Reference Resources

MikroTik wAP 60G and wAP 60G AP

OS Selections

- RouterOS archive
  Index of /downloads (mikrotik-software.de)
- [No Supported Drivers] Researcher version of Openwrt for wAP 60G/LHGG-60ad/wAP 60Gx3 AP
  GitHub - IMDEANetworksWNG/Mikrotik-researcher-tools: An OpenWRT fork for all the IEEE 802.11ad MikroTik devices

Troubleshoot

- Common Procedures for MikroTik RouterBoard Products
  [OpenWrt Wiki] Common Procedures for MikroTik RouterBoard Products
- If the device is bricked: Manual: Netinstall
  Manual: Netinstall - MikroTik Wiki

Configuration Tools

- Winbox in Linux: winobx-installer
  GitHub - mriza/winbox-installer: Install winbox in fedora/ubuntu linux, using wine
- [RouterOS 7] New beta versions have alignment mode included (it will update information much faster) to use run from CLI:
  - `/interface w60g align wlan60-1`

Commonly Used Router OS Configuration Options

- Get SSID
  iw dev wlan0 info

Measurement Tools

- Measurement Tool for RouterOS: https://github.com/wyfbw07/MikroTik-RouterOS-Measurement-Tool
- Measurement Tool for OpenWRT:
  [Need to add]
- Owamp:
  https://software.internet2.edu/sources/I2util/
- Throughput Test Tool: iPerf3
  https://iperf.fr/iperf-download.php
  https://github.com/ar51an/iperf3-win-builds

Communication Protocols

QUIC

- QUIC: quiche
  GitHub - cloudflare/quiche: 🥧 Savoury implementation of the QUIC transport protocol and HTTP/3
- Multipath QUIC: quiche
  (Old version of MP-QUIC)
  https://github.com/qdeconinck/quiche/tree/multipath
  (New version of MP-QUIC)
  https://github.com/qdeconinck/quiche/tree/multipath-new-path-id-ietf-120

OWAMP

Download and install i2-utils
https://software.internet2.edu/sources/I2util/
```
./configure
sudo make
sudo make install
```

Install OWAMP
http://software.internet2.edu/sources/owamp/
```
./configure --with-I2util=/usr/local/lib/
sudo make
sudo make install
```

To run owamp under a restricted user, create a dedicated owamp user
```
sudo useradd owamp
```

Create the directory and assign ownership to the owamp user
```
sudo mkdir -p /var/lib/owamp
sudo chown owamp:owamp /var/lib/owamp
```

Modify datadir in the owampd.conf file
```
# location for "recv" session files.
# The "catalog" subdirectory is completely cleaned and recreated each
time
# owampd is restarted. DONT PUT ANYTHING IN THERE!
# (defaults to $cwd)
datadir /var/lib/owamp
```

Put the conf file under this place:
```
/usr/local/etc/owampd.conf
```

Finally, start the daemon during testing on both end
```
sudo /usr/local/bin/owampd -c /usr/local/etc -Z
```

Start a one way ping test to a machine (replace the IP address)
```
/usr/local/bin/owping -v 192.168.1.1
```

Troubleshoot if there are negative time delay value
Verify and synchronize system time
```
timedatectl status
sudo ntpdate ntp.ubuntu.com
```

Fact Sheet for wAP 60G Devices

- **Key for wAP 60G AP**

```
SoftwareID: 7NJD-IEIR

-----BEGIN MIKROTIK SOFTWARE KEY------------

pr8hQW//Qktz6QIHAmsCPJg138jR852qVBWWlB6vR6MQ

hGy8k1MLCibudzYstsyKfNAojkStTsH5uhiCEcGRNA==

-----END MIKROTIK SOFTWARE KEY--------------
```

- **Width of single antenna pattern and full span in degrees:**
  15-20 degrees single pattern and full span 60 degrees over horizontal and 30 degrees vertical plane.
- **Operational channels / Maximum output power:**
  58.32 GHz / 40 dBm
  60.48 GHz / 40 dBm
  62.64 GHz / 40 dBm
- **Channel Bandwidth 60 GHz (802.11ad/aj/ay)**
  Refer to the 802.11ad/aj/ay standards, also known as WiGig, operate in the 60 GHz V band unlicensed ISM band spectrum.

Selection	Channel Center (GHz)	Min. (GHz)	Max. (GHz)	BW (GHz)
1	58.32	57.24	59.4	2.16
2	60.48	59.4	61.56	2.16
3	62.64	61.56	63.72	2.16
4	64.8 (Not available)	63.72	65.88	2.16
5	66.96 (Not available)	65.88	68.04	2.16
6	69.12 (Not available)	68.04	70.2	2.16

Archive: OpenWRT on wAP 60G AP

AP (wAP 60G AP) on OpenWRT

```
root@OpenWrt:~# hostapd -B /etc/hostapd.conf
Configuration file: /etc/hostapd.conf
wlan0: interface state UNINITIALIZED->COUNTRY_UPDATE
Using interface wlan0 with hwaddr 48:a9:8a:41:50:cd and ssid "Mikrotik"
wlan0: interface state COUNTRY_UPDATE->ENABLED
wlan0: AP-ENABLED
root@OpenWrt:~# arp
IP address       HW type     Flags       HW address            Mask     Device
192.168.1.2      0x1         0x2         50:9a:4c:59:d1:eb     *        br-lan
```

STA (wAP 60G) on OpenWRT

```
root@OpenWrt:~# wpa_supplicant -D nl80211  -i wlan0 -c /etc/wpa_supplicant.conf -B
Successfully initialized wpa_supplicant
```

```
root@OpenWrt:~# arp
IP address       HW type     Flags       HW address            Mask     Device
192.168.1.2      0x1         0x0         00:00:00:00:00:00     *        br-lan
192.168.1.4      0x1         0x2         2c:16:db:aa:8e:6b     *        br-lan
```

```
root@OpenWrt:~# ping 192.168.1.2
PING 192.168.1.2 (192.168.1.2): 56 data bytes
^C
--- 192.168.1.2 ping statistics ---
5 packets transmitted, 0 packets received, 100% packet loss
```

Re: mmWave Connection Problem

WY **Wang, Yifan <wangy77@rpi.edu>**

Thursday, August 1, 2024 at 3:30 PM

To: Hongmiao Yu; Shaoyu Tu; **Cc:** Kar, Koushik; K.K. Ramakrishnan

Hi Hongmiao and Kevin,

TLDR:
Initially, we had issues with the UDP throughput tests. It has high package loss even in the baseline tests, and we have two options to resolve it:

1. Install and Try OpenWRT
2. Revert all RouterOS firmwares to the factory version

We decided to try OpenWRT first, but there are issues with setting up the link.
So, we tried the second option. We re-did all the tests, and it seems performing well.

I'm writing to let you know that the week after the previous meeting we decided to switch back to RouterOS, and that means we are now going with a different path than you in setting up the Mikrotik devices, and we are setting up QUIC recently.

We successfully installed OpenWRT on the devices, but when trying to start the AP and STA and set up the link following the guide in the repo, we only see "Successfully initialized wpa_supplicant" in the AP and nothing else, and that means the connection is not built. I suspect there's something wrong, and that's why I contacted and asked you again about the correct behavior in the meeting. You mentioned that the devices should automatically continue to establish a connection after a successful initialization.

This problem is somehow tricky because we don't see any output in the terminal after a successful initialization. It doesn't have any error or timeout messages and made us difficult to find the cause. After some research, I suspect that it could be the following reasons:

1. The fact that our devices are not officially supported by OpenWRT and that this is an old, customized researcher's repo means the driver for those devices could no longer work.
2. The reason for it not working could be that MikroTik made some adjustments to the driver.
3. The reason for MikroTik adjusting the driver could be because of the several revisions our devices (wAP 60G AP and wAP 60G) experienced.

The issue seems to arise during the driver installation when following the steps in the repo: We need to extract the wireless driver package from RouterOS and install it into OpenWRT. We also tried with driver files other than wil6210-d0.fw (There are many driver files after extracting) and not surprisingly they all failed during initialization.
The only find confirmation that I can find is that it would work for Revision 1. We have no idea why the wAP 60G undergoes several revisions although they are listed as the same model. They redid the entire PCB layout, and possibly also chose some other hardware and drivers) during revision 2. I also opened up our devices, they are of Revision 3, and look very similar to Revision 2 pictures that I found online. Support for Revision 2(and 3) possibly never happens.

I just want to let you know and see if you have suggestions, it's okay if you don't any. But anyhow, I appreciate your help along the way very much. Now we are using the factory version of RouterOS. We re-did all the tests, and they seem performing well.

Best,
Yifan Wang