

Configuring OpenWRT Devices for Operation on the NW-MESH Network via the GUI

This document assumes you have completed the first phase of the install and sysupgrade to the Attitude_Adjustment Beta release (12.09_Beta). While a Ubiquiti Bullet was used to create the screenshots shown in this example, the process and configuration items will be almost identical on any single-radio device supported by OpenWRT.

Prerequisites:

- 1) A device running OpenWRT v12.09_Beta
- 2) The device should have Internet access
- 3) A computer with an SSH client that can connect to the OpenWRT device.

Install the GUI and OLSR on the target device

- 1) SSH into the OpenWRT device
- 2) Issue the command “opkg update” to update the database of installable packages
- 3) Install the listed packages to enable the GUI and OLSR

```
root@OpenWrt:~# opkg update
```

```
Downloading http://downloads.openwrt.org/attitude_adjustment/12.09-beta/ar71xx/generic/packages/Packages.gz.  
Inflating http://downloads.openwrt.org/attitude_adjustment/12.09-beta/ar71xx/generic/packages/Packages.gz.  
Updated list of available packages in /var/opkg-lists/attitude_adjustment.  
root@OpenWrt:~#
```

```
root@OpenWrt:~# opkg install luci luci-ssl nano pciutils luci-app-olsr  
luci-app-olsr-services luci-app-olsr-viz olsrd olsrd-mod-arprefresh olsrd-  
mod-bmf olsrd-mod-dot-draw olsrd-mod-dyn-gw olsrd-mod-dyn-gw-plain olsrd-  
mod-httpinfo olsrd-mod-mdns olsrd-mod-nameservice olsrd-mod-p2pd olsrd-mod-  
pgraph olsrd-mod-secure olsrd-mod-txtinfo olsrd-mod-watchdog
```

Start the web server and configure the OpenWRT device to start the web server each time it is rebooted.

```
root@OpenWrt:~# /etc/init.d/uhttpd enable
root@OpenWrt:~# /etc/init.d/uhttpd start

Generating RSA private key, 1024 bit long modulus
Generating selfsigned certificate with subject
'C=DE;ST=Berlin;L=Berlin;CN=OpenWrt;' and validity 2012-10-10
23:53:57-2014-10-10 23:53:57
root@OpenWrt:~#
```

Reboot the OpenWRT device to ensure all services are properly configured to operate after a reboot.

OpenWrt - Overview - LuCI - Mozilla Firefox

192.168.137.37/cgi-bin/luci/stok=31d1e9b9a29cdf0e0919b41cabd55db/admin/status/

Your browser has been updated and needs to be restarted.

OpenWrt | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.30 0.18 0.20 | Auto Refresh: **on** **Unsaved Changes: 1**

Status System Services Network Logout

Overview Firewall Routes System Log Kernel Log Processes Realtime Graphs OLSR

Status

System

Router Name	OpenWrt
Router Model	Ubiquiti Bullet M
Firmware Version	OpenWrt Attitude Adjustment 12.09-beta / LuCI Trunk (trunk+svn9220)
Kernel Version	3.3.8
Local Time	Thu Oct 11 18:03:28 2012
Uptime	18h 24m 12s
Load Average	0.06, 0.52, 0.44

Memory

Total Available	14596 kB / 29344 kB (49%)
Free	2080 kB / 29344 kB (7%)
Cached	10700 kB / 29344 kB (36%)
Buffered	1816 kB / 29344 kB (6%)

Network

IPv4 WAN Status

Type: static
Address: 192.168.137.37
Netmask: 255.255.255.0
Gateway: 192.168.137.1
Connected: 18h 23m 59s

Active Connections: 35 / 16384 (0%)

DHCP Leases

Hostname	IPv4-Address	MAC-Address	Leasetime remaining
There are no active leases.			

Wireless

Generic 802.11bgn Wireless Controller (radio0)

SSID: OpenWrt
Mode: Unknown
Channel: 11 (0.000 GHz)
Bitrate: ? Mbit/s
Wireless is disabled or not associated

Associated Stations

MAC-Address	Network	Signal	Noise	RX Rate	TX Rate
-------------	---------	--------	-------	---------	---------

This is the primary status screen of the OpenWRT GUI.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.04 0.04 0.18 | Auto Refresh: **on** Unsaved Changes: 1

System | Administration | Software | Startup | Scheduled Tasks | LED Configuration | Backup / Flash Firmware | Reboot

System

Here you can configure the basic aspects of your device like its hostname or the timezone.

System Properties

General Settings | Logging | Language and Style

Local Time: Thu Oct 11 18:15:15 2012 [Sync with browser](#)

Hostname: **KY9K-2M210**

Timezone: UTC

Time Synchronization

Enable builtin NTP server: ☒

NTP server candidates:

0.openwrt.pool.ntp.org	✖
1.openwrt.pool.ntp.org	✖
2.openwrt.pool.ntp.org	✖
3.openwrt.pool.ntp.org	✖

[Reset](#) [Save](#) **[Save & Apply](#)**

The first step is to set the name of the OpenWRT device. After entering your desired hostname, press the “Save & Apply” button to save the change and update the running configuration.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.07 0.05 0.15 Unsaved Changes: 1

System | **Administration** | Software | Startup | Scheduled Tasks | LED Configuration | Backup / Flash Firmware | Reboot

Router Password

Changes the administrator password for accessing the device

Password:

Confirmation:

SSH Access

Dropbear offers SSH network shell access and an integrated SCP server

Dropbear Instance [✖ Delete](#)

Interface: ☐ lan: ☒ unspecified

Port: 2222

Listen only on the given interface or, if unspecified, on all

Specifies the listening port of this Dropbear instance

Allow root logins with password: ☒

Allow SSH password authentication: ☒

Allow the root user to login with password: ☒

Allow remote hosts to connect to local SSH forwarded ports: ☐

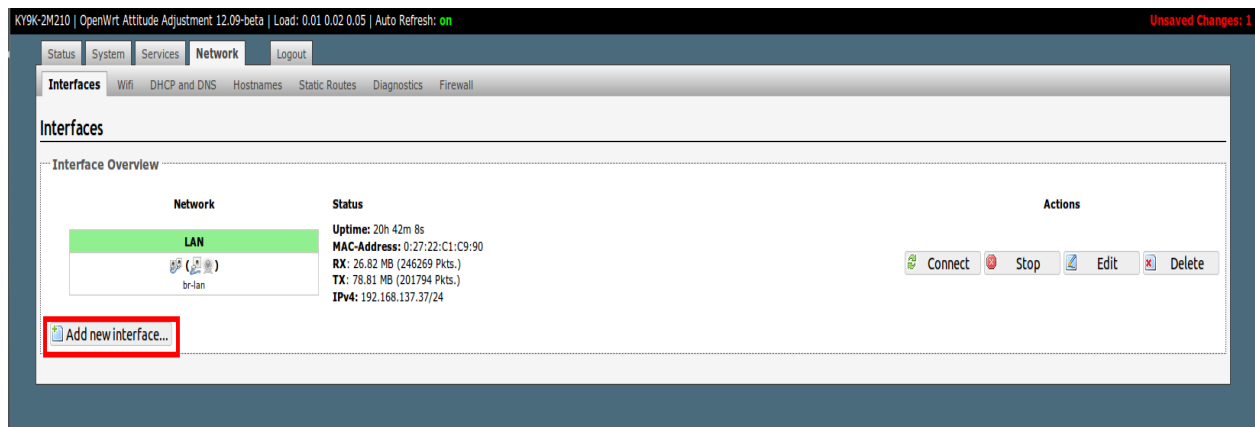
[Add](#)

SSH-Keys

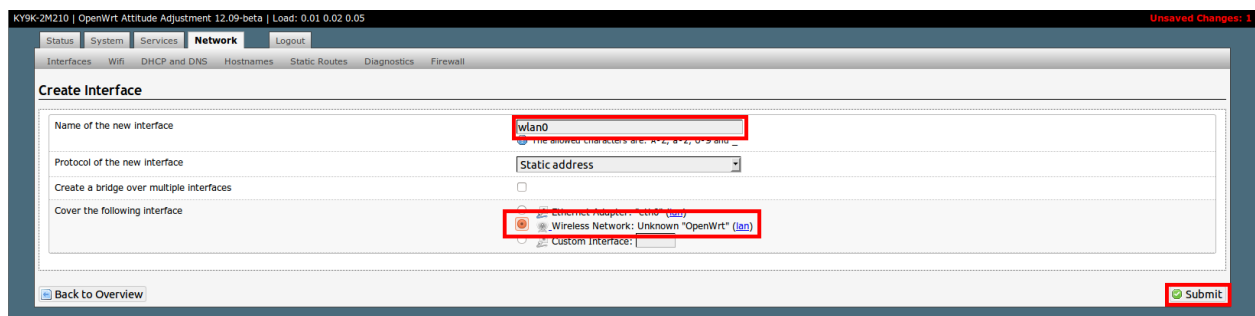
Here you can paste public SSH-Keys (one per line) for SSH public-key authentication.

[Reset](#) [Save](#) **[Save & Apply](#)**

To match the configuration used with the NW-MESH (DEV-MESH) and HSMM-MESH software on the WRT54G platform, set the SSH port number to “2222” and press the “Save & Apply” button.



Initially, the only interface on a Ubiquiti Bullet is the “LAN” interface. This interface includes the LAN port and the wireless interface. Press the “Add new interface” button to create a new interface.



Enter the interface name (“wlan0” recommended) and check the box for the correct wireless network interface. Then press “submit”.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.00 0.01 0.05 | Auto Refresh: **on** Unsaved Changes: 4

Status System Services **Network** Logout

Interfaces Wifi DHCP and DNS Hostnames Static Routes Diagnostics Firewall

WLAN0 LAN

Interfaces - WLAN0

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the names of several network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANID (e.g.: eth0.1).

Common Configuration

General Setup **Advanced Settings** Physical Settings Firewall Settings

Status wlan0 Interface not present or not connected yet.

Protocol Static address

IPv4 address 10.255.255.210

IPv4 netmask 255.0.0.0

IPv4 gateway

IPv4 broadcast

Use custom DNS servers

DHCP Server

No DHCP Server configured for this interface Setup DHCP Server

Reset Save **Save & Apply**

Fill in the IP address and netmask for the interface. Then press "Save & Apply". DO NOT USE THE IP ADDRESS SHOWN HERE. Make a posting to the NW-MESH@yahoogroups.com mailing list and request a subnet for your use. Please make an estimate of the number of non-WRT54G devices you intend to load in the next 3 months. Unlike the WRT54G, other devices do not auto-assign an IP address that is likely to be unique in the 10.0.0.0/8 subnet.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.11 0.05 0.06 | Auto Refresh: **on** Unsaved Changes: 1

Status System Services **Network** Logout

Interfaces **Wifi** DHCP and DNS Hostnames Static Routes Diagnostics Firewall

radio0: Unknown "OpenWrt"

Wireless Overview

Generic 802.11bgn Wireless Controller (radio0)

SSID: OpenWrt | Mode: Unknown
0% Wireless is disabled or not associated

Scan Add

Enable **Edit** Remove

Associated Stations

SSID	MAC-Address	IPv4-Address	Signal	Noise	RX Rate	TX Rate
No information available						

Press the "Edit" button to enter additional configuration data for the wifi interface. NOTE: If you are configuring a device with multiple radio cards/ports, this configuration applies to the 2.4GHz card/port you desire to attach to the mesh.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.09 0.05 0.06 | Auto Refresh: on Unsaved Changes: 1

Status System Services **Network** Logout

Interfaces **Wifi** DHCP and DNS Hostnames Static Routes Diagnostics Firewall

radio0: Unknown "OpenWrt"

Wireless Network: Unknown "OpenWrt" (radio0.network1)

The Device Configuration section covers physical settings of the radio hardware such as channel, transmit power or antenna selection which is shared among all defined wireless networks (if the radio hardware is multi-SSID capable). Per network settings like encryption or operation mode are grouped in the *Interface Configuration*.

Device Configuration

General Setup

Advanced Settings

Status

SSID: OpenWrt | Mode: Unknown

0% Wireless is disabled or not associated

Wireless network is disabled

☒ Enable

Channel

3 (2.422 GHz)

Transmit Power

20 dBm (100 mW)

Interface Configuration

General Setup

Wireless Security

ESSID

NW-MESH

Mode

Ad-Hoc

BSSID

Network

☐ lan:
☒ wlan0: (no interfaces attached)
☐ create:

Choose the network(s) you want to attach to this wireless interface or fill out the create field to define a new network.

Reset

Save

Save & Apply

In this screen you will set the basic operating parameters for the wifi interface on the mesh. In this example I set the power to 100mW for testing. 500-800mW would be appropriate for a BulletMxHP or BulethHP unit when deployed for actual use. Once these settings have been applied, enable the wifi interface.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.83 0.28 0.13 | Auto Refresh: on Unsaved Changes: 1

Status System Services **Network** Logout

Interfaces **Wifi** DHCP and DNS Hostnames Static Routes Diagnostics Firewall

radio0: Ad-Hoc "NW-MESH"

Wireless Network: Ad-Hoc "NW-MESH" (wlan0)

The Device Configuration section covers physical settings of the radio hardware such as channel, transmit power or antenna selection which is shared among all defined wireless networks (if the radio hardware is multi-SSID capable). Per network settings like encryption or operation mode are grouped in the *Interface Configuration*.

Device Configuration

General Setup

Advanced Settings

Mode

802.11g

Country Code

US - United States

Use ISO/IEC 3166 alpha2 country codes.

Distance Optimization

Distance to farthest network member in meters.

Fragmentation Threshold

RTS/CTS Threshold

Interface Configuration

General Setup

Wireless Security

ESSID

NW-MESH

Mode

Ad-Hoc

BSSID

Network

☐ lan:
☒ wlan0:
☐ create:

Choose the network(s) you want to attach to this wireless interface or fill out the create field to define a new network.

Reset

Save

Save & Apply

In the "Advanced Settings" tab it is necessary to set the device to use 802.11g only. With the current OpenWRT base code, attempting to run mixed g-n networks is unreliable.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.51 0.43 0.21 Unsaved Changes: 1

Status System **Services** Network Logout

OLSR

Plugins HNA Announcements Display

OLSR Daemon

The OLSR daemon is an implementation of the Optimized Link State Routing protocol. As such it allows mesh routing for any network equipment. It runs on any wifi card that supports ad-hoc mode and of course on any ethernet device. Visit olsrd.org for help and documentation.

General settings

General Settings Link Quality Settings SmartGW Advanced Settings

Internet protocol

FIB metric

Port

Main IP

Interfaces Defaults

General Settings IP Addresses Timing and Validity

Mode

Weight

LinkQuality Multiplier

Interfaces

Enable	Network	Mode	Hello	TC	MID	HNA	
<input checked="" type="checkbox"/>		mesh	5.0s / 40.0s	2.0s / 256.0s	18.0s / 324.0s	18.0s / 108.0s	Edit Delete

[Add](#)

Now that the wifi interface has been configured, it must be added to the OLSR configuration. From the Services-OLSR menu click the “Add” button in the “Interfaces” section near the bottom of the screen.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.31 0.39 0.21 Unsaved Changes: 11

Status System **Services** Network Logout

OLSR

Plugins HNA Announcements Display

OLSR Daemon - Interface

The OLSR daemon is an implementation of the Optimized Link State Routing protocol. As such it allows mesh routing for any network equipment. It runs on any wifi card that supports ad-hoc mode and of course on any ethernet device. Visit olsrd.org for help and documentation.

Interface

General Settings IP Addresses Timing and Validity

Enable ☒

Network ☒ wlan0

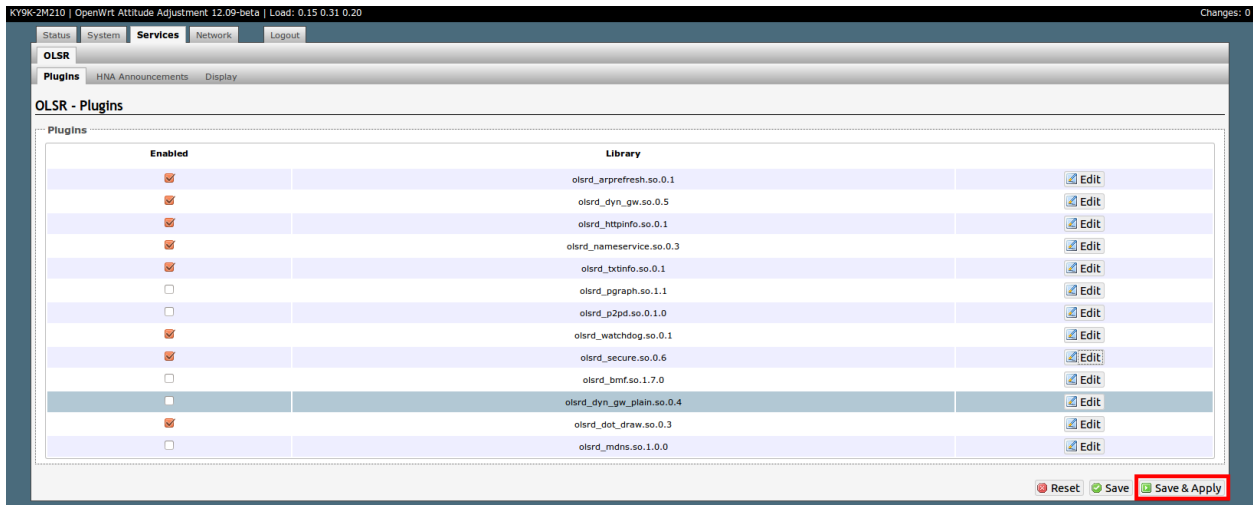
Mode

Weight

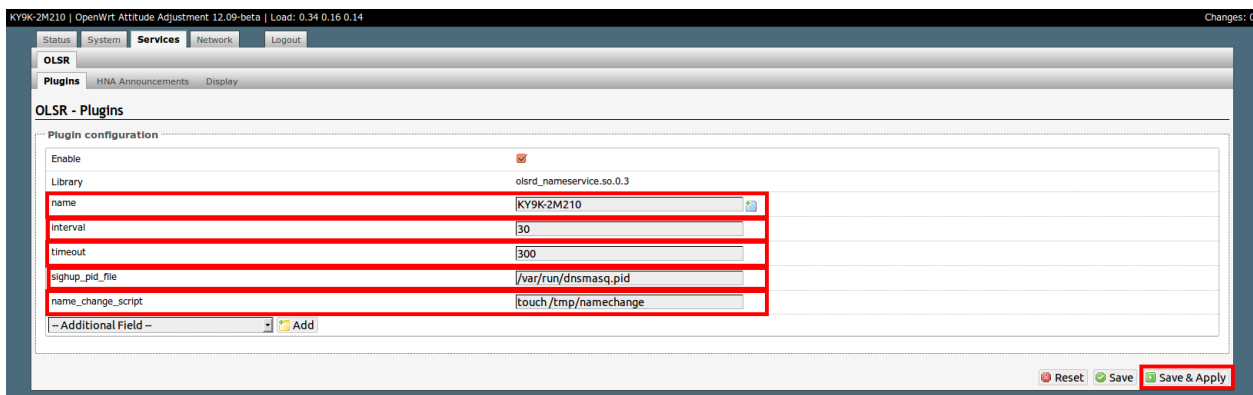
LinkQuality Multiplier

[Back to Overview](#) [Reset](#) [Save](#) [Save & Apply](#)

Select the “wlan0” interface or whatever name you called your 2.4GHz wifi interface to be attached to the mesh. Press “Save & Apply”.



Ensure all the appropriate OLSR plugins are active. They are checked in the above view. Once all the appropriate items have been checked and verified, press the “Save & Apply” button. Then press the “Edit” button on the line for “olsrd_nameservice”.



For each parameter shown, select the field name on the left side in the drop down “-Additional Field-” box and click “Add”. Set the “name” value to match the name of your node. Once all entries have been added and checked, press the “Save & Apply” button.

Connect to the OpenWRT device using SSH and edit the key file which is used to cryptographically sign the olsr routing updates. This file is not included in this document. Please post to the NW-MESH@yahoogroups.com email list and request the file. Since this is the file which control authorized access to the mesh it should not be shared with other than amateur radio operators participating in the NW-MESH network.

One of the packages installed is the “nano” text editor. It has a friendlier interface than “vi”. If you are comfortable with vi, then by all means use it. To edit the key file using nano, enter the command “**nano /etc/config/olsr.key**” on the OpenWRT device. Simply paste the key into the file, and ensure there are no blank lines left in the file. The press **<CTRL>-x** to exit the editor. When asked if you want to save the file, type “**y**” and **<ENTER>**.

It is now necessary to edit the olsrd configuration file location at /etc/config/olsrd. Enter the command “**nano /etc/config/olsrd**” and edit the olsrd_secure section of the file so it looks like the following:

```
config LoadPlugin
    option library 'olsrd_secure.so.0.6'
    option keyfile '/etc/config/olsr.key'
    option ignore '0'
```

Enter the command “**uci commit olsrd**” to regenerate the configuration file for olsr. Then issue the command “**/etc/init.d/olsrd restart**” to restart olsrd and read the new configuration file.

At this point if you have another mesh node in range (highly recommended) you should see the OpenWRT device establish a connection to the mesh node.

The screenshot shows the OpenWRT LuCI Status page. The top navigation bar includes Overview, Firewall, Routes, System Log, Kernel Log, Processes, Realtime Graphs, and OLSR. The main content is divided into several sections:

- Status**
 - System**: Router Name (KY9K-2M210), Router Model (Ubiquiti Bullet M), Firmware Version (OpenWrt Attitude Adjustment 12.09-beta / LuCI Trunk (trunk+svn9220)), Kernel Version (3.3.8), Local Time (Thu Oct 11 20:35:56 2012), Uptime (20h 56m 40s), Load Average (0.06, 0.12, 0.14).
 - Memory**: Total Available (13344 kB / 29344 kB (45%)), Free (3740 kB / 29344 kB (12%)), Cached (8212 kB / 29344 kB (27%)), Buffered (1392 kB / 29344 kB (4%)).
 - Network**: IPv4 WAN Status (Type: static, Address: 192.168.137.37, Netmask: 255.255.255.0, Gateway: 192.168.137.1, Connected: 20h 56m 27s), Active Connections (54 / 16384 (0%)).
 - DHCP Leases**: Table with columns Hostname, IPv4-Address, MAC-Address, Leasetime remaining. Note: There are no active leases.
 - Wireless**: Generic 802.11bgn Wireless Controller (radio0). Details: SSID: NW-MESH, Mode: Ad-Hoc, Channel: 6 (2.437 GHz), Bitrate: 1 Mbit/s, BSSID: 06:87:48:70:76:FB, Encryption: -.
 - Associated Stations**: Table with columns MAC-Address, NETWORK, Signal, Noise, RX Rate, TX Rate. One station is listed: 20:AA:4B:48:7F:DB, Ad-Hoc "NW-MESH", -6 dBm, -95 dBm, 1.0 Mbit/s, MCS 0, 20MHz, 1.0 Mbit/s, MCS 0, 20MHz.

Powered by LuCI Trunk (trunk+svn9220)

You can also click “Status – OLSR” in the GUI to see more information about the nodes currently meshed with the OpenWRT device.

To provide a display of node names instead of simply the mesh interface IP address for each connected node, make the following additional changes in the GUI.

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.13 0.08 0.12 | Auto Refresh: on | Unsaved Changes: 3

Status System Services **Network** Logout

Interfaces Wifi **DHCP and DNS** Hostnames Static Routes Diagnostics Firewall

DHCP and DNS

Dnsmasq is a combined DHCP-Server and DNS-Forwarder for NAT firewalls

Server Settings

General Settings **Resolve and Hosts Files** TFTP Settings Advanced Settings

Use /etc/ethers ☒ Read /etc/ethers to configure the DHCP-Server

Leasefile ☒ /tmp/dhcp.leases
File where given DHCP-leases will be stored

Ignore resolve file ☐

Resolve file ☒ /tmp/resolv.conf.auto
local DNS file

Ignore Hosts files ☐

Additional Hosts files ☒ /var/run/hosts_olsr

Active DHCP Leases

Hostname	IPv4-Address	MAC-Address	Leasetime remaining
There are no active leases.			

Static Leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served. Use the Add Button to add a new lease entry. The MAC-Address identifies the host, the IPv4-Address specifies to the fixed address to use and the Hostname is assigned as symbolic name to the requesting host.

Hostname	MAC-Address	IPv4-Address
This section contains no values yet		

KY9K-2M210 | OpenWrt Attitude Adjustment 12.09-beta | Load: 0.20 0.11 0.13 | Auto Refresh: on | Changes: 0


Status System Services **Network** Logout

Interfaces Wifi **DHCP and DNS** Hostnames Static Routes Diagnostics Firewall

DHCP and DNS

Dnsmasq is a combined DHCP-Server and DNS-Forwarder for NAT firewalls

Applying changes

 /etc/config/dhcp

Server Settings

General Settings **Resolve and Hosts Files** TFTP Settings Advanced Settings

Domain required ☒ Don't forward DNS-Requests without DNS-Name

Authoritative ☒ This is the only DHCP in the local network

Local server ☒ /lan/
Local domain specification. Names matching this domain are never forwarded and resolved from DHCP or hosts file only

Local domain ☒ mesh.us
Local domain suffix appended to DHCP names and hosts file entries

Log queries ☐ Write received DNS requests to syslog

DNS forwardings ☒ example.org/10.1.2.3
List of DNS servers to forward requests to

Rebind protection ☒ Discard upstream RFC1918 responses

Allow localhost ☒ Allow upstream responses in the 127.0.0.0/8 range, e.g. for RBL services

Domain whitelist ☒ host.netflix.com
List of domains to allow RFC1918 responses for

Active DHCP Leases

Hostname	IPv4-Address	MAC-Address	Leasetime remaining
There are no active leases.			

Static Leases

Static leases are used to assign fixed IP addresses and symbolic hostnames to DHCP clients. They are also required for non-dynamic interface configurations where only hosts with a corresponding lease are served. Use the Add Button to add a new lease entry. The MAC-Address identifies the host, the IPv4-Address specifies to the fixed address to use and the Hostname is assigned as symbolic name to the requesting host.

Hostname	MAC-Address	IPv4-Address
This section contains no values yet		

HAPPY MESHING!!!!