

RARE "Day One": [freeRouter CLI #004] - "Saving private OpenWRT", thanks freeRouter's TFTP server !

This is a new article for the blog serie called "RARE Day One". Today we will explore one of freeRouter feature that is used a lot in Service Provider trusted environment" TFTP server

Requirement

- Basic Linux/Unix knowledge
- Service provider networking knowledge



Overview

I'm not sure if this is still the case now, but back in 1999, I had the opportunity to managed multiple VPNs at a very huge French Service Provider. I'm saying huge as in this type of MPLS multi-service core network, you could have hundreds of VRF in the same PE router connecting a myriads of CPE via X25 (XOT), frame-relay and ATM PVC at best. In that context, some companies could have several thousands of routers in their VPNs and it was not common to follow a high pace deployment which was at ~10 CPEs per day for a new customer VPN implementation. So one of my favorite CLI command was:

staging a CPE with its final configuration

```
copy tftp run
Address or name of remote host []? <x.y.z.t>
Source filename []? <router-cpe-config-file-name>
Destination filename [running-config]?
...
```

That being said, I'm not sure if this has evolved since then as TFTP occurred inside a very protected out of band management network, it was very good and did a perfect job. Keep in mind that we could be hundreds of "VPN owner" deploying CPEs at the same time. This has to be highly available.

That was for the anecdote, but recently I attempted to upgrade my OpenWRT wifi router from 18.06.02 to the latest code train: 19.07.4. As a I'm lazy, I just sticked with OpenWRT web upgrade via LuCI. Not sure if I was right ... I don't know why and how but the upgrade failed and my wifi router got "bricked". 😞

After a lot of googling and reading, i concluded that I had only one solution: restore from factory and re-install OpenWRT 19.07.04 installation by hand. You have guess the rest of the article, the factory-reset procedure requires a TFTP server. 😊



Note

But before that, I had to solder an USB - UART module as described [here](#).

Article objective

As again i was lazy on installing a TFTP server on my MAC and disconnect my current LAN access in order to have a direct connectivity with the OpenWRT box, I had an idea (this is not often 😊) off the top of my head: "Hey, maybe freeRouter has a TFTP server that I can activate in few lines ?"... Well, after a terminal connection to my [home router](#) let me introduce you to freeRouter/TFTP server:

sdn6 is the port #6 connected from my [SOHO router](#) to OpenWRT router.

TFTP server configuration

```
sh run tftp
server tftp openwrt
  path /rtr/owrt/
  interface sdn6
  vrf inet
  exit
!
sh run sdn6
interface sdn6
  description mjolnir@LAN6[08:00.0]
  mtu 1500
  macaddr 004c.7307.0a77
  vrf forwarding inet
  ipv4 address 192.168.136.1 255.255.255.0
  ipv4 broadcast-multicast
  no shutdown
  no log-link-change
  exit
!
...
```

So the LAN port of my OpenWRT router is like this:

OpenWRT config (this can be done via Web GUI)

```
...
config interface 'lan'
  option type 'bridge'
  option proto 'static'
  option ipaddr '192.168.136.2'
  option netmask '255.255.255.0'
  option broadcast '192.168.136.255'
  option gateway '192.168.136.1'
  option ip6assign '60'
  list dns '192.168.254.1'
  option ifname 'eth0 eth0.1 eth0.2 wlan0 wlan1'
...
```

Basic connectivity check (well technically you could not ping as it is part if TFTP restore to factory process. Remember our box crashed! 😊)

ping OpenWRT

```
ping 192.168.136.2 /vrf inet
pinging 192.168.136.2, src=null, vrf=inet, cnt=5, len=64, tim=1000, ttl=255, tos=0, sweep=false
!!!!
result=100%, rcv/sent/lost=5/5/0, rtt min/avg/max/total=0/1/2/5
...
```

So we are basically ready ...

Initiate OpenWRT factory restore process via TFTP

```
=====
MT7621  stage1 code 10:33:11 (ASIC)
CPU=50000000 HZ BUS=12500000 HZ
=====
Change MPLL source from XTAL to CR...
do MEMPLL setting..
MEMPLL Config : 0x11100000
3PLL mode + External loopback
```

```

=== XTAL-40Mhz === DDR-1200Mhz ===
PLL2 FB_DL: 0x9, 1/0 = 567/457 25000000
PLL3 FB_DL: 0xc, 1/0 = 596/428 31000000
PLL4 FB_DL: 0x11, 1/0 = 560/464 45000000
do DDR setting..[00320381]
Apply DDR3 Setting...(use customer AC)
      0   8  16  24  32  40  48  56  64  72  80  88  96 104 112 120
-----
0000:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0001:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0002:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0003:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0004:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0005:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0006:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0007:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0008:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0009:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
000A:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
000B:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
000C:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
000D:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
000E:| 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1
000F:| 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0
0010:| 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0
0011:| 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0
0012:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0013:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0014:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0015:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0016:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0017:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0018:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0019:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
001A:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
001B:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
001C:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
001D:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
001E:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
001F:| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
rank 0 coarse = 15
rank 0 fine = 72
B:| 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0
opt_dle value:11
DRAMC_R0DELDLY[018]=00001F1F
=====
RX      DQS perbit delay software calibration
=====
1.0-15 bit dq delay value
=====
bit|    0  1  2  3  4  5  6  7  8  9
-----
0 |   10 7 9 9 7 7 8 7 3 6
10 |   6 7 7 9 6 9
-----

=====
2.dqs window
x=pass dqs delay value (min-max)center
y=0-7bit DQ of every group
input delay:DQS0 =31 DQS1 = 31
=====
bit    DQS0    bit    DQS1
0 (1~61)31  8 (1~56)28
1 (1~58)29  9 (1~61)31
2 (1~60)30 10 (1~59)30
3 (1~58)29 11 (1~57)29
4 (1~57)29 12 (1~60)30
5 (1~61)31 13 (1~60)30
6 (1~58)29 14 (1~61)31
7 (1~62)31 15 (1~61)31

```

```

=====
3.dq delay value last
=====
bit|   0  1  2  3  4  5  6  7  8  9
-----
0 |   10 9 10 11 9 7 10 7 6 6
10 |   7 9 8 10 6 9
=====

TX perbyte calibration
=====
DQS loop = 15, cmp_err_1 = ffff0000
dqs_perbyte_dly.last_dqsdly_pass[0]=15, finish count=1
dqs_perbyte_dly.last_dqsdly_pass[1]=15, finish count=2
DQ loop=15, cmp_err_1 = ffff0080
dqs_perbyte_dly.last_dqdly_pass[1]=15, finish count=1
DQ loop=14, cmp_err_1 = ffff0000
dqs_perbyte_dly.last_dqdly_pass[0]=14, finish count=2
byte:0, (DQS,DQ)=(8,8)
byte:1, (DQS,DQ)=(8,8)
20,data:88
[EMI] DRAMC calibration passed

=====
MT7621 stage1 code done
CPU=50000000 HZ BUS=12500000 HZ
=====

U-Boot 1.1.3 (Apr 17 2017 - 17:00:02)

Board: Ralink APSoC DRAM: 256 MB
Power on memory test. Memory size= 256 MB...OK!
relocate_code Pointer at: 8ffac000

Config XHCI 40M PLL
*****
Software System Reset Occurred
*****
Allocate 16 byte aligned buffer: 8ffdffd0
Enable NFI Clock
# MTK NAND # : Use HW ECC
NAND ID [C8 D1 80 95 42]
Device not found, ID: c8d1
Not Support this Device!
chip_mode=00000001
Support this Device in MTK table! c8d1
select_chip
[NAND]select ecc bit:4, sparesize :64 spare_per_sector=16
Signature matched and data read!
load_fact_bbt success 1023
load fact bbt success
[mtk_nand] probe successfully!
mtd->writesize=2048 mtd->oobsize=64, mtd->erasesize=131072 devinfo.iowidth=8
..=====
Ralink UBoot Version: 5.0.0.0
-----
ASIC MT7621A DualCore (MAC to MT7530 Mode)
DRAM_CONF_FROM: Auto-Detection
DRAM_TYPE: DDR3
DRAM bus: 16 bit
Xtal Mode=5 OCP Ratio=1/4
Flash component: NAND Flash
Date:Apr 17 2017 Time:17:00:02
=====
icache: sets:256, ways:4, linesz:32 ,total:32768
dcache: sets:256, ways:4, linesz:32 ,total:32768

##### The CPU freq = 880 MHZ #####
estimate memory size =256 Mbytes
#Reset_MT7530

```

```

set LAN/WAN LWLLL

Please choose the operation:
  1: Load system code to SDRAM via TFTP.
  2: Load system code then write to Flash via TFTP.
  3: Boot system code via Flash (default).
  4: Entr boot command line interface.
  7: Load Boot Loader code then write to Flash via Serial.
  9: Load Boot Loader code then write to Flash via TFTP.
4
You choosed 2

0

2: System Load Linux Kernel then write to Flash via TFTP.
Warning!! Erase Linux in Flash then burn new one. Are you sure?(Y/N)
Please Input new ones /or Ctrl-C to discard
  Input device IP (192.168.31.1) ==:192.168.31.1
  Input server IP (192.168.31.100) ==:192.168.31.2
  Input Linux Kernel filename () ==: <my_factory_router_image>

...

```

And ... Voilà !



Note

We won this factory reset battle but the war is over. After having restored the genuine official vendor image, we need to re-install OpenWRT with the latest 19.07.4 image and configure OpenWRT so that it can acts as a "dummy Wifi Access Point". DHCP, DNS will be served by the SOHO router.

Discussion

You can deploy freeRouter [manually](#) in a VM or [container](#) and [bind it to a linux interface](#) if you need a TFTP server in order to apply configuration to all your equipment. When final staging are done in a secure Out of Band management network context having a TFTP server is a blessing as it correspond to a gain of time in a production environment. Imaging hundreds of people working in a SP environment and working at the same time.

Conclusion

In this 4th article:

- We presented freeRouter **TFTP embedded server**
- You can use it in order to undertake network equipment deployment requiring TFTP
- This TFTP server is compatible with IPv4/IPv6

TFTP is a basic but a common tool in SP environment (or it was? If it is still used, yes please confirm !) In this example, I demonstrated the use of TFTP server in order to flash a wifi router to factory default. I have 802.11ac back up and running !



Final words

freeRouter can be perceived not only as a router but it is a networking Swiss army knife. in further articles we will shed some lights in various treasures hidden into freeRouter... And for free !

Last but not least, you can play with these different servers from this sandbox: (You'll be able to spot amazing server that will be the object of further article.)

type "telnet dl.nop.hu" in a terminal and choose "1"

```

Trying 193.224.23.5...
Connected to dl.nop.hu.
Escape character is '^]'.
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXX XXXXX XXX   XXX   XXX XX XX XXXX XXXXXXXXXXXXXXXXXXXXXXXX
XXXX  XXXX XX XXXX XX XXXX XX XX XX XXXX XXXXX/~::~::~\XXXXXX

```

```
XXXX X XXX XX XXXX XX XXXX XX XX XX XXXX XXXX| player |XXXXX
XXXX XX XX XX XXXX XX      XXX   XX XXXX XXXXX\_____/XXXXXX
XXXX XXX X XX XXXX XX XXXXXXX XX XX XXXX XXXXXXXXXXXXXXXXXXXXX
XXXX XXXX  XX XXXX XX XXXXXXX XX XX XXXX XXXXXXXXXXXXXXXXXXXXX
XXXX XXXXX XXX   XXX XXX XX XX XXX  XXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

```
welcome
line ready
menu lab:
# - reboot router1
$ - reboot router2
% - reboot router3
1 - connect to router1
2 - connect to router2
3 - connect to router3
^ - rebuild routers
l - connect to lg.nop.dn42
x - exit
choose:1 - attach vdc lab1
```

```
welcome
line ready
yourname#conf t
warning user.userLineHandler.doExec:userLine.java:606 <nobody> configuring from ttyl
yourname(cfg)#server ?
  bmp2mrt      - configure an bmp to mrt server
  bstun        - configure a bstun server
  chargen      - configure a chargen server
  daytime      - configure a daytime server
  dcp          - configure a dcp server
  dhcp4        - configure a dhcp4 server
  dhcp6        - configure a dhcp6 server
  discard      - configure a discard server
  dns          - configure a dns server
  echo         - configure an echo server
  etherip      - configure a etherip server
  forwarder    - configure a forwarder server
  ftp          - configure a ftp server
  geneve       - configure a geneve server
  gopher       - configure a gopher server
  gre          - configure a gre server
  gtp          - configure a gtp server
  honeypot     - configure a honeypot server
  http         - configure a http server
  irc          - configure an irc server
  iscsi        - configure an iscsi server
  l2f          - configure a l2f server
  l2tp2        - configure a l2tp v2 server
  l2tp3        - configure a l2tp v3 server
  loadbalancer - configure a loadbalancer server
  lpd          - configure a lpd server
  modem        - configure a modem server
  mplsip       - configure a mplsip server
  mplsudp      - configure a mplsudp server
  multiplexer  - configure a multiplexer server
  netflow      - configure a netflow server
  nrpe         - configure a nrpe server
  ntp          - configure a ntp server
  openflow     - configure an openflow server
  p4lang       - configure an p4lang server
  pcep         - configure a pcep server
  pckodtls     - configure a pckodtls server
  pckotcp      - configure a pckotcp server
  pckotxt      - configure a pckotxt server
  pckoudp      - configure a pckoudp server
  pop3         - configure a pop3 server
  pptp         - configure a pptp server
  prometheus   - configure a prometheus server
  quote        - configure a quote server
  radius       - configure a radius server
```

```
rfb          - configure a rfb server
rpki         - configure a rpki server
sip          - configure a sip server
smtp         - configure a smtp server
snmp         - configure a snmp server
socks        - configure a socks server
streamingmdt - configure a streaming telemetry server
stun         - configure a stun server
syslog       - configure a syslog server
tacacs       - configure a tacacs server
telnet       - configure a telnet server
tftp         - configure a tftp server
time         - configure a time server
udpfwd       - configure an udp forwarder server
udptn        - configure an udptn server
upnpfwd      - configure an upnp forwarder server
upnp hub     - configure an upnp hub server
voice        - configure a voice server
vxlan        - configure a vxlan server
```

```
yourname(cfg)#server
...
```

In order to exit the sandbox session use the following escape sequence: Ctrl-c + Ctrl-x

Enjoy