

## MikroTik hAP ax lite Network Extender Application

### DESCRIPTION

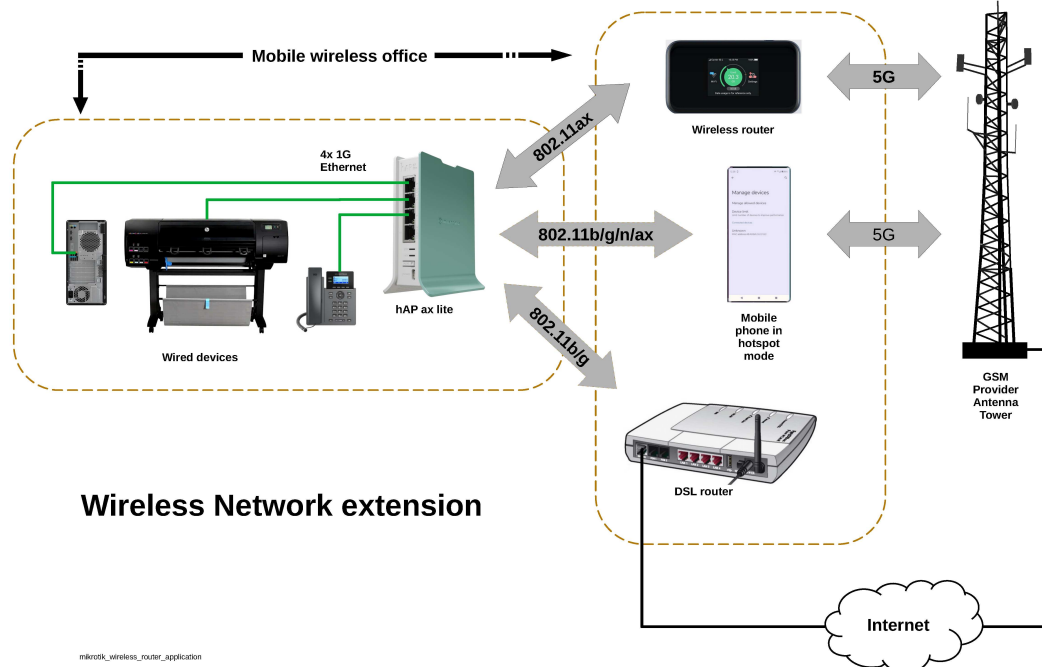
Detailed configuration of the **MikroTik hAP ax lite** router to access the Internet via an existing WiFi Access Point (AP).

The router is equipped with a 2.4 GHz WiFi 6 / IEEE 802.11ax wireless interface and four (4) 1Gb Ethernet ports connected to a network controller (MT7531BE).

[https://mikrotik.com/product/hap\\_ax\\_lite](https://mikrotik.com/product/hap_ax_lite)

### APPLICATIONS

- Wireless network extension connecting to the Internet AP of a wired router providing 4x wired Ethernet connections.
- Wireless network extension connecting to the Internet AP / hotspot of a mobile phone or GSM/4G/5G router (e.g. ZTE MU5001).
- Mobile wireless office.
- Implementation of secure access protocols (not covered in this note).



## AFTER THE ROUTER IS CONFIGURED

- All wired interfaces (**ether1 - ether4**) of the router will belong to the same LAN bridge.
- The LAN bridge, running a Dynamic Host Control Protocol (DHCP) client, will have acquired a LAN address, gateway and NTP server address from the connected AP.
- Devices connected to the wired interfaces running a DHCP client will acquire an address from the connected AP and will be able to access the Internet via the AP.
- The LAN bridge is still running the default DHCP server assigning addresses in the range (192.168.88.10 - 192.168.88.254), therefore connected devices running DHCP clients will still be able to interoperate in the absence of a remote AP.
- The router will accept connections to the address assigned by the connected AP but also to the default LAN bridge address / router management address (192.168.88.1).

## CONFIGURATION INSTRUCTIONS

To configure the router you need a computer connected to one of router ports 2, 3, or 4 - marked as LAN ports. In its default configuration port 1 of the router is used as the WAN port.

### Reset

If router credentials are lost or forgotten, the router may be reset to a known configuration:

- Press the reset button. Use a ball-point pen.
- Keep holding the reset button until the green indicator marked 'usr' starts flashing.
- Release the reset button.
- Wait until all indicator lights flash (about 40 seconds).

For more reset button options see <https://help.mikrotik.com/docs/display/ROS/Reset+Button>

### Router management / programming

**Note:** Following instructions are based on **WebFig** menus, followed by corresponding terminal commands shown in **monospaced** font. In terminal mode, use **<TAB>** to show available command options.

**WebFig** - a built-in web-based application

**WinBox** - application provided by MikroTik (<https://mikrotik.com/download>, Linux version currently in Beta)

**Terminal** (within WebFig / WinBox)

**SSH** - use for terminal commands or via SFTP for file transfer

**FTP** - use for file transfer

**TELNET** - use for terminal commands

### Services provided by the router

PORT	STATE	SERVICE	
21/tcp	open	ftp	
22/tcp	open	ssh	
23/tcp	open	telnet	
53/tcp	open	domain	
80/tcp	open	http	
443/tcp	open	https	<< (not running by default)
2000/tcp	open	cisco-sccp	
8291/tcp	open	winbox	
8728/tcp	open	api	
8729/tcp	open	api-ssl	

**Default router address**

```
192.168.88.1
```

**Default user / password**

Printed on the label at the bottom of the device

```
admin / XXXXXXXXXXXX
```

After router configuration is complete you may add a secondary address to your wired Ethernet interface for accessing the router (replace **eth2** in the example with the name of the connected network interface).

```
su
ifconfig eth2:0 192.168.88.2 up
```

**Test router accessibility**

```
ping 192.168.88.1
```

**Initial router login**

- Connect the configuration computer to one of the 'LAN' ports (ether2 - ether4)
- Setup the Ethernet port of the configuration computer with a low address in the default router LAN address range (e.g. 192.168.88.3)
- Login using a web browser with recent 'features' (e.g. Firefox) or via SSH (e.g. ssh admin@192.168.88.1)

You will be asked to change the admin password if this is the first login after reset

**Restore system configuration to factory defaults**

```
System > Reset Configuration
```

```
/system reset-configuration
```

Remove the current router entry from the `~/ssh/known_hosts` file of the configuration computer. The default password will need to be changed (again) at next login.

**Update (if RouterOS version is < 7.13)**

If the router is already running and connected to the Internet, you may use the update commands

```
/system package update install [ignore-missing]
/system routerboard upgrade
```

Otherwise you may go the manual way:

- Download a version supporting station-pseudobridge mode from

```
https://mikrotik.com/download/archive
select all_packages-arm-7.16.zip
```

or directly

```
https://download.mikrotik.com/routeros/7.16/all\_packages-arm-7.16.zip
```

- Unzip the packages to a local directory and upload to the router's root directory using FTP or SFTP
- Reboot the router and login (see Restore system configuration to factory defaults)

```
https://help.mikrotik.com/docs/display/ROS/Upgrading+and+installation
```

**Configure WiFi**

```
WiFi > wifi1
  General > Mode: station pseudobridge
  Configuration > SSID: <access point SSID>
  Configuration > Country: <access point country>
  Configuration > [Rx] Chains: 0, 1
  Configuration > Tx Chains: 0,1
  Configuration > Tx Power: 14
  Configuration > Antenna Gain: 5
  Configuration > Manager: local
  Channel > Frequency: 2300-7300 (actually it uses only the 2400MHz band)
  Channel > Reselect Interval: 00:10:00 00:20:00
  Security > Authentication Types: WPA2 PSK, WPA3 PSK
  Security > Passphrase: <access point password>
  Apply
```

```
/interface wifi set [ find default-name=wifi1 ] channel.band=2ghz-ax \
.frequency=2300-7300 .reselect-interval=10m..20m \
.secondary-frequency=disabled,disabled \
.skip-dfs-channels=10min-cac .width=20/40mhz configuration.antenna-gain=5 \
.beacon-interval=1s .chains=0,1 .country=<access point country> \
.dtim-period=1 .manager=local .mode=station-pseudobridge \
.multicast-enhance=disabled .ssid=<access point SSID> \
.tx-chains=0,1 .tx-power=14 disabled=no \
security.authentication-types=wpa2-psk,wpa3-psk .connect-priority=0 \
.encryption="" .ft=yes .ft-over-ds=yes \
.group-encryption=ccmp .passphrase=<access point password>
```

**Remove ether1 from the WAN list**

```
Interfaces > Interface List > WAN > ether1 > Remove
```

```
/interface/list/member/print
Columns: LIST, INTERFACE
# LIST INTERFACE
;;; defconf
0 LAN bridge
;;; defconf
1 WAN ether1

/interface list member remove numbers=1
```

**Add ether1 to the LAN bridge**

```
Bridge > Ports > Add New
  Interface: ether1
  Bridge: bridge
  Apply

/interface bridge port add bridge=bridge interface=ether1
```

**Add DHCP Client to the LAN bridge and remove it from ether1**

```
IP > DHCP Client > Add New
```

```
Interface: bridge
```

```
Apply
```

```
Select line with ether1 > Remove
```

```
/ip dhcp-client add interface=bridge
```

```
/ip dhcp-client remove ether1
```

Check that both the default static address and the assigned dynamic address are present

```
IP > Addresses
```

```
/ip/address/print detail
```

**NTP client**

Not all access points provide an NTP server. NTP servers may be added, as needed.

```
System > NTP Client > Enabled
```

```
Mode: unicast
```

```
NTP Servers: xx.pool.ntp.org (and/or others, as needed)
```

```
Apply
```

```
/system ntp client set enabled=yes set primary-ntp=xx.xx.xx.xx
```

**Wireless status indication**

The following command will enable the *usr* indicator to light steadily when the wireless connection is active and flash slowly if not. `interface-activity`, `interface-receive`, `interface-transmit` are also viable options.

```
System > LEDs > New
```

```
Type: wireless status
```

```
Interface: wifi1
```

```
Apply
```

```
/system leds add disabled=no interface=wifi1 leds=user-led type=wireless-status
```

**CONFIGURATION CHECK**

Reboot the router and check that the entire network chain is accessible (computer is assigned an address from the AP LAN, router LAN bridge is accessible, AP is accessible).

```
System > Reboot
```

```
/system reboot
```

**Disable Services**

Unwanted / unneeded services (open ports) should be disabled. Press <TAB> in terminal mode after the enable or disable command to see all available services.

```
IP > Services > (Select service) > Enabled (check / uncheck, as required) > Apply
```

```
/ip service enable www-ssl
```

```
/ip service disable telnet
```

## SCRIPTS FOR CHANGING AP

It is a good idea to prepare and store scripts to enable a quick change between known Access Points (APs). Scripts can be prepared off-line and stored using the command line or the built-in editor.

In the following command-line example, change xxxx with relevant information (script name, ssid, country, passphrase).

```
/system script add name=connect_to_xxxx source={
    # Connect to xxxx
    /ip dhcp-client release bridge
    /interface wifi disable [ find default-name=wifi1 ]
    :delay 2
    /interface wifi set [ find default-name=wifi1 ] \
        configuration.ssid=xxxx \
        configuration.country=xxxx \
        security.passphrase=xxxx
    /interface wifi enable [ find default-name=wifi1 ]
    /ip dhcp-client renew bridge
}
```

The syntax to use the built-in text editor for editing the `.source` attribute of the script is the following:

```
/system script edit connect_to_xxxx source
```

The command to run the stored script follows.

```
/system script run connect_to_xxxx
```

**Note** that connected devices running DHCP clients will also need to renew their leases following an access point change (replace **eth2** in the example with the name of the connected network interface).

```
ifdown eth2
ifup eth2
```

## READABLE ROUTER CONFIGURATION

Use the following command in order to obtain the router configuration in plain text. The `show-sensitive` option will include password and installation-specific information.

```
/export show-sensitive
or
/export show-sensitive verbose
```

## NO COPYRIGHT - NO WARRANTY

Written by Dimitri Marinakis (rtsys, rtsys gr).

This document contains MikroTik RouterOS configuration instructions and scripts placed in the public domain.

The information contained in this document is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

Corrections and comments are welcome.