MILE TEA: CYBER ESPIONAGE CAMPAIGN TARGETS ASIA PACIFIC BUSINESSES AND GOVERNMENT AGENCIES

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(This blog post is also available in Japanese.)

In June 2016, Unit 42 published the blog post "Tracking Elirks Variants in Japan: Similarities to Previous Attacks", in which we described the resemblance of attacks using the Elirks malware family in Japan and Taiwan.

Since then, we continued tracking this threat using Palo Alto Networks AutoFocus and discovered more details of the attacks, including target information. We've seen examples of this attack campaign, which we've named "MILE TEA" (MIcrass Logedrut Elirks TEA), appearing as early as 2011, and that it has since expanded the scope of targets. It involves multiple malware families and often tricks targets by sending purported flight e-tickets in email attachments. The identified targets include three separate Japanese trading companies, a Japanese petroleum company, a mobile phone organization based in Japan, the Beijing office of a public organization of Japan, and a government agency in Taiwan.

ATTACK OVERVIEW

Figure 1 shows the number of attacks considered as a part of the MILE TEA campaign since 2011. As we can see, the volume of the threats is small in total.

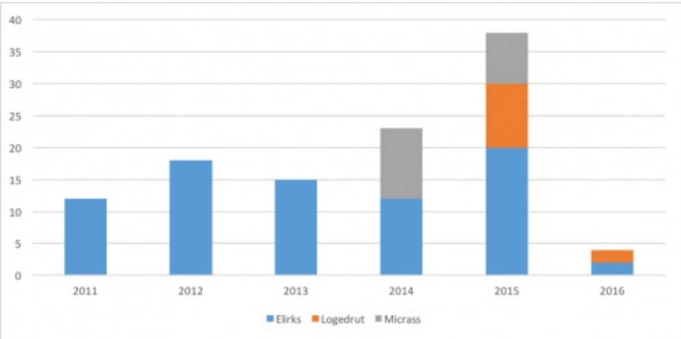


Figure 1 Number of threats used in the attack campaign

In the first three years, most of the reported attacks were from Taiwan. saw infections in a few other countries in Asia, but the number was miniscule. In mid-2013, the target base shifted to Japan. Since 2015, most of the reported attacks are from Japan.

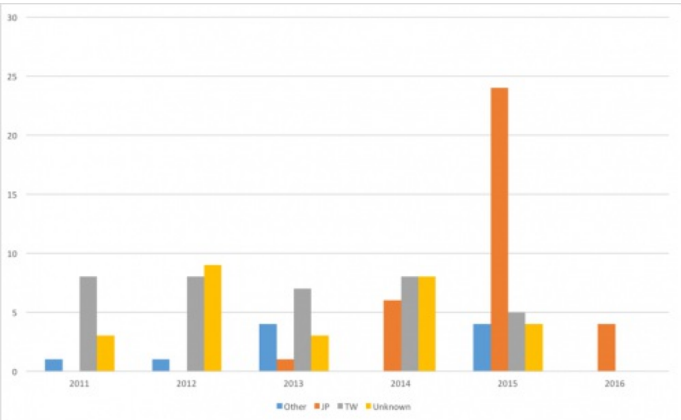


Figure 2 Reports by countries

The primary infection vector is a spear phishing email with a malicious attachment. Although we collected several document based exploit files (RTF, XLS, and PDF) in this attack campaign, most of the attachments were executable files that, interestingly, suggest a custom malware installer. Attackers often use self-extracting executable files or existing installer packages to reduce development costs if they require dropping multiple files. However, in this campaign, the attacker group created its own installer program with the following features:

- Windows executable with folder icon
- Creates directory with pre-determined name in the same path as the installer
- Copies decoy files into the created directory
- Installs a batch file and malware on Temp Dir
- Executes a batch script to delete the installer

Figure 3 shows examples of the custom installer and its different folder icons.

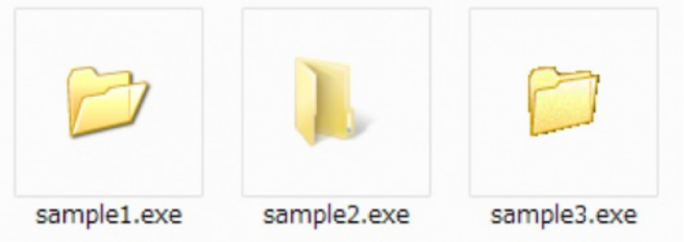


Figure 3 Custom installers with the folder icon

The use of e-flight tickets as phishing lures has been seen repeatedly for a number of years. The following is the list of malicious attachment samples that use this technique. It is the most prevalent lure used by this threat actor to entice targets for this campaign.

Target	Year	SHA256
Japan	2016	71d5bc9404aa2aa40d79cb16837246a31fa3f12b195330a091e3867aa85f1bc6
Taiwan	2015	7b1509051ccacc4676bf491f63c8a8c7c3b42ffd6cbf3d8bb1dd0269424df985
Japan	2014	8c338446764db7478384700df811937dabc3c6747f54fd6325629e22e02de2cc
Taiwan	2014	b393b9774c32de68b35bffd43ace22f9e9d695545de02d8b1d29c8ae38db3488
Taiwan	2014	4607aa975fd9b5aaebe684b26fa31d8ef0840682b148dbcf7f57e9c35d107eb6
Taiwan	2013	f23ab2ee9726c4061b2e0e7f6b9491e384de8103e410871c34b603326b7672da
Taiwan	2013	5de5346613be67e3e3bdf82c215312e30bf5ab07aafd0da0e6967897752e0c1d
Taiwan	2013	1ed808c7909bde7164d81a8c752a62ced116e03cfb6c7502019d84340f04b76a
Taiwan	2012	b6034a3fc6e01729166a4870593e66d9daf0cdff8726c42231662c06358632a7
Taiwan	2012	f18ddcacfe4a98fb3dd9eaffd0feee5385ffc7f81deac100fdbbabf64233dc68

Table 1 Samples of malicious attachments masquerading as E-Ticket

MALWARE

In this MILE TEA campaign, the actor uses the following three malware families as the initial infection by the custom installer. The primary purpose of these families is to establish a bridgehead, collecting system information and downloading additional malware from a remote server.

Malware	Executable Type	Cipher	C2 address from Blog
Elirks	PE, PE64, DLL	TEA, AES	Yes
Micrass	PE	TEA	No
Logedrut	PE, MSIL	DES	Yes

Table 2 Malware characteristics

While many security vendors classify these samples as different malware families, they share functionality, code, and infrastructure, leading us to conclude that they in fact belong to the previously mentioned malware families.

FUNCTIONALITY – BLOG ACCESS

As described in the previous blog post, one of the unique features of Elirks is that it retrieves a command and control (C2) address from a public-facing blog service. When configured, the malware accesses a predetermined blog page, discovers a specific string, and proceeds to decode it with Base64 and decrypts it using the Tiny Encryption Algorithm (TEA) cipher. The same functionality is found in Logedrut, however, instead of using the TEA cipher, it uses DES.

A sample of Logedrut (afe57a51c5b0e37df32282c41da1fdfa416bbd9f32fa94b8229d6f2cc2216486) accesses a free blog service hosted in Japan and reads the following article posted by the threat actor.

2015年 01月 22日

love

doctor fish pKuBzxxnCEeN2CWLAu8tj3r9WJKqbIE+ sech yamatala

Figure 4 Encoded C2 address posted by attacker

The routine called GetAddressByBlog() in Logedrut looks for text between two pre-defined strings. In this particular case, the malware sample will look for test between “doctor fish” and “sech yamatala”. The threat determines encoded text is “pKuBzxxnCEeN2CWLAu8tj3r9WJKqbIE+” and proceeds to handle it using the following function.

```
internal static string GetAddressByBlog(string blogUrl)
{
    Utility.AddLog("GetAddressByBlog");
    string text = Network.HttpGet(blogUrl);
    if (text == null)
    {
        Utility.AddLog("HttpGetError");
        throw new Exception();
    }
    string text2 = Network.m_starttag + "(.*)" + Network.m_endtag;
    Utility.AddLog("Pattern : " + text2);
    Regex regex = new Regex(text2);
    if (!regex.IsMatch(text))
    {
        Utility.AddLog("did not found tag");
        throw new Exception("did not found tag");
    }
    string income = regex.Match(text).Groups[1].Value.Trim();
    Utility.AddLog("Is Match");
    return Utility.DES_DeCrypt(income);
}
```

Figure 5 Code finding encoded C2 address from blog

This code deciphers the string with BASE64 and DES. So far all Logedrut samples use exactly the same key, 1q2w3e4r, for decryption. The following Python code can be used to decode the C2 address.

```
import base64
import Crypto.Cipher.DES

encoded_string = "pKuBzxxnCEeN2CWLAu8tj3r9WJKqblE+"
iv = key = "1q2w3e4r"

decoded_string = base64.b64decode(encoded_string)
des = Crypto.Cipher.DES.new(key, Crypto.Cipher.DES.MODE_CBC, iv)
decrypted_string = des.decrypt(decoded_string)

print decrypted_string
```

CODE – TEA WITH XOR

Elirks and Micrass employ exactly the same TEA cipher. TEA is a block cipher that operates against 64-bit (8 bytes) of data at a time to encrypt and decrypt. The author of the code added and extra cipher operation by XORing data when a block size is less than 64 bits. For example, if the encrypted data length is 248 bits (31 bytes), the code in both malware samples decrypts the first three blocks (64 x 3 = 192 bits) with TEA. The final block is only 56 bits (248 – 192 = 56), so the code uses a simple XOR operation against the remaining data. This supplement to TEA has not been widely used, and all Elirks and Micrass samples have the same static key (2D 4E 51 67 D5 52 3B 75) for the XOR operation. Due to these similarities, we can conclude that the author of both families may be the same, or has access to the same source code.

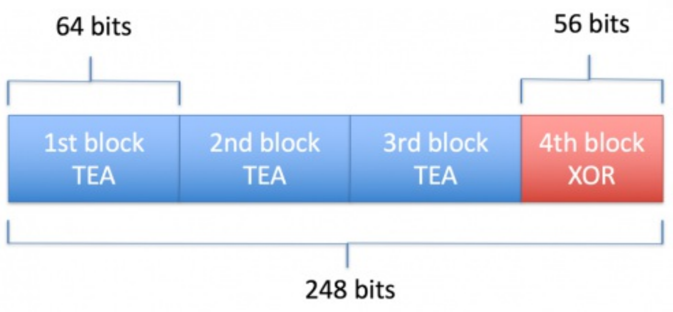


Figure 6 TEA with XOR Cipher in Elirks and Micrass

INFRASTRUCTURE – C2 SERVERS

Based on our analysis, we see that only a handful samples share the same infrastructure directly. The threat actors carefully minimize reusing C2 domains and IP addresses among their malware samples, and yet they prefer using servers located in Hong Kong no matter where the target resides.

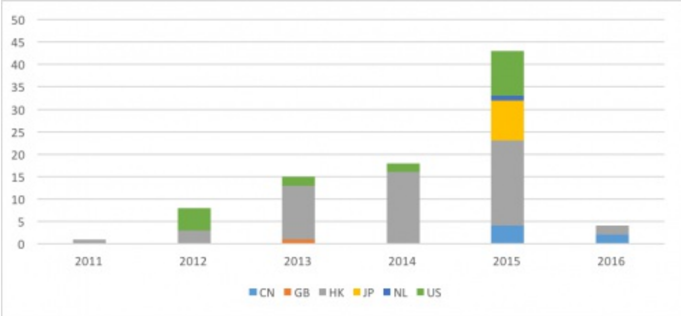


Figure 7 Location of C2 servers

TARGET ANALYSIS

IDENTIFYING TARGETS FROM SPEAR-PHISHING EMAILS

We found a spear phishing email sent to a government agency in Taiwan on March 2015. The email sender masquerades as an airline company, and the RAR archive attachment contains the custom installer named Ticket.exe that drops Ticket.doc and Micrass malware.

Figure 8 Spear-phishing email sent to an agency in Taiwan

During the analysis of the email, we came across an article in a Taiwan newspaper from February 2014 that alerted the public about a similar email message being widely distributed that contained a malicious attachment. The only difference between the email messages in Figure 8 and in the news article was the date. The adversary reused the email message more than a year ago.

IDENTIFYING TARGETS FROM DECOY FILES

The most interesting part of this attack campaign is that the threat actor has been using stolen documents from previously compromised organizations to perform additional attacks since early 2015. These documents are not publicly available nor do they look to be created from scratch by the attacker. Because they contain sensitive data tying to the specific business, it is unlikely that a third party would be able to craft them.

The following figure shows the decoy file installed by a sample identified in early April 2015. The file is a weekly report created at the end of March 2015 by a salesperson at a Japanese trading company. The report includes various sensitive information specific to their business.

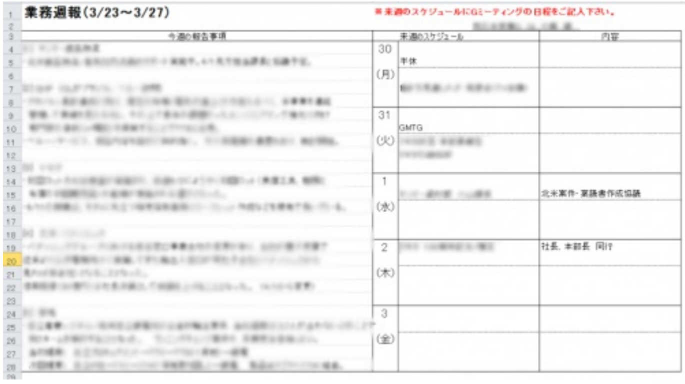


Figure 9 Weekly report from a Japanese trading company

The properties identified within the document indicate that the company name matches the context, and the person who last modified it is the same individual seen in the document itself. Because of this, the file appears legitimate and it’s very unlikely that this document would ever be made publicly available. The threat actor almost certainly stole this document soon after it was created, and reused it as the decoy for next target within a week of the theft.

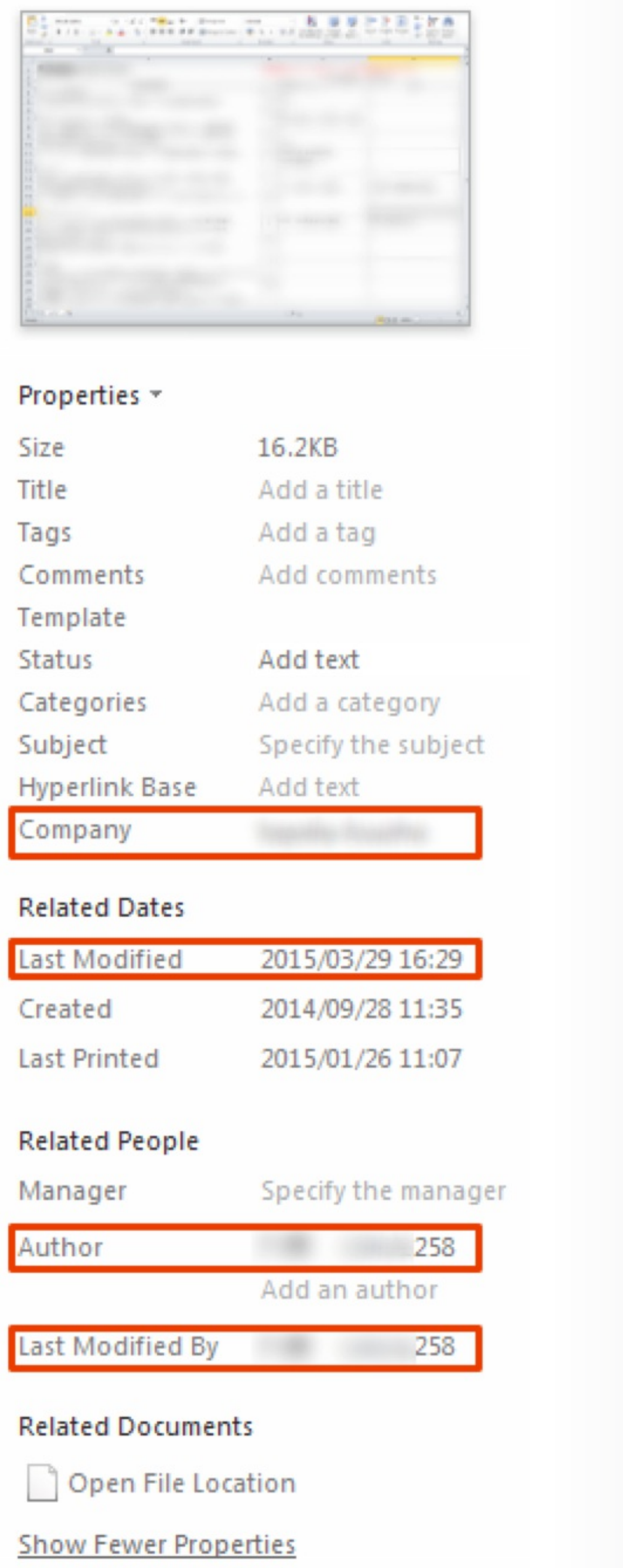


Figure 10 Property of the decoy document

Another installer found in Japan in May 2015 also contained sensitive information. The decoy looks to be a draft version of a legitimate contract addendum between the subsidiary of a Japanese petroleum company based in Australia, and a China-based company. The document provides details of the deal, including price. It contains a bunch of tracked changes by what appears to be two Japanese speaking individuals. We have confirmed that one of the individuals was a manager of an overseas project of the parent company in Japan by the official release of personnel change in 2013. The file is also considered to be stolen from a target organization and used for decoy for the next attack.

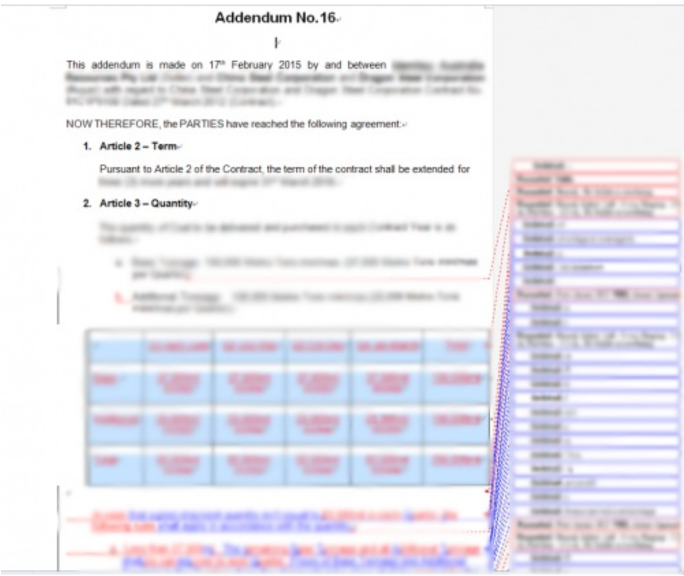


Figure 11 Contract addendum decoy file

In addition to those examples, we found the following decoy files that are likely stolen from previously compromised organizations.

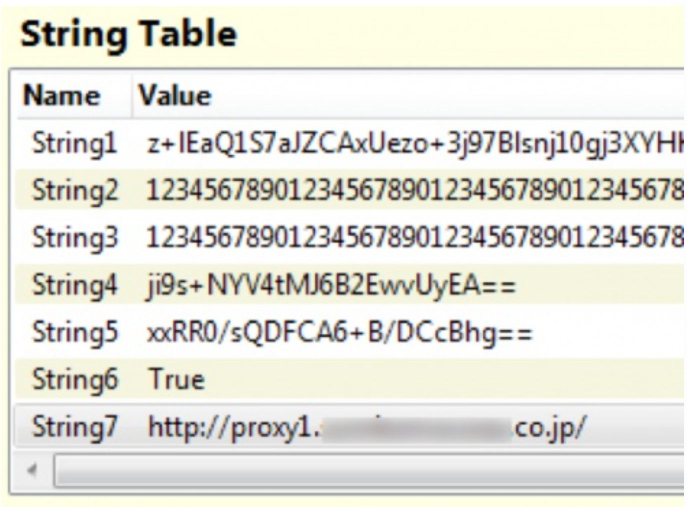
Organization	Type of document
Beijing Office of a public organization of Japan	Budget Report
Another Trading Company in Japan	Internal investigation document
Mobile phone organization in Japan	Inventory of new smartphones

Table 3 Potential source of another decoy file

We cannot confirm whether those files were stolen as part of the MILE TEA campaign or not. Either way, it's difficult to imagine that the threat actor sent those internal documents to entirely different organization or industries. One plausible explanation would be that the threat actors target different persons or departments within same organization or industry.

IDENTIFYING TARGET FROM MALWARE

So far, we have described two trading companies in Japan that are possibly targeted. In addition to these two companies, there is another company in Japan that could be involved in the attack campaign as well. A sample of Logedrut was identified and is capable of communicating with C2 through an internal proxy server in the compromised organization. The sample contains an internal proxy address for a trading company in Japan as seen in String7 in the image below. Thus, the sample is specially crafted for this specific enterprise.



String Table

Name	Value
String1	z+IEaQ1S7aJZCAxUezo+3j97Blsnj10gj3XYHI
String2	12345678901234567890123456789012345678
String3	12345678901234567890123456789012345678
String4	ji9s+NYV4tMJ6B2EwvUyEA==
String5	xxRR0/sQDFCA6+B/DCcBhg==
String6	True
String7	http://proxy1.[illegible]co.jp/

Figure 12 Internal proxy address in Logedrut

CONCLUSION

MILE TEA is five-year-long targeted attack campaign focused on businesses and government agencies in Asia Pacific and Japan. The threat actor behind this maintains and uses multiple malware families, including a custom installer. The actor is interested in organizations that conduct business in multiple countries. The trading companies cover an immensely broad area, from commodity products to aviation around the world. Another possible target is a Japanese petroleum company that has multiple offices and subsidiary companies in overseas countries. A public organization in Japan and a government agency in Taiwan were also targeted.

Palo Alto Networks customers are protected from this threat in the following ways:

1. WildFire accurately identifies all malware samples related to this operation as malicious.
2. Domains used by this operation have been flagged as malicious in Threat Prevention.
3. AutoFocus users can view malware related to this attack using the "Micrass", "Elirks", and "Logedrut" tags.

INDICATORS OF COMPROMISE

Note: We omitted some hashes containing potentially stolen documents from the compromised organization.

Windows Executable Custom Installer
064474ac22dd28bf2211ca6602946409925b11f1cfa5e593487bf65e033f1057
136978934c8a61e4adff415d4f8f6cd39d110cfa27df2c18367c7036c36e006a
1ed808c7909bde7164d81a8c752a62ced116e03cfb6c7502019d84340f04b76a
37e79e1ee7cde57cf3af80c54851fa3f9bea3a7208c5cdb5bd290d832f1c50c6
4607aa975fd9b5aaebe684b26fa31d8ef0840682b148dbcf7f57e9c35d107eb6
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RTF File

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XLS File

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PDF File

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Elirks

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