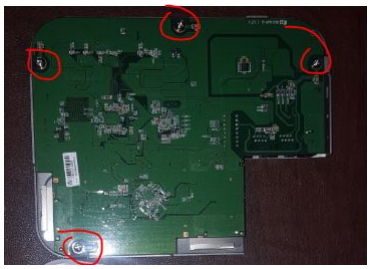
Opening MR12/16

You will need

- T5 TORX screwdriver (T6 for ? Meraki MR16 ? if not covered in tape)
- Philips Screwdriver
- some sort of prying tool
- Unscrew the two screws on either end of the device
    - Notes: They are covered in tape, you can push your Torx screwdriver into it to unscrew through the tape.

- Remove the metal cover from the plastic cover
    - You will need to pry the plastic away from the metal to release the clips
    - The best way to do this is by wedging in guitar-style opening picks between each clip and its mate, then picking one clip to leverage up with a flat-head screwdriver; pictured below

- Once removed, usncrew the board from the metal casing



Prepearing to Flashing MR12/16

You will need

- Machine used for flashing
- USB TTL Cable
- Power cable or POE
- Network Cable

on flashing machine

```
screen /dev/ttyUSB0 115200
```

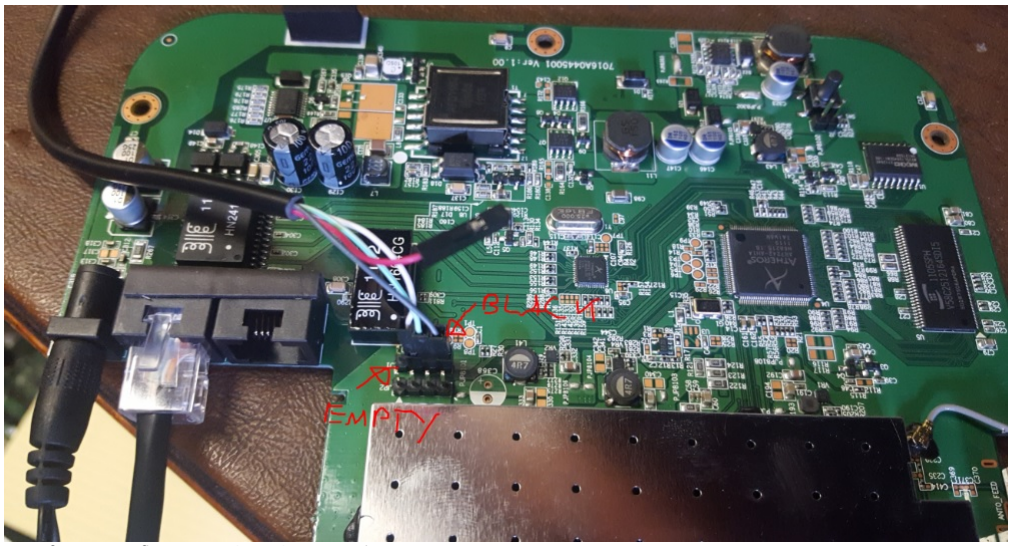
Windows> You can use PUTTY, select Serial, then the COM port found in Device Manager, and baud of 115200

on MR12/16

- Connect TTL
  - J1 on board

- Indicator arrow for pin 1

```
Pin 1 - unpopulated VCC (DO NOT connect the RED wire)
Pin 2 - White
Pin 3 - Green
Pin 4 - Black GND
```



    - if no output, flip PIN 2 and 3 and power cycle
- Press a key when `hit any key to stop autoboot` appear.
- If you miss it and you are not at the `ar7240>` prompt rebot and try again
    - Hint - you can spam the SPACE bar durring boot, just make sure you press enter after you get in to clear the prompt
    - Hint - you can avoid powercycling the MR12/16 by issuing the `reboot` command at the linux primpt

Expected output from MR12

```
Virian External MII mode MDC CFG Value ==> 6
: cfg1 0xf cfg2 0x7014
eth0 link down
eth0: 00:03:7f:e0:00:2a
ATHRSF1_PHY: PHY unit 0x0, address 0x4, ID 0xd04e,
ATHRSF1_PHY: Port 0, Neg Success
ATHRSF1_PHY: unit 0 port 0 phy addr 4
eth0 up
eth0
RESET is un-pushed
Hit any key to stop autoboot:  0
ar7240>
```

on flashing machine

- Install tftpd

```
apt-get install tftpd-hpa
cd /var/lib/tftpboot/
```

- Get binaries and place them in a TFTP root directory

```
wget https://downloads.openwrt.org/releases/18.06.2/targets/ar71xx/generic/openwrt-18.06.2-ar71xx-generic-mr12-squashfs-kernel.bin
wget https://downloads.openwrt.org/releases/18.06.2/targets/ar71xx/generic/openwrt-18.06.2-ar71xx-generic-mr12-squashfs-rootfs.bin

OR

wget https://downloads.openwrt.org/releases/18.06.2/targets/ar71xx/generic/openwrt-18.06.2-ar71xx-generic-mr16-squashfs-kernel.bin
wget https://downloads.openwrt.org/releases/18.06.2/targets/ar71xx/generic/openwrt-18.06.2-ar71xx-generic-mr16-squashfs-rootfs.bin
```

- add 192.168.1.101 to your computer's ip range

```
ifconfig enp3s0:1 192.168.1.101/24
```

Windows> You can use TFTP Server,configure the tftpd folder. then set your computer's ip to 192.168.1.101

FLASHING

on MR12/16

- Flash the board over uboot. Commands as follows
    - Download the kernel to memory
    - Erase the flash where the image will be
    - Copy image from memory to flash
    - Download and flash the rootfs same way
    - Set the starting point of the kernel
    - Save settings
- Note: MR12 and MR16 have differnt starting points for these files
- Note: copy paste each line individualy

MR12

```
tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr12-squashfs-kernel.bin;
erase 0x9fda0000 +0x240000;
cp.b 0x80010000 0x9fda0000 0x240000;

tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr12-squashfs-rootfs.bin;
erase 0x9f080000 +0xD20000;
cp.b 0x80010000 0x9f080000 0xD20000;

setenv bootcmd bootm 0x9fda0000;
saveenv;
```

MR16

```
tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr16-squashfs-kernel.bin;
erase 0xbfda0000 +0x240000;
cp.b 0x80010000 0xbfda0000 0x240000;

tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr16-squashfs-rootfs.bin;
erase 0xbf080000 +0xD20000;
cp.b 0x80010000 0xbf080000 0xD20000;

setenv bootcmd bootm 0xbfda0000;
saveenv;
```

2 LINE FLASH:

Same as above but in only 2 lines

```
tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr16-squashfs-kernel.bin; erase 0xbfda0000 +0x240000; cp.b 0x80010000 0xbfda0000 0x240000;

tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr16-squashfs-rootfs.bin; erase 0xbf080000 +0xD20000; cp.b 0x80010000 0xbf080000 0xD20000;  setenv bootcmd
bootm 0xbfda0000; saveenv; boot;
```

Expected output for MR12

```
ar7240> tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr12-squashfs-kernel.bin
Trying eth0
Using eth0 device
TFTP from server 192.168.1.101; our IP address is 192.168.1.2
Filename 'openwrt-18.06.2-ar71xx-generic-mr12-squashfs-kernel.bin'.
Load address: 0x80010000
Loading: #################################################################
         #################################################################
         #################################################################
         #################################################################
         #########
done
Bytes transferred = 1376970 (1502ca hex)
ar7240> erase 0x9fda0000 +0x240000
Erase Flash from 0x9fda0000 to 0x9ffdffff in Bank # 1
First 0xda last 0xfd sector size 0x10000                                                                                    253
Erased 36 sectors
ar7240> cp.b 0x80010000 0x9fda0000 0x240000
Copy to Flash... write addr: 9fda0000
done
```

- Finally boot the device

```
boot
```

Expected output for MR12

```
ar7240> setenv bootcmd bootm 0x9fda0000;
ar7240> saveenv;
Saving Environment to Flash...
Protect off 9F040000 ... 9F04FFFF
Un-Protecting sectors 4..4 in bank 1
Un-Protected 1 sectors
Erasing Flash...Erase Flash from 0x9f040000 to 0x9f04ffff in Bank # 1
First 0x4 last 0x4 sector size 0x10000
4
Erased 1 sectors
Writing to Flash... write addr: 9f040000
done
Protecting sectors 4..4 in bank 1
Protected 1 sectors
ar7240> boot
## Booting image at 9fda0000 ...
   Image Name:   MIPS OpenWrt Linux-4.9.152
   Created:      2019-01-30  12:21:02 UTC
   Image Type:   MIPS Linux Kernel Image (lzma compressed)
   Data Size:    1376906 Bytes =  1.3 MB
   Load Address: 80060000
   Entry Point:  80060000
   Verifying Checksum ... OK
   Uncompressing Kernel Image ... OK
No initrd
## Transferring control to Linux (at address 80060000) ...
## Giving linux memsize in bytes, 67108864

Starting kernel ...
```

Expected output from MR16

```
U-Boot 1.1.4-g5416eb09-dirty (Mar  3 2011 - 16:28:15)

AP96 (ar7100) U-boot 0.0.1 MERAKI
DRAM:  b8050000: 0xc0140180
64 MB
Top of RAM usable for U-Boot at: 84000000
Reserving 228k for U-Boot at: 83fc4000
Reserving 192k for malloc() at: 83f94000
Reserving 44 Bytes for Board Info at: 83f93fd4
Reserving 36 Bytes for Global Data at: 83f93fb0
Reserving 128k for boot params() at: 83f73fb0
Stack Pointer at: 83f73f98
Now running in RAM - U-Boot at: 83fc4000
id read 0x100000ff
flash size 16MB, sector count = 256
Flash: 16 MB
*** Warning - bad CRC, using default environment

In:    serial
Out:   serial
Err:   serial
Net:   ag7100_enet_initialize...
ATHRF1E: Port 0, Negotiation timeout
ATHRF1E: unit 0 phy addr 0 ATHRF1E: reg0 1000
eth0: 00:03:7f:e0:00:62
eth0 up
No valid address in Flash. Using fixed address
ATHRF1E: Port 1, Negotiation timeout
ATHRF1E: unit 1 phy addr 1 ATHRF1E: reg0 ffff
eth1: 00:03:7f:09:0b:ad
eth1 up
eth0, eth1
RESET is un-pushed
Hit any key to stop autoboot:  0
ar7100> tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr16-squashfs-kernel.bin;
Trying eth0
Using eth0 device
TFTP from server 192.168.1.101; our IP address is 192.168.1.2
Filename 'openwrt-18.06.2-ar71xx-generic-mr16-squashfs-kernel.bin'.
Load address: 0x80010000
Loading: ###################################################################
         ###################################################################
         ###################################################################
         ###################################################################
         #########
done
Bytes transferred = 1376952 (1502b8 hex)
ar7100> erase 0xbfda0000 +0x240000;
Erase Flash from 0xbfda0000 to 0xbffdffff in Bank # 1
First 0xda last 0xfd sector size 0x10000                                  253
Erased 36 sectors
ar7100> cp.b 0x80010000 0xbfda0000 0x240000;
Copy to Flash... write addr: bfda0000
done
ar7100> tftpboot 0x80010000 openwrt-18.06.2-ar71xx-generic-mr16-squashfs-rootfs.bin;
Trying eth0
Using eth0 device
TFTP from server 192.168.1.101; our IP address is 192.168.1.2
Filename 'openwrt-18.06.2-ar71xx-generic-mr16-squashfs-rootfs.bin'.
Load address: 0x80010000
Loading: ###################################################################
         ###################################################################
         ###################################################################
         ###################################################################
         ###################################################################
         ###################################################################
         ############################################################
done
Bytes transferred = 2293764 (230004 hex)
ar7100> erase 0xbf080000 +0xD20000;
Erase Flash from 0xbf080000 to 0xbfd9ffff in Bank # 1
First 0x8 last 0xd9 sector size 0x10000                                   217
Erased 210 sectors
ar7100> cp.b 0x80010000 0xbf080000 0xD20000;
Copy to Flash... write addr: bf080000
done
ar7100> setenv bootcmd bootm 0xbfda0000;
ar7100> saveenv;
Saving Environment to Flash...
Protect off BF040000 ... BF04FFFF
Un-Protecting sectors 4..4 in bank 1
Un-Protected 1 sectors
Erasing Flash...Erase Flash from 0xbf040000 to 0xbf04ffff in Bank # 1
First 0x4 last 0x4 sector size 0x10000                                      4
Erased 1 sectors
Writing to Flash... write addr: bf040000
done
Protecting sectors 4..4 in bank 1
Protected 1 sectors
ar7100>
```

Configuring MAC

Mac address needs to be configured to work properly, otherwase a default mac address is used. Check the plastic case for the stricker indicating the MAC address.

MAC shows as xx:xx:xx:xx:xx:xx Example Below: 00:18:0a:33:44:55

To format the MAC address for the mtd, remove `:` and repend eash set of two with `\x`

In the openwrt prompt

```
mtd erase mac
echo -n -e '\x00\x18\x0a\x33\x44\x55' > /dev/mtd5
echo -n -e '\x00\x18\x0a\x35\xbc\x30' > /dev/mtd5
echo -n -e '\x00\x18\x0a\x35\xa1\xb2' > /dev/mtd5

sync && reboot
```

Excpected output

```
root@opwenwrt:/# mtd erase mac
Unlocking mac ...
Erasing mac ...
root@opwenwrt:/# echo -n -e '\x00\x18\x0a\x33\x44\x55' > /dev/mtd5
root@opwenwrt:/# sync && reboot
root@opwenwrt:/#
```

End of instrucitons for flashing

Additional notes

Flashing a new ART

Sometimes it may become necessary to reflash the ART. The ART For the MR16 is located in the flash at `/dev/mtd6`, but it cannot be written to once OpenWrt has been booted (for safety's purpose). Instead, it must be flashed directly using uBoot.

The ART partition on the MR16 is 128KB long (2 blocks). You may use the previous procedure to bring an ART dump (produced via `dd if=/dev/mtd6 of=/tmp/art.bin`) onto the RAM, and then flash it into place; just make sure that you are connected to your laptop as before, and that the file `art.bin` is present in `/var/lib/tftpboot`:

```
tftpboot 0x80010000 art.bin
erase 0xbffe0000 +0x20000;
cp.b 0x80010000 0xbffe0000 0x20000;

saveenv;
boot
```