Equation: The Death Star of Malware Galaxy

By GReAT on February 16, 2015. 6:55 pm

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"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
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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
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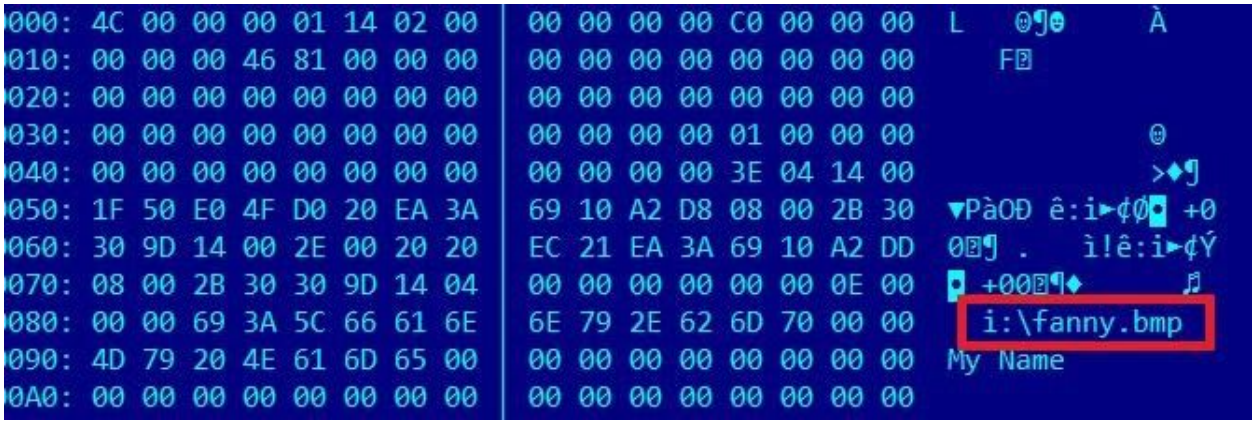
The group itself has many codenames for their tools and implants, including ***SKYHOOKCHOW, UR, KS, SF, STEALTHFIGHTER, DRINKPARSLEY, STRAITACID, LUTEUSOBSTOS, STRAITSHOOTER, DESERTWINTER*** and ***GROK***. Incredible as it may seem for such an elite group, one of the developers made the unforgivable 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.



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