The Pitfall of Threat Intelligence Whitelisting: Specter Botnet is 'taking over' Top Legit DNS Domains By Using ClouDNS Service

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Abstract

In order to reduce the possible impact of false positives, it is pretty common practice for security industry to whitelist the top Alexa domains such as `www.google.com` , `www.apple.com` , `www.qq.com` , `www.alipay.com` . And we have seen various machine learning detection models that bypass data when they sees these popular Internet business domains.

The security war between the white and black never ends, white hats want to see “black” in the data, while hackers always try to blend in and appear “ white". In the follow article, we will see an interesting case which shows that the white we see is not necessarily white.

Our BotMon tracking system recently highlighted that the Specter botnet family started to use two domains `api.github.com` and `www.ibm.com` as C2 domains for its control communicate, while everyone knows for sure there is just no way for these FQDN to be malicious. The hacker utilized a pretty bizarre feature from one public DNS provider ClouDNS to make this all possible.

Doing this will definitely bring troubles to IoC based treat intelligence security, as the C2 are absolutely white.

Origins

We first disclosed the **Specter botnet** back in September last year (September 2020). The botnet is a remote control trojan (RAT) for Linux platforms with flexible configuration and highly modular/plugin-based, It is consist of three major modules: Dropper, Loader, and Plugin, with the main functions determined by the Loader & Plugin, and this botnet has always been active since our disclosure.

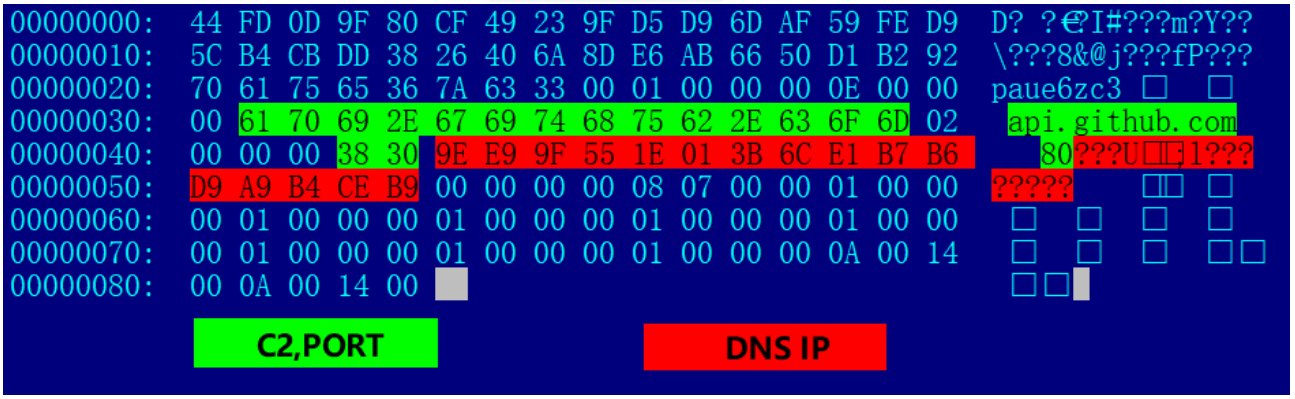
In September this year, our BotMon's C2 auto-extraction system alerted us that there was an update of Specter's sample and the auto-extracted C2 was `api.github.com` on its port `80` .

There is no need to explains what api.github.com is, although we have seen many malware using github.com before, they pretty much all just use its web service to download their own malicious programs.

But here how can Specter uses api.github.com as its C2 communication node and passes control traffic back and forth between github and its bots? Was github hacked, or was it a bug in our own C2 auto-extraction module?

We took a close look at the sample (md5: `2aec3f06abd677f5f129ddb55d2cde67`), and saw that the Specter update focused on the structure of the C2 configuration file, the C2 config in the previous versions could be located by searching the `SpectCF` string. The new version eliminated this. The following is the decrypted C2 configuration

file of this sample, the green part is the C2: `api.github.com:80` mentioned above.



The data in red is the new from this update, and what is it? After parsing in small-end format, weI found that they are the following 4 IP addresses, belonging to the DNS Hosting provider ClouDNS

```
 85.159.233.158
108.59.1.30
217.182.183.225
185.206.180.169
```

The new Specter sample send dns request to C2 using the following code snippet, which has the logic to craft the dns request packets and the ask the DNS IPs described above about the FQDN to finally get the C2 address.

```
v18 = compose_dns_packet((const char *)((v10[7] << 24) | (v10[6] << 16) | (v10[5] << 8) | v10[4]), &v12, &v13, 1u);
if ( v18 )
{
  v15 = random_proc(0, 5);
  for ( i = 0; i <= 4; ++i )
  {
    v3 = v15 + i;
    v14 = v3 % 5;
    v4 = v3 % 5 + 2;
    if ( (v10[4 * v4 + 3] << 24) | (v10[4 * v4 + 2] << 16) | (v10[4 * v4 + 1] << 8) | v10[4 * v4] )
    {
      v17 = dnsquery(
              (int)v18,
              &v12,
              (v10[4 * (v14 + 2) + 3] << 24) | (v10[4 * (v14 + 2) + 2] << 16) | (v10[4 * (v14 + 2) + 1] << 8) | v10[4 * (v14 + 2)],
              0x35u,
              5,
              3u);
```

Readers can use the dig command below on their own and see the difference quite clearly by comparing their output.

```
 dig api.github.com @8.8.8.8

dig api.github.com @85.159.233.158
```

At this point the fog clears and the C2 `api.github.com` used by Specter is actually a subdomain under ZONE `github.com` registered with the DNS Hosting provider ClouDNS. As long as the hacker uses the resolution server provided by ClouDNS, the resolution of `api.github.com` can be any IP the hacker picks.

Github was not hacked, the Specter botnet operator did not enter the wrong C2 domin, our C2 auto-extraction was not buggy, but the white domain api.github.com did indeed become a working C2 domain for this botnet. And this

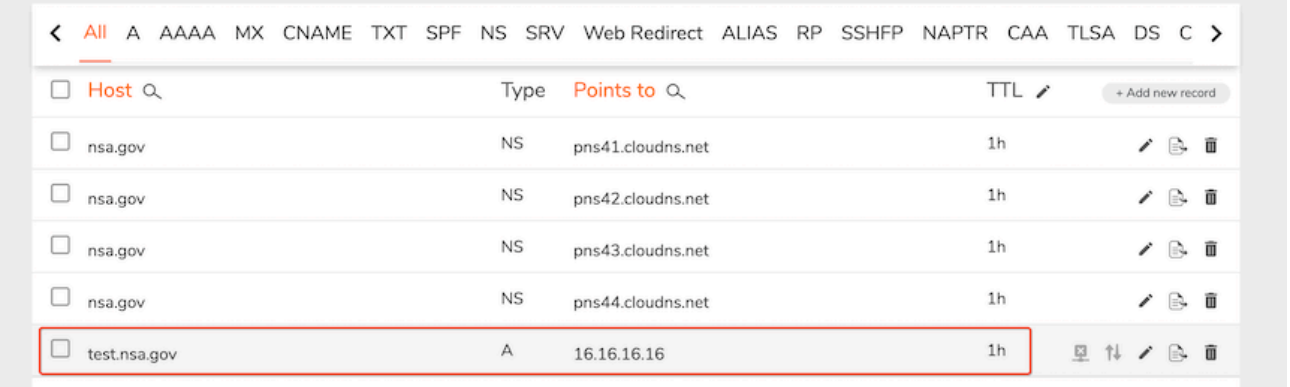
totally legit domain can easily deceive malware analysts and is a great challenge for security tools based on black and white list rules.

ClouDNS

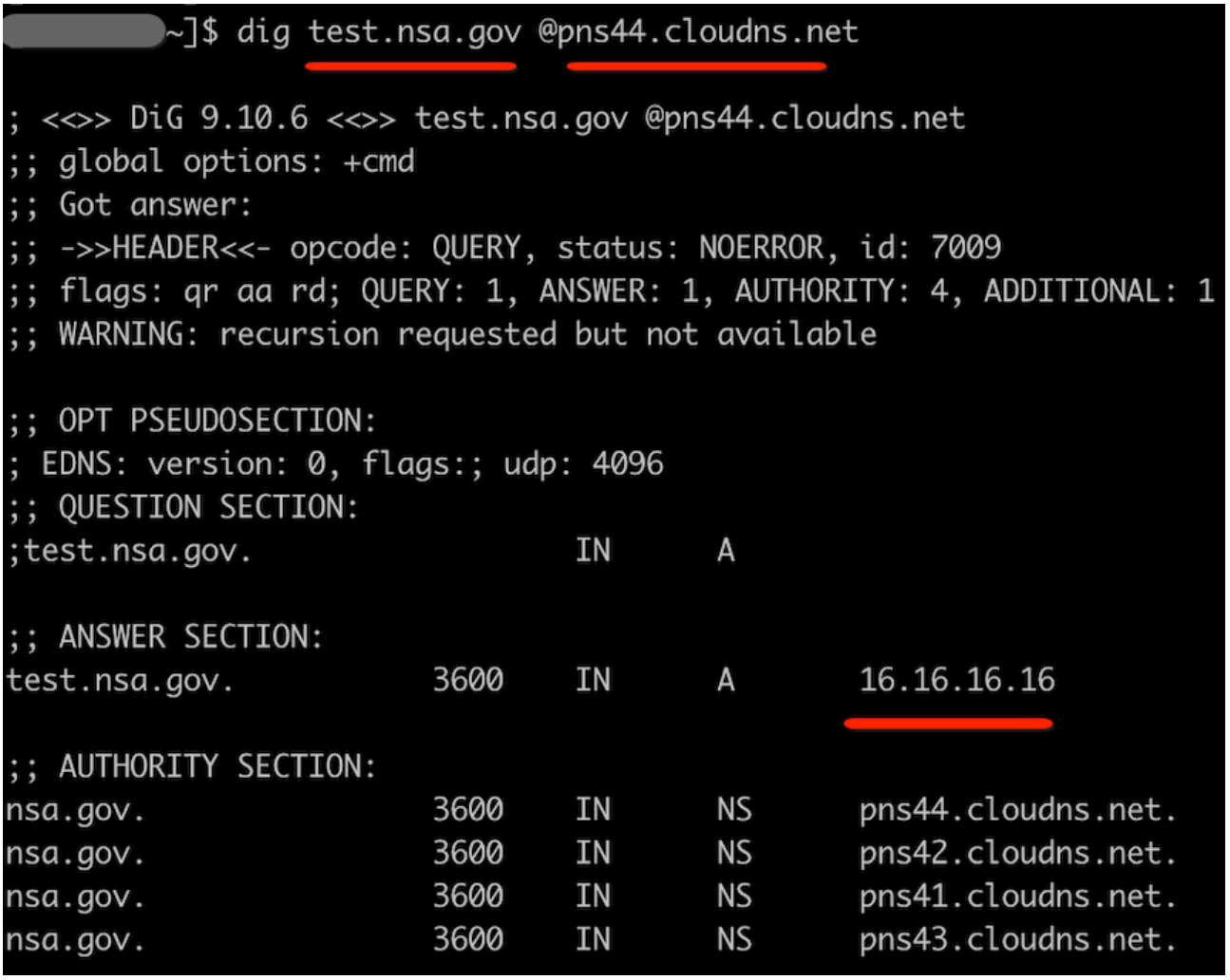
Given the above exploitation process, let's explore ClouDNS a little bit more here.

ClouDNS is a global managed DNS service provider based in Europe, offering services including GeoDNS, Anycast DNS and DNS DDoS protection.

ClouDNS allows arbitrary registration of DNS Zones and the addition of sub-domain resolution. We registered(and later removed after test) a DNS Zone named `nsa.gov`, added a sub-level domain name `test` and resolved to `16.16.16.16`. ClouDNS assigned us 4 Name Servers to resolve this domain name, as shown below.



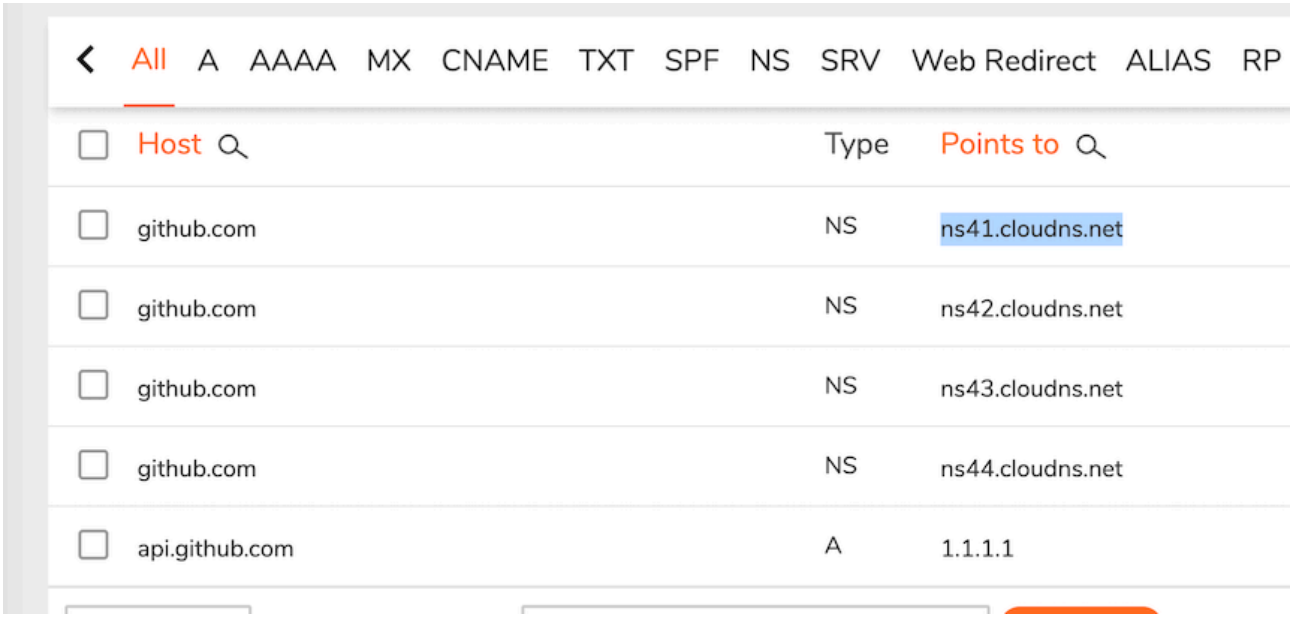
Once created successfully, the Name Servers assigned by the platform can be used to resolve the domain name we created.



Theoretically, we can register any Zone on ClouDNS that is not registered or not restricted by ClouDNS, and the aforementioned Specter C2 `api.github.com` is a domain name generated in this way.

Not only that, but ClouDNS also has a "mysterious logic" in determining whether a domain is "registered" or not. As mentioned earlier, `github.com` was already registered on ClouDNS by the Specter gang, but when we tried to re-register the github.com Zone, we were able to do so, just with a different batch of NSs than the Specter gang, as

shown here.



So, ClouDNS supports creating same zones as long as they are on their different NS Servers, this is pretty bizarre behavior.

> In fact, based on our test, not only ClouDNS, but also some other DNS hosting providers, have similar "vulnerabilities" in the verification of hosted domains, this is not the topic to be covered in this article though.

Explore ClouDNS Random Registration ZONEs

Based on our own Passive DNS data, we selected the TOP 1M popular second-level domains and did some serious tests. We wanted to find out how many SLDs of domains in the existing DNS system were registered with ClouDNS as new Zones and how many of them could be malicious.

The results of the probe showed that there were approximately `300` second-level domains that were registered in bad faith. Some of the maliciously registered SLDs in ClouDNS are as follows.

```
 akadns.net
onedrive.com
plivo.com
safe.com
consalud.cl
godaddysites.com
shopee.com
jsdelivr.net
afraid.org
rumahweb.com
mydomain.com
crypto.com
eq.edu.au
```

adnxs.com
webcindario.com
web.com
lamborghini.com
manager-magazin.de
toto.com
migalhas.com.br
googleadservices.com
example.com
dlink.com
whitehouse.gov
domain.com
googlesyndication.com
fb.com
payeer.com
ya.ru
mql5.com
aaa.com
hola.com
wukong.com
mihanblog.com
wpengine.com
jumia.ma
protonmail.com
tasnimnews.com
nintendo.com
tabnak.ir
lichess.org
digitalocean.com
asriran.com
amazon.com.br
akamaized.net
yjc.ir
office.net
4399.com
opera.com
wp.com
ytimg.com
avast.com
cloudflare.com
playstation.com
hespress.com
leagueoflegends.com
wixsite.com
skype.com
googlevideo.com
wp.pl

```
wix.com
samsung.com
doubleclick.net
weebly.com
udemy.com
speedtest.net
godaddy.com
zoom.us
espn.com
spotify.com
amazonaws.com
adobe.com
wordpress.com
apple.com
msn.com
github.com
office.com
alipay.com
netflix.com
360.cn
amazon.com
qq.com
```

In addition, we also selected the popular TOP 1M FQDNs across to check against ClouDNS, and the results showed that there are over `300` FQDNs that can generate non-normal resolution in ClouDNS, and after clean up, we found that at least `192` FQDNs are maliciously registered.

Summary

We have yet to see other malicious actors using this technique on a large scale, however, this is an important reminder for us that there are cases of malicious behavior being carried out under the cover of apparently normal network behavior.

Contact us

Readers are always welcomed to reach us on Twitter or email us to netlab at 360 dot cn.

IOC

Sample MD5

```
 0ffa01708fd0c67c78e9055b8839d24d
162c245378b2e21bdab6ef35dfaad6b1
2aec3f06abd677f5f129ddb55d2cde67
```

CC

```
 45.141.70.5
www.ibm.com @pns101.cloudns.net
api.github.com @ns103.cloudns.net
```

Source: https://blog.netlab.360.com/the-pitfall-of-threat-intelligence-whitelisting-specter-botnet-is-taking-over-top-legit-dns-domains-by-using-cloudns-service/