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Multiple vulnerabilities found in V-SOL OLTs

From: Pierre Kim <pierre.kim.sec () gmail com>

Date: Mon, 13 Jul 2020 14:45:52 +0100

Hello,

Please find a text-only version below sent to security mailing lists.

The complete version on "Multiple vulnerabilities found in V-SOL OLTs" is posted here:

<https://pierrekim.github.io/blog/2020-07-14-v-sol-olt-0day-vulnerabilities.html>

=== text-version of the advisory ===

-----BEGIN PGP SIGNED MESSAGE-----
Hash: SHA512

Advisory Information

Title: Multiple vulnerabilities found in V-SOL OLTs
Advisory URL: <https://pierrekim.github.io/advisories/2020-v-sol-0x00-olt.txt>
Blog URL: <https://pierrekim.github.io/blog/2020-07-14-v-sol-olt-0day-vulnerabilities.html>
Date published: 2020-07-14
Vendors contacted: None
Release mode: Full-Disclosure
CVE: None yet assigned

Product Description

The V-SOL OLTs are FTTH OLTs allowing to provide FTTH connectivity to a large number of clients (using ONTs). Some of the devices support multiple 10-gigabit uplinks and provide Internet connectivity to up to 1024 ONTs (clients).

We validated the vulnerabilities against V1600D4L OLT in our lab environment with the latest firmware versions (V1.01.49).

Using static analysis, these vulnerabilities also appear to affect all available OLT models as the codebase is similar:

- V1600D (V2.03.69 and V2.03.57)
- V1600D4L (V1.01.49)
- V1600D-MINI (V1.01.48)
- V1600G1 (V2.0.7 and V1.9.7)
- V1600G2 (V1.1.4)

We believe these models are also vulnerable:

- V1600D2-L
- V1600D2
- V1600D4
- V1600D4-DP
- V1600D8
- V1600D16
- V1600G0

For explanation about FTTH architecture, you can check my previous research at <http://pierrekim.github.io/blog/2016-11-01-gpon-ftth-networks-insecurity.html>.

Vulnerabilities Summary

The summary of the vulnerabilities is:

1. Backdoor Access with telnet
2. Enable Backdoor
3. Hardcoded RSA keys
4. Potential command injection
5. Code quality
6. Backdoor used for account creation
7. Backdoor specific to V1600D model
8. Insecure management interfaces

Details - Backdoor Access with telnet

A telnet server is running in the appliance and is reachable from the WAN interface and from the FTTH LAN interface (from the ONTs).

You can find below backdoor (undocumented) credentials, giving an attacker a low-privilege CLI access.

```
login: admin
password: !j@1#y$z%x6x7q8c9z)
```

The credentials have been extracted from firmware images:

[please use the HTML version at
<https://pierrekim.github.io/blog/2020-07-14-v-sol-olt-0day-vulnerabilities.html>
to see the image]

Authentication process with hardcoded credentials

```
$ telnet [ip]
Trying [ip]...
Connected to [ip].
Escape character is '^['.
```

```
Hello, this is epon olt platform (version 1.00).
Copyright 2010-2018, All Rights Reserved.
```

User Access Verification

Bad UserName or Bad Password , Login Failed.

Please retry

```
Login: admin
Password: !j@1#y$z%x6x7q8c9z)
```

```

olt> enable
Password: !j@!#y$z%xk7q8c9z)
olt#
clear          Reset functions
configure      Configuration from vty interface
copy           Copy configuration
disable        Turn off privileged mode command
end            Exit current mode and down to previous mode
exit           Exit current mode and down to previous mode
help           Description of the interactive help system
ip             Global IP configuration subcommands
list           Print command list
no             Negate a command or set its defaults
quit           Exit current mode and down to previous mode
show           Show running system information.
terminal       Set terminal line parameters
vtty           Virtual terminal
who            Display who is on vty
write          Write running configuration to memory, network, or terminal
olt#

```

This is vulnerable to a command injection, allowing to run commands as root.

The function starting the tftp process using system(3) will use the argument provided by the attacker, as shown below:

[please use the HTML version at
<https://pierrekim.github.io/blog/2020-07-14-v-sol-olt-0day-vulnerabilities.html>
to see the image]
TFTP command injection

Detail - Code quality

In the firmware image of V1600D4L and V1600D-MINI, we can find the following inside the 'init.sh' script:

```
$ cat init.sh
#!/bin/sh
[...]
ifconfig eth0 0.0.0.0
ifconfig eth0 up
[...]

telnetd -l /bin/sh&
```

During the update, the script appears to start telnetd without authentication.

Backdoor used for account creation

The string '4ef9ceal0b2362f15ba4558b1d5c081f' is being compared with an input value in the function used to create new users.

The code will check if the user is 'admin' or if the backdoor password '4ef9ceal0b2362f15ba4558b1d5c081f' is provided.

It appears it is being used to create admin users from non-admin users.

[please use the HTML version at
<https://pierrekim.github.io/blog/2020-07-14-v-sol-olt-0day-vulnerabilities.html>
to see the image]
Creation of new user, using a 'backdoor' password

Due to time constraints, we did not study this backdoor in depth.

Backdoor specific to V1600D model

This backdoor appeared in version 2.03.69.

The string 'K0LTdi@gnos3l2\$' is being compared with the password provided by the remote attacker. If it matches, the access will be provided.

[please use the HTML version at
<https://pierrekim.github.io/blog/2020-07-14-v-sol-olt-0day-vulnerabilities.html>
to see the image]
Authentication process with hardcoded credentials

Due to time constraints, we did not study this backdoor in depth.

Details - Insecure management interfaces

By default, the appliance can only be managed remotely with HTTP, HTTPS, telnet and SNMP. Some devices may support SSH. Furthermore, SSL is using hardcoded keys. An attacker can intercept passwords sent in clear-text and MITM the management of the appliance.

Dorks

"Hello, this is epon olt platform (version 1.00)."
"Copyright 2010-2018, All Rights Reserved."

Vendor Response

Full-disclosure is applied as we believe some backdoors are intentionally placed by the vendor.

Report Timeline

* Dec 29, 2019: Vulnerabilities found and this advisory was written.
* Jul 14, 2020: A public advisory is sent to security mailing lists.

Credits

These vulnerabilities were found by Pierre Kim (@PierreKimSec) and Alexandre Torres (@AlexTorSec).

References

<https://pierrekim.github.io/advisories/2020-v-sol-0x00-olt.txt>
<https://pierrekim.github.io/blog/2020-07-14-v-sol-olt-0day-vulnerabilities.html>

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-----BEGIN PGP SIGNATURE-----

```
iQIzBAEBCgAdFiEEoSgI9MSrzdXWrmCx4D40n2TLbwFA18MX4oACgkQxQd402n2T
LbYmBAArmUCDEI/WHC5ch3lYfXxhSZOTDl15GOD7osIixteXT67jCns5EGdhBJ
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gMzCzi/EZhuOAOArXimg7Qoxn3TvedmTorCtUrbC1MEIjQ8weuSxKCUK+joPGmkmv
I46u4GkyS2wmm+2DFQmxSXTZKX689YckXAlhgr7bpSDk3yBz12w=
-D0Ib
```

-----END PGP SIGNATURE-----

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