Flying Kitten to Rocket Kitten, A Case of Ambiguity and Shared Code

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Background

In our most recent post, "iKittens: Iranian Actor Resurfaces with Malware for Mac," the inadvertent disclosure of macOS Keychains from a malware test machine recalled a long dormant group through references to an alias "mb_1986" (a hacker named Mojtaba Borhani that we have tracked since at least April 2013). The overlap speaks to a more generalizable theme: the ecosystem of Iranian actors is chaotic and ever-changing, making disambiguating different campaigns and groups a troublesome process. The reference to Mojtaba isn't the only call back to previous groups that we have come across in our time monitoring Iranian actors.

One of the first reports to systematically describe Iranian intrusion campaigns as persistent threat actors was FireEye's "Operation Saffron Rose," which documented an espionage operation targeting the defense sector through malware. Later labeled "Flying Kitten," the group had engaged in extensive surveillance primarily targeting domestic dissidents. Flying Kitten was prolific at spearphishing account credentials, targeting at least hundreds of individuals over more than a year, beginning at least before the June 2013 Presidential election. The tactics and infrastructure involved in these campaigns evolved over time, but kept to basic themes of fake messages from platform providers about account security. The use of the "Stealer" described by FireEye was also much more extensive than previously documented. Days after the FireEye report was released in May 2014, the domains and servers connected with the group were taken down or lapsed, not to be used again. While some malware samples surfaced that summer that were potentially connected to the group, by most accounts Flying Kitten ceased to exist.

Five months later, in September 2014, ClearSky published a blog post 'Gholee – a "protective edge" themed spear phishing campaign' that documented a new wave of attacks originating out of Iran. As these campaigns continued, they were attributed to a group labeled "Rocket Kitten." The infrastructure and tactics within the Rocket Kitten campaigns represent a visible break from Flying Kitten with the domains connected to Rocket Kitten largely registered after July 2014. From the outset, the Rocket Kitten espionage campaigns were also directed against Iranian activists. The lull in intrusion attempts against these communities after Flying Kitten lasted for less than three months, until an Iranian journalist received notifications purporting to be from Google claiming that their accounts had been accessed from "The Russia." Unlike its predecessor, while the publications shaped Rocket Kitten's behavior, it did not end the campaigns.

The case of mb_1986 is not the first time that researchers have see similarities in supposedly different Iranian groups. Check Point notes in its November 2015 report "Rocket Kitten: A Campaign With 9 Lives" that the Rocket Kitten group maintained a "very similar mode of operation and phishing domain naming scheme" as Flying Kitten, but noted a lack of concrete evidence to link the two. In this post, we document two recent

disclosures of attacker-developed infrastructure that draws a connection between Rocket Kitten and Flying Kitten. While we cannot assert that the groups are the same, we can establish that there was direct exchanges of source code, and in all likelihood an overlap in membership.

Case 1: Phishing Infrastructure

The commonalities between externally-visible components the attacks conducted by both Flying Kitten and Rocket Kitten are notable. Check Point suggests the two shared a domain naming scheme, for example Drive-Google.com.co (created April 2014, connected to Flying Kitten) compared to Drive-Google.co (created July 2014, associated with Rocket Kitten). A comparison of the content of credential theft attempts adds more suspicion about a relationship. However, without disclosures of private operational information, these are weak indicators, and could as easily suggest that members learned from the FireEye report. Through the disclosure of the code used in Rocket Kitten spearphishing, we demonstrate that these commonalities are more than superficial – that Rocket Kitten has used Flying Kitten tools for credential theft.

Publications thus far have indicated that Rocket Kitten used different malware and credential theft resources than Flying Kitten. In Check Point's report, the company documented a database-driven credential theft platform, named by its creator as the "Oyun Management System." Through gaining access to the backend database, the researchers were able to observe a year's worth of phishing attempts, starting in August 2014. Screenshots from the database show some URLs that were used in phishing, often following a schema of:

```
http://profiles.googel.com.inc.gs/?_schema=([0-9]+)&rnd=([0-9]+)
```

This parallels first-hand observation of attempts against Iranians journalists during September and October 2014. The pattern also provides a possible fingerprint for Rocket Kitten attacks. However, the tactics and tools in phishing campaigns attributed to Rocket Kitten were not homogenous, even at the same time. The first post Flying Kitten spearphishing attempts we have observed occurred at the start of August 2014, and a different pattern in the URLs of phishing sites is apparent:

```
http://account-google.co/EditPassd?pli=([A-Z0-9]+)
http://drive-google.co/Check?pli=([A-Z0-9]+)
```

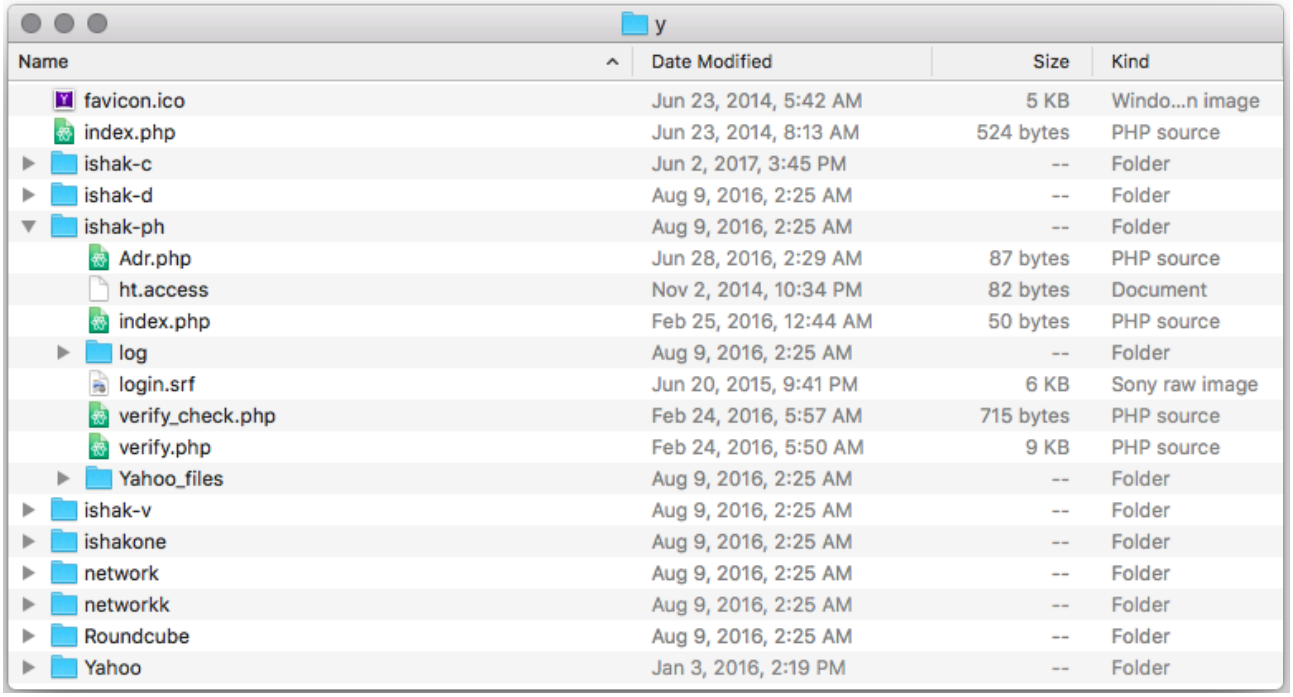
ClearSky notes these domains in its "Thamar Reservoir" report, despite the different parameter schema. On face value, this would not entirely rule out the use of Oyun, but this creates the possibility of their being two different phishing tookits.

The August 2014 attempts have more similarities with Flying Kitten attempts than Check Point's Rocket Kitten. The same parameter scheme is seen in a December 2013 message that "hackers recently want to hijack your account," conducted by Flying Kitten:

```
http://accounts.privacy-google.com/EditPassd?pli=([A-Z0-9]+)&Service=mail&TTL=True
```

There are many other tactical and stylistic differences between these "Rocket Kitten" attempts, including meaningful differences in template of the fake Google notice. Whereas Rocket Kitten had registered Gmail accounts that appeared to be official (e.g. "accourrt.noreply" and "team.mail.secure"), both Flying Kitten and the August 2014 messages used compromised sites to relay messages spoofed to appear as Google (e.g. "Services-Team@accounts.google.com"). Aside from these technical properties, both of the latter sets of messages shared common grammatical failures, focused on common targets, and used similar social engineering strategies.

Despite these differences in tools and behaviors, the seemingly distinct patterns are commonly lumped in as "Rocket Kitten."



Two years later, in August 2016, Rocket Kitten exposed the scripts used in its spearphishing campaigns, providing access to an archive of source code and operational materials. The set of PHP scripts used in these campaigns was rudimentary but had clearly been used for at least dozens of attacks. For clarity, we will refer to this codebase as "Ishak" – reflecting the naming of the folders in the archive.

What was immediately striking is how closely the Ishak source code resembled previously obtained copies of Flying Kitten's Hotmail, Yahoo, and Facebook scripts. On the most basic level, the folder that contained victims' passwords and other logs controlled external access with the same .htpasswd entry:

```
admin:$apr1$.M.6gO9b$HKm8rKGoUMsesWMq14QsG/
```

The differences extend further into the code. The earliest file creation date in the Ishak codebase was December 2012 – a file named "all.php" that does nothing but echo back the visitor's IP address. This exact file also present in in the Flying Kitten codebase. Still other files and folders have the same structure and names, such as the log file "Zerang.log" ("clever"). Both have blocked roughly the same sets of IP addresses through the Apache .htaccess file (mostly search engine crawlers, but potentially researchers as well).

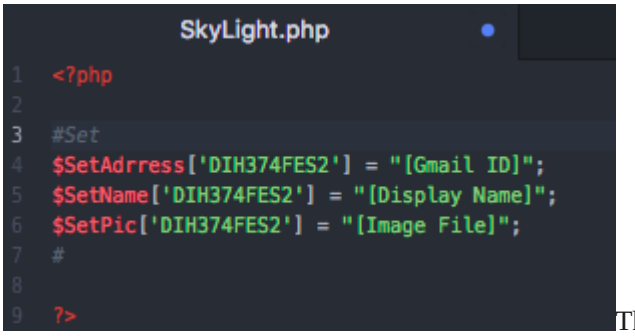
While the codebases are not the same, there are substantial similarities elsewhere, especially in components that would not require updates to accommodate changes in the user interfaces of the sites they mimick. For example, in the page that logs unexpected attempts to access the site (such as expired or empty victim identifiers), the only change was to push users to the Yahoo! homepage rather than a Persian-language pornographic site (the latter which was common across Flying Kitten properties).

Flying Kitten, November 2013 (xn--facebook-06k.com)

Rocket Kitten, August 2016 (yahoo-reset.signin-useraccount-mail.com)

Flying Kitten, March 2014 (drive.yahoomail.com.co)

Rocket Kitten, August 2016 (yahoo-drive.signin-useraccount-mail.com)



The Ishak scripts are substantially different from the Oyun spearphishing platform that Check Point documented. Tthe latter of which uses a database to store the target information that populates the phishing page. Instead, both the Flying Kitten and Ishak toolkits are more simple – victim identifiers are stored as an array in a file that is essentially a phone book for the platform. The victim identifiers appear to be manually set, which explains why in-the-wild attacks sometimes appeared with victim IDs as non-random, "asdf"-style sequences of characters, or target names – instead of Oyun's number-based identifier.

Ishak was almost certainly used in-the-wild in attacks attributed to Rocket Kitten. The difference in parameter schemas provides indication that the Ishak codebase was used in attacks documented by others in 2015, as the difference in URLs for those sites resembles Ishak's approach rather the Oyun.

URL Path Differences:

```
Oyun (e.g. profiles.googel.com.inc.gs in September 2014): /?_schema=([0-9]+)&rnd=([0-9]+)
Ishak (e.g. user-setting.com in March 2015): /Drive-Auto/AutoSecond?Chk=([A-Z0-9]+)
```

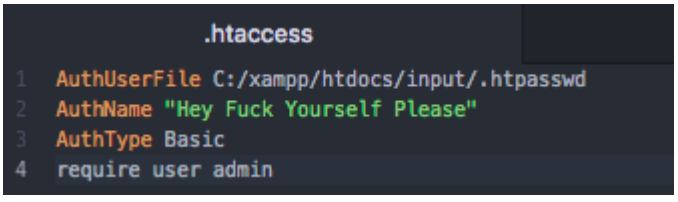
Other similarities exists between Ishak and past reports. ClearSky also notes that a log file was publically accessible in the attacks they observed:

Interestingly, the log file for the previous pages was hosted publicly on the same virtual folder. The log contained the false credentials the target submitted (as she recognized this was a fake)[4]:

ClearSky's logs strongly resemble the format found both on Flying Kitten and the Ishak phishing pages, which follow a somewhat unique format that differs slightly across copies, for example in Ishak:

```
$data = "$date  |  user:$user  | email:$email | pass:-$password- | $IP | $Page$URI | $Agent | $r
```

One addition to the Ishak codebase related to logging and authentication that was not previously seen in Flying Kitten kit, which appears to respond to ClearSky's report:



The scripts have changed over time. The different folders capture iterative versions up to August 2016. While there are phishing-related files as old as June 2014 in the Ishak code, the actual spearphishing activity reflected in logs begins around February 2016. These logs reflect an active group targeting a broad range of sectors, although with a clear focus on Iranian domestic politics. Since no publications have focused on Rocket Kitten since the Check Point report, there is no external confirmation about the origin of these campaigns. However, our direct

observation of Rocket Kitten attacks against the human rights community runs unbroken from August 2014 to present, and while there are shifts over time, there is also a fair amount of congruency.

Examples of recorded hostnames within the Ishak logs include:

- network.us14-userfile-permission-account-signin.com (created 2016-06-28)
- onedrive.signin-useraccount-mail.com (created 2016-07-26)
- verify-your-password-for-secure-your-account.cf (accessed 2016-06)
- mg5-myfile-available-signin.ga (accessed 2016-02)
- yahoo-drive.signin-useraccount-mail.com (created 2016-07-26)
- yahoo-reset.signin-useraccount-mail.com (created 2016-07-26)
- your-file-drive-permission-for-download.cf (accessed 2016-05)
- drive-useraccount-signin-mail.ga (accessed 2016-08)
- userfile-need-permission-download-signin.com (created 2016-06-28)

Aside from the popular communications platforms, namely Yahoo!, Microsoft, Facebook and Google, the repository includes sites modified for special use cases. These include attempts to target:

- The Network Solutions accounts of Asharq al-Awsat, an Arabic international newspaper headquartered in London, and of GEM TV, a Persian-language entertainment satellite broadcaster;
- The Roundcube webmail service of an Iranian medicine company;
- Cox webmail, directed against an unknown individual; and
- American and British universities, targeting Iran-focused scholars.

The preference of the Ishak scripts over Oyun may be explained by a change in behavior we observed in Fall 2015, when Rocket Kitten was the subject of multiple publications. After these incidents, Rocket Kitten was more circumspect about its activities. Prior to the change, Rocket Kitten provided a predictable trail across campaigns, as certain infrastructure was used across multiple targets for extended periods of time (several months).

After the heightened level of exposure, Rocket Kitten shifted techniques to reduce the linkability and hide infrastructure. Rather than operate within a consistent bounds of leased servers and clever domains for months, later spearphishing attempts conducted by the group treated hosts and names as more disposable. Instead, spearphishing attempts were stood up for short-term episodes with a specific set of targets in mind. Upon indication of discovery, success, or suspicion of failure, the sites are taken offline and not reused. It stands to reason that if a server would only be used against a few targets over a couple of days, Oyun’s requirements of installing and configuring a database became costly. Thus Ishak would be a more flexible approach, even if not as sophisticated.

An alternative hypothesis is that Rocket Kitten is internally uncoordinated, or certain campaigns were misattributed. Check Point’s report includes a chart of attacks that records no activity for June and July 2015, however, we see "Rocket Kitten" spearphishing attempts during this time. Similarly, while IP addresses associated with the German satellite provider IABG are documented in multiple Rocket Kitten reports, we only see that ISP in attacks in September 2014 and not others.

Case 2: Malware

In January 2017, a domain "IranianUkNews[.]com" was created with registration information that matched previously identified Rocket Kitten domains and was hosted on an IP address adjacent to a Rocket Kitten credential theft site. The domain was noteworthy since it bore a resemblance to the independent news site "Iranian UK" (iranianuk.com) that covers Iranian politics. The new domain was not the first case of Iranian UK being impersonated. A series of credential theft attempts observed in September 2013 using the domain "qooqle.com[.]co" were hosted and registered alongside a domain "iraniannuk[.]com" – a campaign that marked the beginning of a new phase in Flying Kitten's activities.

Having flagged the domain early, we were privy to the process of the site being set up. From our monitoring of the IranianUkNews, there appeared to be two resources hosted on the suspicious domain:

- a Persian-language page impersonating Iranian UK that we were not able to directly observe; and,
- a fake Adobe Flash site containing a malicious Windows executable.

The Adobe Flash page that was hosted on the IranianUkNews bore immediate similarities in content to another Flying Kitten resource – the "Plugin-Adobe[.]com" domain that FireEye documented in Operation Saffron Rose. In the case of Operation Saffron Rose, this domain was used to host malware, and we observed another Flying Kitten page that impersonated BBC Persian (domain: "persian-bbc.co[.]uk") in order to deceive the visitor to install malware to supposedly view a video.

The full path for Flash site on new IranianUkNews domain was the following:

```
iranianuknews.com/adobe/flashplayer/Download/78923582514/index.php?id=7892358
```

Similar to the case of the Flying Kitten phishing script, we had a copy of the backend of Plugin-Adobe[.]com. Timestamps of the Flying Kitten files and logs suggest their site was initially created in August 2013. A comparison of the structure and content of the Flying Kitten page and the new site strongly indicates that they are nearly the same code. Minor differences in the CSS and Javascript of the Flash download page suggests that the attacker made small iterative changes to the original scripts, but used the original source to continue operations (including references to a version of Flash released in July 2013).

```
$exists = false;
if (isset($_GET['id']))
{
    //$userid = $_GET['id'];
    $exists = url_exists("http://plugin-adobe.com/logs/$userid-log.log");
}
```

Logging Functions on a Fake BBC Persian Malware Site

The functionality and behavior of the sites is similar despite the code being undisclosed. Flying Kitten was often meticulous about logging, as the phishing script illustrates, and in that spirit their fake Adobe site would maintain logs separated out in different files based on campaigns (defined based on URL parameters). Understanding this predictable behavior, we were able to retrieve the logs from the new Rocket Kitten site. These logs also bear a similarity to between themselves and the Ishak credential theft logs.

Flying Kitten (2013)

```
2013-08-07 16:39:21 | user:demo | 81.91.146.232 | plugin-adobe.com/tst.php?id=demo | Mozilla
2013-08-07 17:24:11 | user:demo | 81.91.146.232 | plugin-adobe.com/tst.php?id=demo | Mozilla
2013-08-07 17:37:01 | user:demo | 81.91.146.232 | plugin-adobe.com/tst.php?id=demo | Mozilla
```

Rocket Kitten (2017)

```
2017-01-04 21:03:33 | id=[78923582514] | 127.0.0.1 | 127.0.0.1/adobe/flashplayer/Download/78
2017-01-24 13:59:09 | id=[78923582514] | 185.81.40.230 | iranianuknews.com/adobe/flashplayer
```

The January 2017 logs demonstrate that an individual had engaged in a fair amount of testing earlier in the month on a local machine prior to staging the site on the Internet. After posting the page on the IranianUkNews domain, IP addresses associated with the PureVPN service and the Iranian ISP "Parsdade Advanced Technology" then began to test the site again. Parsdade has been observed repeatedly within Rocket Kitten operations, and is not a very large ISP. This demonstrates that the individual staging the new IranianUkNews site had both the original scripts used by Flying Kitten and was based in Iran, therefore lowering the possibility that the incident was the result of a security researchers doing testing.

Malware

The departure between our observations of Flying Kitten and the Rocket Kitten site begins at the malware downloaded by the fake Flash page. Initially, the new IranianUkNews site would download a file with an Android application (.APK) extension. In reality, the binary was a mislabelled Windows executable, although changing URL parameters would prompted the site to offer a .EXE file (the same file). No actual Android malware was observed. Flying Kitten was never observed by us as targeting mobile devices, and this aspect appears to be a newer enhancement. Rocket Kitten has been observed using Android malware as we noted last year.

In Operation Saffron Rose, FireEye documents Flying Kitten's malware agent, "Stealer," a simple keylogger with an easy-to-use builder application. The fake Flash installer on new IranianUkNews is not Stealer, but rather appears to be a predecessor that is in certain respects better designed than Stealer. The existence of another Flying Kitten malware agent would account for why we found files on their command and control FTP servers in 2013 that appeared to be malware logs that were not generated by Stealer, including files with the name "mb_1986." Once again, Mojtaba. Based on static references in the malicious library, we will refer to this version as "TKeylogger." Given that TKeylogger is extremely old, and has not been observed being actively used in attacks, a writeup of the malware agent is not in scope for this article.

It notable that the compile time for the dropper of the TKeylogger sample is "2009-07-13 23:42"; which taking into account the inclusion of the signed Mozilla binary from 2012, is clearly a fake timestamp. This exact compile time also appears in malware samples noted in Saffron Rose, however, FireEye's samples are confirmed to be

Stealer. The mozalloc.dll library itself has a compilation timestamp of "2013-08-07 07:02," a couple of hours prior to the file modification time and the day same as the logs captured from Flying Kittens' site.

TKeylogger Beacon

```
GET /tst.php?id=14258974894 HTTP/1.1
User-Agent: Mozilla/2.0 (compatible; MSIE 6.0; Windows NT 5.2)
Host: plugin-adobe.com
Cache-Control: no-cache
```

One behavior not seen in Stealer is an initial beacon upon infection to an HTTP endpoint. Stealer simply exfiltrated logs over FTP, although FireEye notes unused or incomplete code for HTTP POST, SFTP and SMTP communications. The unchanging value provided as an "id" in the beacon appears to be a unix timestamp (14258974894). The date for this "timestamp" would be November 2412, but shifting the value one place puts the date at a more reasonable (but unexplained) March 9, 2015. The sample of TKeylogger acquired beacons back to the old "plugin-adobe[.]com," which we believe is still sinkholed by researchers, and there are static references in the sample to an IP address 5.9.244[.]137 on Hetzner with a username of "father" and the password "AzInjaBoro" ("get out of here"). The Hetzner address also appears to have been used by Flying Kitten for other previously identified domains four years ago.

It is also notable that within our observation of Flying Kitten, much of the activity was conducted from IP addresses within the small range assigned to a "Jahan Pishro" ("World Leading"). The sample conducting the test in the old Flying Kitten captured logs also originated from the Jahan Pishro range (81.91.146[.]232). TKeylogger submits this beacon with the unusual user agent "Mozilla/2.0 (compatible; MSIE 6.0; Windows NT 5.2)" – which again appears in the old captured logs. This indicates that our old logs reflect the testing of TKeylogger by its developer, and that our sample is similar to the original malware.

Here as well, disclosure of previously undocumented malware indicates that Rocket Kitten had direct access to Flying Kitten's tools.

Infrastructure Overlap

The registration of IranianUkNews and the credential theft sites follows within a long chain of domains connected to the Rocket Kitten group based on several different indicators. For example, the registration name Hiram Ryan, a name that appears to have been taken from the registration of a small aviation company, appears in Google credential theft domains. The domain also reflects a fingerprint of Rocket Kitten domains present since around the Check Point report, which followed a pattern:

```
Registrant Name: (First) (Last)
Registrant Organization: (First or Last).co
```

Example:

```
Domain Name: logins-mydrive-useraccount.com
Creation Date: 2015-12-17T04:00:00Z
Registrant Name: William Morse
Registrant Organization: William.co
```

IranianUkNews[.]com Registration:

```
Registrant Name: Hiram  Ryan
Registrant Organization: Ryan.co
Registrant Email: admin@iranianuknews.com
```

Hiram Ryan and Ryan.co, further lead to a "cool.hiram@yandex.com" with still more domains registered in January and February 2017:

- display-ganavaro-abrashimchi.com
- iforget-memail-user-account.com
- change-mail-accounting-register-single.com
- change-user-account-mail-permission.com
- display-error-runtime.com

The nature of some of these domains are unclear, but several have been observed in credential theft attempts, and likely use the Ishak code.

These activities are importantly connected to the Telegram-focused credential theft and reconnaissance we disclosed in our Black Hat presentation. The Parsdade IP address that logged onto the IranianUkNews site was also observed conducting Telegram phishing attempts using the domain telegrem[.]org; a domain that is registered by the tracyreed.cfl@gmail.com involved in the "shaftool" and other API scraper domains. In fact, the ghalpaq.com domain that was originally identified with the Telegram enumeration attempts was originally pointed to a LeaseWeb host identified by ClearSky in "Thamar Reservoir."

Passive DNS Record: 178.162.203.56

- 2015-09-23 www.google-verify.com
- 2015-08-10 profiles-verify.com
- 2015-06-09 ghalpaq.com
- 2015-03-17 www.google-setting.com
- 2015-03-03 google-setting.com
- 2015-03-03 google-verify.com
- 2015-03-03 verify-ycervice.com
- 2015-03-03 verify-yservice.com
- 2015-03-03 ymail-service.com

Conclusion

Rocket Kitten has been substantially less active after the successive reports in Fall 2015, often nearly dormant for months. Whereas Rocket Kitten was previously the most prolific group, the spearphishing attempts posed to civil society have shifted to other operators. In the lead up to the February 2016 parliamentary election, the malware "Infy" became the most active threat in our monitoring, with only a few Rocket Kitten attempts. Since then, the mantle has been taken by Charming Kitten (Newcaster), Oilrig, and others.

Unfortunately, it is not always clear why researchers assert that certain domains are related, imposing hurdles to scrutinizing claims. Similar targeting is not sufficient toward establishing attribution – Iranian groups generally maintain the same focus.

On the other hand, the efforts that were labeled Rocket Kitten could have been organized in a more nebulous arrangement – and Rocket Kitten was never a uniform operator to begin with. Like Iran's "mosaic defense" military organizing structure, the hacking efforts are clearly more decentralized and fluid than countries with advanced cyber warfare operations. This makes tracking and attributing attacks originating from Iran all the more complex. These two cases touch on the core of Flying Kitten's toolkit as we understand it with code was either repurposed or experimented with by Rocket Kitten.

The group, whatever we call it, has still engaged in spearphishing campaigns, however, the level of professionalism has declined and the nature of their activities changed. This could indicate that just as Flying Kitten appears to have disbursed, so has Rocket Kitten. Taken together, these differences start to define two personalities – both described as "Rocket Kitten" – one using the tools tied to an individual named Yaser Balaghi (Gholee, Woolger, MPK, Oyun) and one connected to Flying Kitten tools (Ishak).

If our version of Rocket Kitten is not the real Rocket Kitten, then what is? Is it still Flying Kitten?

Moving forward, this also tells a cautionary tale as researchers find fingerprints of multiple Iranian groups involved in attacks such as [those targeting Saudi Arabia]. The history of Iranian actors has shown that toolkits move, and so do people.

Contact

Email

Claudio (nex@amnesty.org)

- Fingerprint: E063 75E6 B9E2 6745 656C 63DE 8F28 F25B AAA3 9B12

Collin (cda@cda.io)

- PGP Key: https://cda.io/key.asc
- Fingerprint: 510E 8BFC A60E 84B4 40EA 0F32 FAFB F2FA

Indicators of Compromise

Malware

Filename

MD5

mozalloc.dll

8ad0485fd3509042b0a477f65507f711

Credential Theft from Ishak Logs

account-signin-myaccount-users.ga

aol.userfile-need-permission-download-signin.com

changepassword.userfile-need-permission-download-signin.com

cox.userfile-need-permission-download-signin.com

drive-sigin-permissionsneed.ml

drive-useraccount-signin-mail.ga

drive.signin-account-privacymail.com

dropebox.co

durham-ac-uk.userfile-need-permission-download-signin.com

hangouting-signin-to-chat.ga

mg5-myfile-available-signin.ga

network.us14-userfile-permission-account-signin.com

onedrive.signin-useraccount-mail.com

security-supportteams-mail-change.ga

singin-your-drive.ga

userfile-need-permission-download-signin.com

verify-account-for-secure.ga

verify-google-password.userfile-need-permission-download-signin.com

www.drive-useraccount-signin-mail.ga

yahoo-drive.signin-useraccount-mail.com

yahoodrive.signin-account-privacymail.com

your-file-drive-permission-for-download.cf
