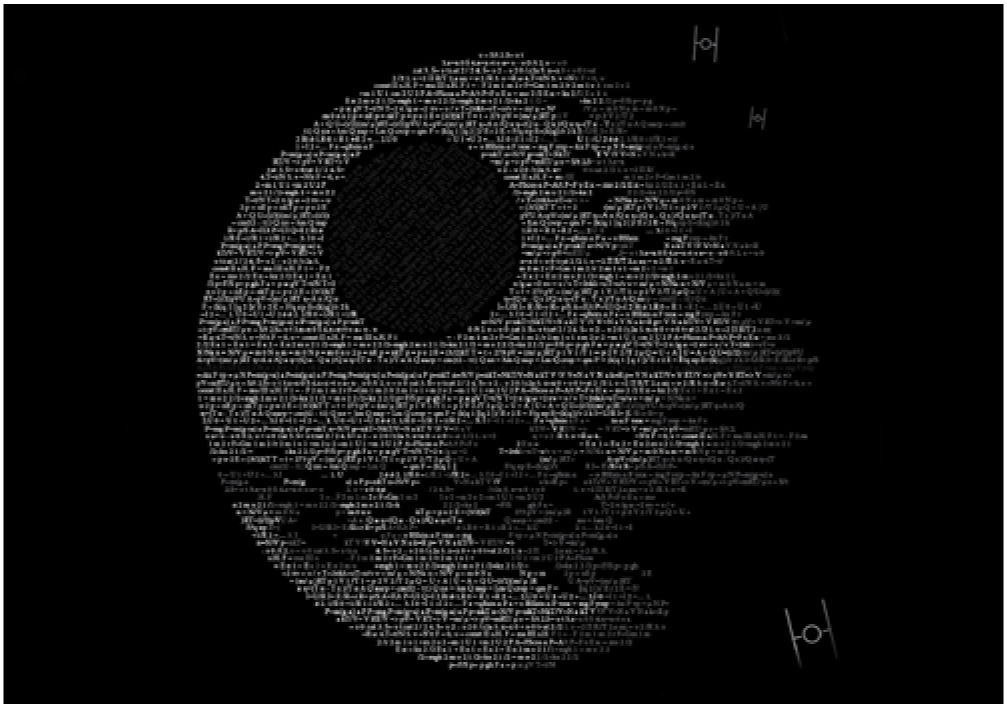
Equation: The Death Star of Malware Galaxy

securelist.com/equation-the-death-star-of-malware-galaxy/68750/



Authors

Expert GReAT

Download “Equation group: questions and answers” PDF

“Houston, we have a problem”

One sunny day in 2009, Grzegorz Brzęczyszczykiewicz[1] embarked on a flight to the burgeoning city of Houston to attend a prestigious international scientific conference. As a leading scientist in his field, such trips were common for Grzegorz. Over the next couple of days, Mr Brzęczyszczykiewicz exchanged business cards with other researchers and talked about the kind of important issues such high level scientists would discuss (which is another way of saying “who knows?”). But, all good things must come to an end; the conference finished and Grzegorz Brzęczyszczykiewicz flew back home, carrying with him many highlights from a memorable event. Sometime later, as is customary for such events, the organizers sent all the participants a CDROM carrying many beautiful pictures from the conference. As Grzegorz put the CDROM in his computer and the slideshow opened, he little suspected he had just became the victim of an almost omnipotent cyberespionage organization that had just infected his computer through the use of three exploits, two of them being zero-days.

A rendezvous with the "God" of cyberespionage

It is not known when the Equation[2] group began their ascent. Some of the earliest malware samples we have seen were compiled in 2002; however, their C&C was registered in August 2001. Other C&Cs used by the Equation group appear to have been registered as early as 1996, which could indicate this group has been active for almost two decades. For many years they have interacted with other powerful groups, such as the Stuxnet and Flame groups; always from a position of superiority, as they had access to exploits earlier than the others.

> The #EquationAPT group is probably one of the most sophisticated cyber attack groups in the world #TheSAS2015
>
> Tweet

Since 2001, the Equation group has been busy infecting thousands, or perhaps even tens of thousands of victims throughout the world, in the following sectors:

- Government and diplomatic institutions
- Telecoms
- Aerospace
- Energy
- Nuclear research
- Oil and gas
- Military
- Nanotechnology
- Islamic activists and scholars
- Mass media
- Transportation
- Financial institutions
- Companies developing encryption technologies

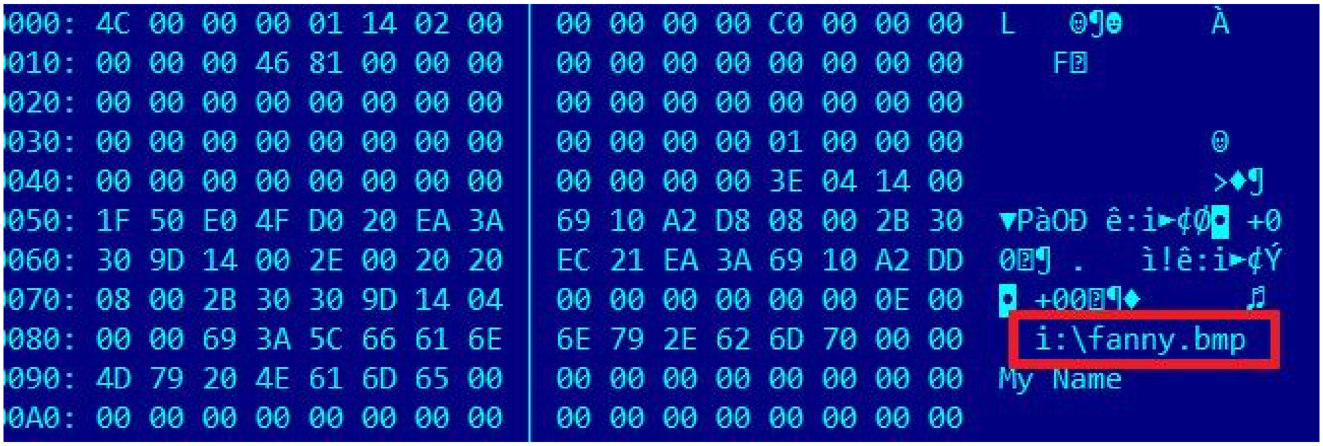
To infect their victims, the Equation group uses a powerful arsenal of "implants" (as they call their Trojans), including the following we have created names for: EQUATIONLASER, EQUATIONDRUG, DOUBLEFANTASY, TRIPLEFANTASY, FANNY and GRAYFISH. No doubt other "implants" exist which we have yet to identify and name.

> The #EquationAPT group interacted with other powerful groups, such as the #Stuxnet and #Flame groups #TheSAS2015
>
> Tweet

The group itself has many codenames for their tools and implants, including ***SKYHOOKCHOW, UR, KS, SF, STEALTHFIGHTER, DRINKPARSLEY, STRAITACID, LUTEUSOBSTOS, STRAITSHOOTER, DESERTWINTER*** and ***GROK***. Incredible as it may seem for such an elite group, one of the developers made the unforgivable mistake of leaving his username: "***RMGREE5***", in one of the malware samples as part of his working folder: "***c:\users\rmgree5\***".

Perhaps the **most powerful tool in the Equation group's arsenal** is a mysterious module known only by a cryptic name: "**nls_933w.dll**". It allows them to **reprogram the hard drive firmware** of over a dozen different hard drive brands, including Seagate, Western Digital, Toshiba, Maxtor and IBM. This is an astonishing technical accomplishment and is testament to the group's abilities.

Over the past years, the Equation group has performed many different attacks. One stands out: the **Fanny** worm. Presumably compiled in July 2008, it was first observed and blocked by our systems in December 2008. Fanny used **two zero-day exploits**, which were later uncovered during the discovery of Stuxnet. To spread, it used the Stuxnet LNK exploit and USB sticks. For escalation of privilege, Fanny used a vulnerability patched by the Microsoft bulletin **MS09-025**, which was also used in one of the early versions of Stuxnet from 2009.



```
000: 4C 00 00 00 01 14 02 00 │ 00 00 00 00 C0 00 00 00  L   ☺¶☻     À
010: 00 00 00 46 81 00 00 00 │ 00 00 00 00 00 00 00 00     F
020: 00 00 00 00 00 00 00 00 │ 00 00 00 00 00 00 00 00
030: 00 00 00 00 00 00 00 00 │ 00 00 00 00 01 00 00 00              ☺
040: 00 00 00 00 00 00 00 00 │ 00 00 00 00 3E 04 14 00              >♦¶
050: 1F 50 E0 4F D0 20 EA 3A │ 69 10 A2 D8 08 00 2B 30  ▼PàOÐ ê:i►¢Ø◘ +0
060: 30 9D 14 00 2E 00 20 20 │ EC 21 EA 3A 69 10 A2 DD  0¶ .   ì!ê:i►¢Ý
070: 08 00 2B 30 30 9D 14 04 │ 00 00 00 00 00 00 0E 00  ◘ +00¶♦       ♫
080: 00 00 69 3A 5C 66 61 6E │ 6E 79 2E 62 6D 70 00 00    i:\fanny.bmp
090: 4D 79 20 4E 61 6D 65 00 │ 00 00 00 00 00 00 00 00  My Name
0A0: 00 00 00 00 00 00 00 00 │ 00 00 00 00 00 00 00 00
```

LNK exploit as used by Fanny

It's important to point out that these two exploits were **used in Fanny before they were integrated into Stuxnet**, indicating that the Equation group had access to these zero-days *before* the Stuxnet group. The main purpose of Fanny was the **mapping of air-gapped networks**. For this, it used a unique USB-based command and control mechanism which allowed the attackers to pass data back and forth from air-gapped networks.

> Two zero-day exploits were used by the #EquationAPT group before they were integrated into #Stuxnet #TheSAS2015
>
> Tweet

In the coming days, we will publish more details about the Equation group malware and their attacks. The first document to be published will be a general FAQ on the group together with indicators of compromise.

By publishing this information, we hope to bring it to the attention of the ITSec community as well as independent researchers, who can extend the understanding of these attacks. The more we investigate such cyberespionage operations, we more we understand how little we actually know about them. Together, we can lift this veil and work towards a more secure (cyber-)world.

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Indicators of compromise (“one of each”):

Name	EquationLaser
MD5	752af597e6d9fd70396accc0b9013dbe
Type	EquationLaser installer
Compiled	Mon Oct 18 15:24:05 2004

Name	Disk from Houston “autorun.exe” with EoP exploits
MD5	6fe6c03b938580ebf9b82f3b9cd4c4aa
Type	EoP package and malware launcher
Compiled	Wed Dec 23 15:37:33 2009

Name	DoubleFantasy
MD5	2a12630ff976ba0994143ca93fecd17f
Type	DoubleFantasy installer
Compiled	Fri Apr 30 01:03:53 2010

Name	EquationDrug
MD5	4556ce5eb007af1de5bd3b457f0b216d
Type	EquationDrug installer (“LUTEUSOBSTOS”)
Compiled	Tue Dec 11 20:47:12 2007

Name	GrayFish
MD5	9b1ca66aab784dc5f1dfe635d8f8a904
Type	GrayFish installer
Compiled	Compiled: Fri Feb 01 22:15:21 2008 (installer)

Name	Fanny
MD5	0a209ac0de4ac033f31d6ba9191a8f7a
Type	Fanny worm
Compiled	Mon Jul 28 11:11:35 2008

Name	TripleFantasy	
MD5	9180d5affe1e5df0717d7385e7f54386	loader (17920 bytes .DLL)
Type	ba39212c5b58b97bfc9f5bc431170827	encrypted payload (.DAT)
Compiled	various, possibly fake	

Name	_SD_IP_CF.dll – unknown
MD5	03718676311de33dd0b8f4f18cffd488
Type	DoubleFantasy installer + LNK exploit package
Compiled	Fri Feb 13 10:50:23 2009

Name	nls_933w.dll
MD5	11fb08b9126cdb4668b3f5135cf7a6c5
Type	HDD reprogramming module
Compiled	Tue Jun 15 20:23:37 2010

Name	standalonegrok_2.1.1.1 / GROK
MD5	24a6ec8ebf9c0867ed1c097f4a653b8d
Type	GROK keylogger
Compiled	Tue Aug 09 03:26:22 2011

C&C servers (hostnames and IPs):

DoubleFantasy:

advancing-technology[.]com
avidnewssource[.]com
businessdealsblog[.]com
businessedgeadvance[.]com
charging-technology[.]com
computertechanalysis[.]com
config.getmyip[.]com – **SINKHOLED BY KASPERSKY LAB**
globalnetworkanalys[.]com
melding-technology[.]com
myhousetechnews[.]com – **SINKHOLED BY KASPERSKY LAB**
newsterminalvelocity[.]com – **SINKHOLED BY KASPERSKY LAB**
selective-business[.]com
slayinglance[.]com
successful-marketing-now[.]com – **SINKHOLED BY KASPERSKY LAB**
taking-technology[.]com
techasiamusicsvr[.]com – **SINKHOLED BY KASPERSKY LAB**
technicaldigitalreporting[.]com
timelywebsitehostesses[.]com
www.dt1blog[.]com
www.forboringbusinesses[.]com

EquationLaser:

lsassoc[.]com – **re-registered, not malicious at the moment**
gar-tech[.]com – **SINKHOLED BY KASPERSKY LAB**

Fanny:

webuysupplystore.mooo[.]com – **SINKHOLED BY KASPERSKY LAB**

EquationDrug:

newjunk4u[.]com
easyadvertonline[.]com
newip427.changeip[.]net – **SINKHOLED BY KASPERSKY LAB**
ad-servicestats[.]net – **SINKHOLED BY KASPERSKY LAB**
subad-server[.]com – **SINKHOLED BY KASPERSKY LAB**
ad-noise[.]net
ad-void[.]com
aynachatsrv[.]com

damavandkuh[.]com
fnlpic[.]com
monster-ads[.]net
nowruzbakher[.]com
sherkhundi[.]com
quik-serv[.]com
nickleplatedads[.]com
arabtechmessenger[.]net
amazinggreentechshop[.]com
foroushi[.]net
technicserv[.]com
goldadpremium[.]com
honarkhaneh[.]net
parskabab[.]com
technicupdate[.]com
technicads[.]com
customerscreensavers[.]com
darakht[.]com
ghalibaft[.]com
adservicestats[.]com
247adbiz[.]net – **SINKHOLED BY KASPERSKY LAB**
webbizwild[.]com
roshanavar[.]com
afkarehroshan[.]com
thesuperdeliciousnews[.]com
adsbizsimple[.]com
goodbizez[.]com
meevehdar[.]com
xlivehost[.]com
gar-tech[.]com – **SINKHOLED BY KASPERSKY LAB**
downloadmpplayer[.]com
honarkhabar[.]com
techsupportpwr[.]com
webbizwild[.]com
zhalehziba[.]com
serv-load[.]com
wangluoruanjian[.]com
islamicmarketing[.]net
noticiasftpsrv[.]com
coffeehausblog[.]com
platads[.]com
havakhosh[.]com

toofanshadid[.]com
bazandegan[.]com
sherkatkonandeh[.]com
mashinkhabar[.]com
quickupdateserv[.]com
rapidlyserv[.]com

GrayFish:

ad-noise[.]net
business-made-fun[.]com
businessdirectnessource[.]com
charmedno1[.]com
cribdare2no[.]com
dowelsobject[.]com
following-technology[.]com
forgotten-deals[.]com
functional-business[.]com
housedman[.]com
industry-deals[.]com
listennewsnetwork[.]com
phoneysoap[.]com
posed2shade[.]com
quik-serv[.]com
rehabretie[.]com
speedynewsclips[.]com
teatac4bath[.]com
unite3tubes[.]com
unwashedsound[.]com

TripleFantasy:

arm2pie[.]com
brittlefilet[.]com
cigape[.]net
crisptic01[.]net
fliteilex[.]com
itemagic[.]net
micraamber[.]net
mimicrice[.]com
rampagegramar[.]com
rubi4edit[.]com
rubiccrum[.]com

rubriccrumb[.]com
team4heat[.]net
tropiccritics[.]com

Equation group’s exploitation servers:

standardsandpraiserepurpose[.]com
suddenplot[.]com
technicalconsumerreports[.]com
technology-revealed[.]com

IPs hardcoded in malware configuration blocks:

149.12.71.2
190.242.96.212
190.60.202.4
195.128.235.227
195.128.235.231
195.128.235.233
195.128.235.235
195.81.34.67
202.95.84.33
203.150.231.49
203.150.231.73
210.81.52.120
212.61.54.239
41.222.35.70
62.216.152.67
64.76.82.52
80.77.4.3
81.31.34.175
81.31.36.174
81.31.38.163
81.31.38.166
84.233.205.99
85.112.1.83
87.255.38.2
89.18.177.3

Kaspersky products detection names:

- Backdoor.Win32.Laserv
- Backdoor.Win32.Laserv.b
- Exploit.Java.CVE-2012-1723.ad

- HEUR:Exploit.Java.CVE-2012-1723.gen
- HEUR:Exploit.Java.Generic
- HEUR:Trojan.Java.Generic
- HEUR:Trojan.Win32.DoubleFantasy.gen
- HEUR:Trojan.Win32.EquationDrug.gen
- HEUR:Trojan.Win32.Generic
- HEUR:Trojan.Win32.GrayFish.gen
- HEUR:Trojan.Win32.TripleFantasy.gen
- Rootkit.Boot.Grayfish.a
- Trojan-Downloader.Win32.Agent.bjqt
- Trojan.Boot.Grayfish.a
- Trojan.Win32.Agent.ajkoe
- Trojan.Win32.Agent.iedc
- Trojan.Win32.Agent2.jmk
- Trojan.Win32.Diple.fzbb
- Trojan.Win32.DoubleFantasy.a
- Trojan.Win32.DoubleFantasy.gen
- Trojan.Win32.EquationDrug.b
- Trojan.Win32.EquationDrug.c
- Trojan.Win32.EquationDrug.d
- Trojan.Win32.EquationDrug.e
- Trojan.Win32.EquationDrug.f
- Trojan.Win32.EquationDrug.g
- Trojan.Win32.EquationDrug.h
- Trojan.Win32.EquationDrug.i
- Trojan.Win32.EquationDrug.j
- Trojan.Win32.EquationDrug.k
- Trojan.Win32.EquationLaser.a
- Trojan.Win32.EquationLaser.c
- Trojan.Win32.EquationLaser.d
- Trojan.Win32.Genome.agegx
- Trojan.Win32.Genome.akyzh
- Trojan.Win32.Genome.ammqt
- Trojan.Win32.Genome.dyvi
- Trojan.Win32.Genome.ihcl
- Trojan.Win32.Patched.kc
- Trojan.Win64.EquationDrug.a
- Trojan.Win64.EquationDrug.b
- Trojan.Win64.Rozena.rpcs
- Worm.Win32.AutoRun.wzs

Yara rules:

```
rule apt_equation_exploitlib_mutexes {

meta:

   copyright = "Kaspersky Lab"
   description = "Rule to detect Equation group's Exploitation library"
   version = "1.0"
   last_modified = "2015-02-16"
   reference = "https://securelist.com/blog/"


strings:

   $mz="MZ"

   $a1="prkMtx" wide
   $a2="cnFormSyncExFBC" wide
   $a3="cnFormVoidFBC" wide
   $a4="cnFormSyncExFBC"
   $a5="cnFormVoidFBC"

condition:

(($mz at 0) and any of ($a*))
}
```

```
rule apt_equation_doublefantasy_genericresource {

meta:

   copyright = "Kaspersky Lab"
   description = "Rule to detect DoubleFantasy encoded config"
   version = "1.0"
   last_modified = "2015-02-16"
   reference = "https://securelist.com/blog/"

strings:

   $mz="MZ"
   $a1={06 00 42 00 49 00 4E 00 52 00 45 00 53 00}
   $a2="yyyyyyyyyyyyyyyy"
   $a3="002"


condition:

(($mz at 0) and all of ($a*))  and filesize &lt; 500000
}
```

```
rule apt_equation_equationlaser_runtimeclasses {

meta:

   copyright = "Kaspersky Lab"
   description = "Rule to detect the EquationLaser malware"
   version = "1.0"
   last_modified = "2015-02-16"
   reference = "https://securelist.com/blog/"

strings:

   $a1="?a73957838_2@@YAXXZ"
   $a2="?a84884@@YAXXZ"
   $a3="?b823838_9839@@YAXXZ"
   $a4="?e747383_94@@YAXXZ"
   $a5="?e83834@@YAXXZ"
   $a6="?e929348_827@@YAXXZ"

condition:

   any of them
}
```

```
rule apt_equation_cryptotable {

meta:

    copyright = "Kaspersky Lab"
    description = "Rule to detect the crypto library used in Equation group malware"
    version = "1.0"
    last_modified = "2015-02-16"
    reference = "https://securelist.com/blog/"

strings:


    $a={37 DF E8 B6 C7 9C 0B AE 91 EF F0 3B 90 C6 80 85 5D 19 4B 45 44 12 3C E2 0D 5C 1C 7B C4 FF D6 05 17 14 4F 03 74 1E 41 DA 8F 7D DE 7E 99 F1 35 AC B8 46 93 CE 23 82 07 EB 2B D4 72 71 40 F3 B0 F7 78 D7 4C D1 55 1A 39 83 18 FA E1 9A 56 B1 96 AB A6 30 C5 5F BE 0C 50 C1}


condition:

    $a

}
```

[1] pseudonym, to protect the original victim’s identity **>>**

[2] the name “Equation group” was given because of their preference for sophisticated encryption schemes **>>**

- APT

- Cyber espionage
- Equation
- Flame
- Gauss
- Spyware
- Stuxnet
- Targeted attacks

Authors

GReAT

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