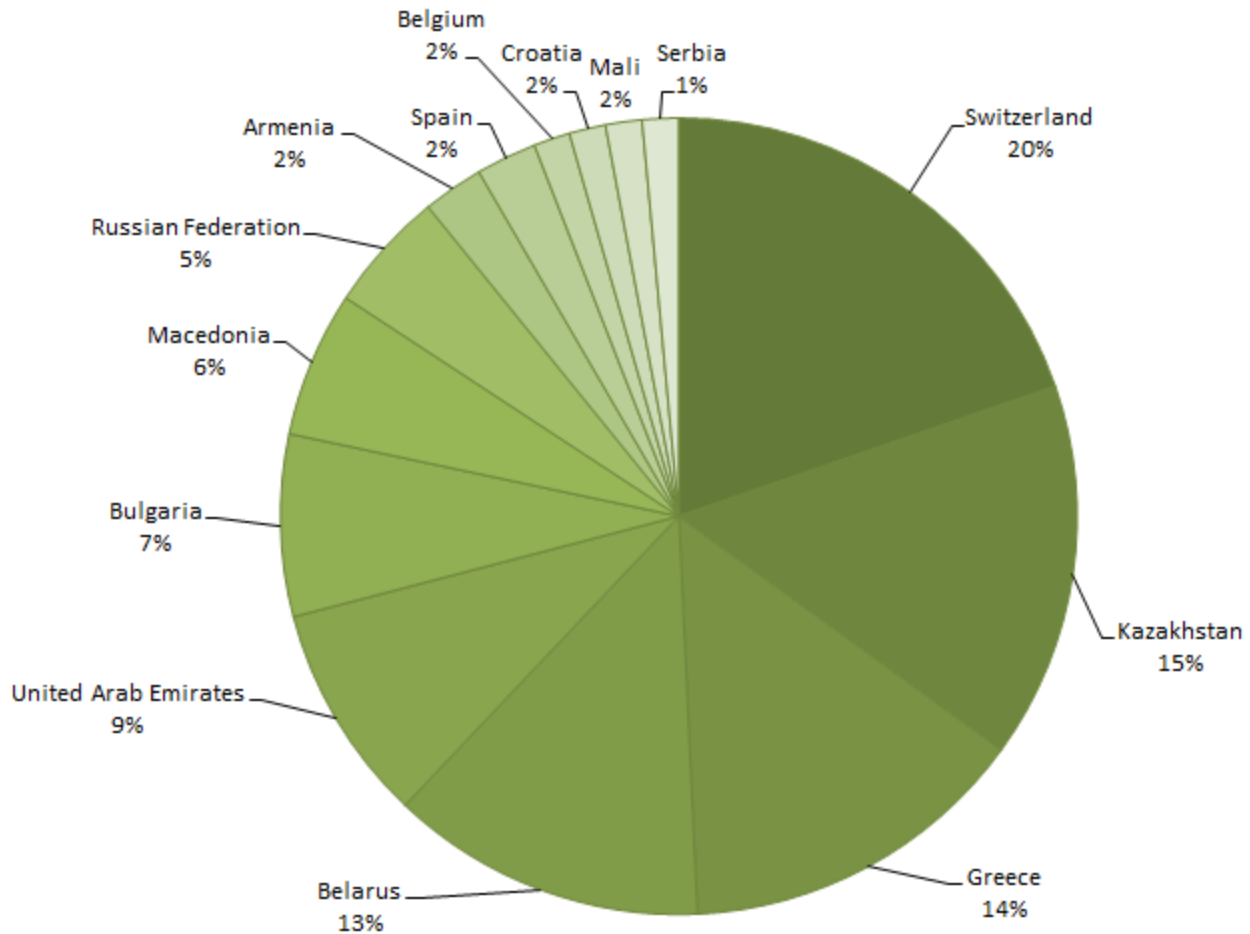
All the sinkholed domains currently point to “95.211.172.143”, which is Kasperskys’ sinkhole server.

During the monitoring period (2- Nov 2012 – 10 Jan 2013), we registered over 55,000 connections to the sinkhole. The most popular domain is “dll-host-update.com”, which is receiving most of the traffic.

Sinkholed domains - number of connections 2 Nov 2012 - 3 Jan 2013



From the point of view of country distribution of connections to the sinkhole, we have observed victims in 39 countries, with most of IPs being from Switzerland. Kazakhstan and Greece follow next.



Interestingly, when connecting to the sinkhole, the backdoors submit their unique victim ID, which allows us to separate the multiple IPs per victims.

```

00: 50 4F 53 54 20 2F 63 67 69 2D 62 69 6E 2F 64 6C POST /cgi-bin/dl
10: 6C 68 6F 73 74 2F 61 63 20 0A 51 55 45 52 59 20 lhost/ac QUERY
20: 0A 04 00 00 00 34 9B 5E 20 00 00 00 00 00 00 00 C 4>^
30: 00 46 44 36 31 33 32 39 35 30 33 39 30 30 35 43 FD613295039005C
40: 44 31 33 32 35 D9 7D 0D 13 00 00 00 00 00 00 00 D1325U)F!!
50: 00 00 00 07 9B 55 68 B7 A6 B3 F1 08 48 B4 12 9C .>Uh | 3R H' fo
60: D6 04 DB 6C CC E6 D6 00 00 00 00 00 00 00 00 00 00 Ö♦U1IæÖ
70: 00 00 00 00 00 00 00 00 00 00 00 C8 91 56 3A 00 E`U:
80: 00 00 00
  
```

Based on the traffic received to our sinkhole, we created the following list of unique victim IDs, countries and possible profiles:

Victim ID	Country	Victim profile
0706010C1BC0B9E5B702	Kazakhstan	Gov research institute
0F746C2F283E2FACE581	Kazakhstan	?
150BD7E7449C42C66ED1	Kazakhstan	?

15B7400DBC4975BFAEF6	Austria	?
24157B5D2CD0CA8AA602	UAE	?
3619E36303A2A56DC880	Russia	Foreign Embassy
4624C55DEF872FBF2A93	Spain	?
4B5181583F843A904568	Spain	?
4BB2783B8AEC0B439CE8	Switzerland	?
5392032B24AAEE8F3333	Kazakhstan	?
569530675E86118895C4	Pakistan	?
57FE04BA107DD56D2820	Iran	Foreign Embassy
5D4102CD1D87417FF93B	Russia	Gov research institute
5E65486EF8CC4EE4DB5B	Japan	Foreign Trade Commission
6127D685ED1E72E09201	Kazakhstan	?
6B9AFF89A02958C79C17	Ireland	Foreign Embassy
6D97B24C08DD64EEDE03	Czech Republic	?
7B14DE85C80368337E87	Turkey	?
89BF96469244534DC092	Belarus	Gov research institute
8AA071A22BEDD8D8EC13	Moldova	Government
8C58407030570D3A3F52	Albania	?
947827A169348FB01E2F	Bosnia and Herzegovina	?
B34C94D561B348EAC75D	Switzerland	?
B49FC93701E7B7F83C44	Belgium	?
B6E4946A47FC3963ABC1	Kazakhstan	Energy research group
C978C25326D96C995038	Russia	?
D48A783D288DC72A702B	Kazakhstan	Aerospace
DAE795D285E0A01ADED5	Russia	Trading company
DD767EEEF83A62388241	Russia	Gov research institute

In some cases, it is possible to create a profile of the victim based on the IP address; in most of the cases, however, the identity of the victim remains unknown.

KSN + sinkhole data

Some of the victim organizations were identified using IP addresses and public WHOIS information or remote system names.

Most “interesting” out of those are:

Algeria – Embassy

Afghanistan – Gov, Military, Embassy,

Armenia – Gov, Embassy

Austria – Embassy

Azerbaijan – Oil/Energy, Embassy, Research,

Belarus – Research, Oil/Energy, Gov, Embassy

Belgium – Embassy

Bosnia and Herzegovina – Embassy

Botswana – Embassy

Brunei Darussalam – Gov

Congo – Embassy

Cyprus – Embassy, Gov

France – Embassy, Military

Georgia – Embassy

Germany – Embassy

Greece – Embassy

Hungary -Embassy

India – Embassy

Indonesia – Embassy

Iran – Embassy

Iraq – Gov

Ireland – Embassy

Israel – Embassy

Italy -Embassy

Japan – Trade, Embassy

Jordan – Embassy

Kazakhstan – Gov, Research, Aerospace, Nuclear/Energy, Military

Kenya – Embassy

Kuwait – Embassy

Latvia – Embassy

Lebanon – Embassy

Lithuania – Embassy

Luxembourg – Gov

Mauritania – Embassy

Moldova – Gov, Military, Embassy

Morocco – Embassy

Mozambique – Embassy

Oman – Embassy

Pakistan – Embassy

Portugal – Embassy

Qatar – Embassy

Russia – Embassy, Research, Military, Nuclear/Energy

Saudi Arabia – Embassy

South Africa – Embassy

Spain – Gov, Embassy

Switzerland – Embassy

Tanzania – Embassy

Turkey – Embassy

Turkmenistan – Gov, Oil/Energy

Uganda – Embassy

Ukraine – Military

United Arab Emirates – Oil/Energy, Embassy, Gov

United States – Embassy

Uzbekistan – Embassy

C&C information

A list of the most popular domains used for command and control can be found below:

Domain	Registered by	Registrant e-mail	Created
nt-windows-online.com	Ustuygov Denis Egorovich	ustuygov_d@mail.ru	1-Apr-11
genuine-check.com	Privacy Protect	?	18-Jun-10
genuineupdate.com	Igor Shaven / Sellsgroup LLC	shaven@mail.ru	21-Jun-10
nt-windows-update.com	Privacy Protect	?	1-Apr-11
nt-windows-check.com	Privacy Protect	?	4-Apr-11
genuineservicecheck.com	Igor S Zorin	zorin_24@mail.ru	24-Jun-10
svchost-check.com	Denis Kajan	dkajan@list.ru	7-Jun-11
svchost-online.com	Privacy Protect	?	7-Jun-11
microsoftsupdate.com	Simmy Tujk	simmutijjk@rambler.ru	5-Dec-08
microsoft-msdn.com	SINKHOLED Simmu Ivanovich / Suur-Karja	stijk@yandex.ru	6-Dec-08
microsoftcheck.com	Privacy Protect	?	5-Dec-08
msinfoonline.org	Yuriy Poletaev	kleyton107@rambler.ru	12-Nov-07
win-check-update.com	Privacy Protect	?	22-Dec-09
mobile-update.com	Privacy Protect	?	14-Jan-11
ms-software-check.com	Denis gartovanov	gartovanov@bk.ru	26-Sep-11
ms-software-update.com	Valdis Nevelskij	nevelskij@bk.ru	26-Sep-11
ms-software-genuine.com	Sergej Kalinin	kaliniserg@rambler.ru	26-Sep-11
windowscheckupdate.com	Privacy Protect	?	27-Oct-09
windows-genuine.com	SINKHOLED Pushkareva Sofya Sergeevna	pyshkareva_76@mail.ru	27-Oct-09
windowonlineupdate.com	SINKHOLED Jan kilkys	kilkys@yandex.ru	27-Oct-09
csrss-check-new.com	Privacy Protect	?	27-Apr-12
csrss-update-new.com	Leonid Kluev	kluev.leonid@rambler.ru	27-Apr-12
csrss-upgrade-new.com	Aleksandr Lavrov	aleksandriavrov@lenta.ru	3-May-12
dll-host-update.com	SINKHOLED NEVER REGISTERED	SINKHOLED	2-Nov-12
dll-host-check.com	Volin Sergej	volinsergej@yandex.ru	4-Oct-10
dll-host.com	Sergej I Orlov	orlov.orloffsergej@yandex.ru	1-Oct-10
win-driver-upgrade.com	Lykash V.D.	lykashvadim@rambler.ru	11-Apr-12
update-genuine.com	Valdas Palajtis / thinks Sells	valdas-palajtis@yandex.ru	22-Apr-09
svchost-update.com	Sergej Dumkovskij	dumkovskij@rambler.ru	7-Jun-11
os-microsoft-check.com	Contact Privacy Inc. Customer 0123124787	?	23-Feb-10
xponlineupdate.com	Eherik Kristi	eherik-kirsti@rambler.ru	5-Nov-08
dll-host-udate.com	Privacy Protect	?	4-Oct-10
new-driver-upgrade.com	Dima Grivenev	dgriven@mail.ru	21-Mar-12
dllupdate.info	Privacy Protect	?	1-Oct-08
os-microsoft-update.com	Syhar Denis Ivavovich	den-syhar@rambler.ru	23-Feb-10
wingenuine.com	Privacy Protect	?	31-Mar-09
drivers-update-online.com	Ivan lystenko	lystenko@inbox.ru	1-Feb-10
wins-update.com	Igor Proskyren	praskyren@mail.ru	11-Feb-08
wins-driver-update.com	Privacy Protect	?	11-04-2012
msonlineupdate.com	Denis Dumkov	denis-dumkov@rambler.ru	14-04-2010
wins-driver-check.com	anton Zinin	zinin-ant@bk.ru	11-04-2012
drivers-check.com	Mihail Stupin	stypin_86@mail.ru	11-Oct-12
drivers-get.com	Igor Sidorenko	sidorenko_81@list.ru	5-Feb-12
osgenuine.com	Vidmans Semenov	vidmans-semenov@yandex.ru	22-Apr-09
msgenuine.net	SINKHOLED Vacheslav Bulanov	BULANOV24@YAHOO.COM	22-May-07
msonlinecheck.com	Denis Butov	botov_denis@mail.ru	14-Apr-10
msonlineget.com	Demidkov Denis	denis_demidkov@mail.ru	18-May-10

Interestingly, although the domain “dll-host-update.com” appears in one of the malware configurations, it had not been registered by the attackers. The domain has since been registered by Kaspersky Lab on Nov 2nd, 2012 to monitor the attacker’s activities.

Another interesting example is “dll-host-udate.com” – the “udate” part appears to be a typo.

All the domains used by attackers appear to have been registered between 2007-2012. The oldest known domain was registered in Nov 2007; the newest on May 2012.

Most of the domains have been registered using the service “reg.ru”, but other services such as “webdrive.ru”, “webnames.ru” or “timeweb.ru” have been used as well.

During our monitoring, we observed the domains pointing to several malicious web servers. A list of servers with confirmed malicious behavior can be found below.

In total, we have identified 10 different servers which exhibited confirmed malicious behavior. Most of these servers are located in Germany, at Hetzner Online Ag.

IP	Active	Confirmed Malicious	Location	Hosting
141.101.239.225	Oct-12	Yes	Russia	Leadertelecom Ltd.
178.63.208.49	Oct-12	Yes	Germany	Nuremberg Hetzner Online Ag
188.40.19.247	Oct-12	Yes	Germany	Nuremberg Hetzner Online Ag
37.235.54.48	Oct-12	Yes	-unclear- ? Austria / UK /Spain	Edis Gmbh
78.46.173.15	Oct-12	Yes	Germany	Nuremberg Hetzner Online Ag
88.198.30.44	Oct-12	Yes	Germany	Nuremberg Hetzner Online Ag
88.198.85.161	Oct-12	Yes	Germany	Nuremberg Hetzner Online Ag
92.53.105.40	Oct-12	Yes	Russia	Ooo Lira-s
31.41.45.119	Nov-12	Yes	Russia	Relink Ltd
176.9.241.254	Nov-12	Yes	Germany	Nuremberg Hetzner Online Ag

During our analysis, we were able to obtain an image of one of the command-and-control servers. The server itself proved to be a proxy, which was forwarding the request to another server on port 40080. The script responsible for redirections was found in /root/scp.pl and relies on the “socat” tool for stream redirection.

By scanning the Internet for computers with port 40080 open, we were able to identify three such servers in total, which we call “mini-motherships”:

IP	Date	Confirmed malicious	Country	ISP
31.41.45.139	Oct-12	Yes, mini-mothership	Russia	Relink Ltd.
91.226.31.40	Oct-12	Yes, mini-mothership	Russia	i7 Ltd
178.63.208.63	Oct-12	Yes, mini-mothership	Germany	Nuremberg Hetzner Online Ag

Connecting to these hosts on port 40080 and fetching the index page, we get the following standard content which is identical in all C&Cs:

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<html>
<head>
<title>BBC - Homepage</title>
<meta http-equiv="REFRESH"
content="0;url=http://www.bbc.com/"></HEAD>
</HTML>
```

Fetching the index info (via HTTP "HEAD") for these servers, reveals the following:

```
curl -I -referer "http://www.google.com/" -user-agent "Mozilla/4.0 (compatible; MSIE 6.0;
Windows NT 5.1)" http://31.41.45.139:40080
```

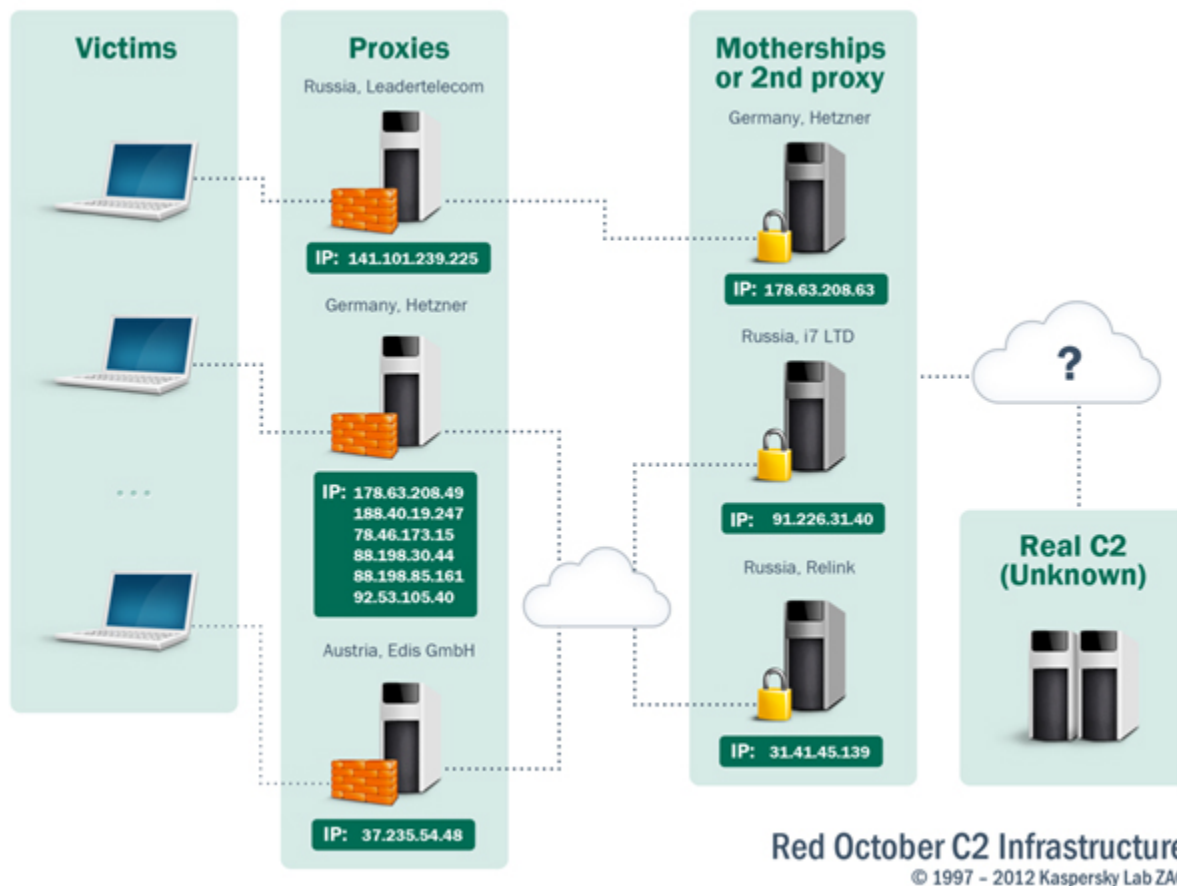
```
HTTP/1.1 200 OK
Date: Mon, 12 Nov 2012 09:58:37 GMT
Server: Apache
Last-Modified: Tue, 21 Feb 2012 09:00:41 GMT
ETag: "8c0bf6-ba-4b975a53906e4"
Accept-Ranges: bytes
Content-Length: 186
Content-Type: text/html
```

```
curl -I -referer "http://www.google.com/" -user-agent "Mozilla/4.0 (compatible; MSIE 6.0;
Windows NT 5.1)" http://178.63.208.63:40080
```

```
HTTP/1.1 200 OK
Date: Mon, 12 Nov 2012 09:59:09 GMT
Server: Apache
Last-Modified: Tue, 21 Feb 2012 09:00:41 GMT
ETag: "8c0bf6-ba-4b975a53906e4"
Accept-Ranges: bytes
Content-Length: 186
Content-Type: text/html
```

It should be noted that the "last modified" field of the pages points to the same date: Tue, 21 Feb 2012 09:00:41 GMT. This is important and probably indicates that the three known mini-motherships are probably just proxies themselves, pointing to the same top level "mothership" server.

This allows us to draw the following diagram of the C&C infrastructure as of November 2012:



For the Command and Control servers, the various generations of the backdoor connect to different scripts:

Domain	Script location
nt-windows-update.com, nt-windows-check.com, nt-windows-online.com	/cgi-bin/nt/th /cgi-bin/nt/sk
dll-host-update.com	/cgi-bin/dllhost/ac
microsoft-msdn.com	/cgi-bin/ms/check /cgi-bin/ms/flush
windows-genuine.com	/cgi-bin/win/wcx /cgi-bin/win/cab
windowonlineupdate.com	/cgi-bin/win/cab

For instance, the script “/cgi-bin/nt/th” is being used to receive commands from the command-and-control server, usually in the form of new plugins to run on the victim’s computer. The “/cgi-bin/nt/sk” script is called by the running plugins to upload stolen data and

information about the victim.

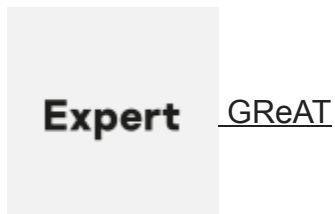
When connecting to the C&C, the backdoor identifies itself with a specific string which includes a hexadecimal value that appears to be the victim's unique ID. Different variants of the backdoor contain different victim IDs. Presumably, this allows the attackers to distinguish between the multitudes of connections and perform specific operations for each victim individually.

For instance, a top level XLS dropper presumably used against a Polish target, named "Katyn_-_opinia_Rosjan.xls" contains the hardcoded victim ID "F50D0B17F870EB38026F". A similar XLS named "tactlist_05-05-2011_.8634.xls / EEAS New contact list (05-05-2011).xls" possibly used in Moldova contains a victim ID "FCF5E48A0AE558F4B859".

Part 2 of this paper will cover malware modules and provide more technical details about their operation.

- [APT](#)
- [Cyber espionage](#)
- [Mobile Malware](#)
- [Spear phishing](#)
- [Targeted attacks](#)

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