

AREDN Documentation for Mikrotik devices and Yealink telephones

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Flash Mikrotik devices

Preparations

The small Mikrotik box or square Access Point (AP) will hereafter be referred to as "target devices."

Green are the notes for the AP.

Deactivate Wi-Fi on the PC and copy the «Installation_Directory» to a known place on your PC. Since all the necessary files for the target devices are available, you don't have to download anything else.

Unless you want to check the newest version of the files on

<http://downloads.arednmesh.org/firmware/html/stable.html> .

Unpack the target device, including the power supply, two short network cables, and the AP's PoE adapter (Y cable)

Supply power to the target device.

Two files are required for an initial installation, BIN and ELF. As said, they are already in your directory. Both target devices need the same .elf file.

The name of the hap router is: RB912UAG-5HPnD, and the .bin file has a 16M-ac in the name.

The name of the AP is: RBSXTsq-5HPnD, and the file has a 16M with no ac in the name.

Then download the Tiny PXE Server (<http://erwan.labalec.fr/tinypxeserver/pxesrv.zip>), unpack it, and save it in a directory (also available in our directory).

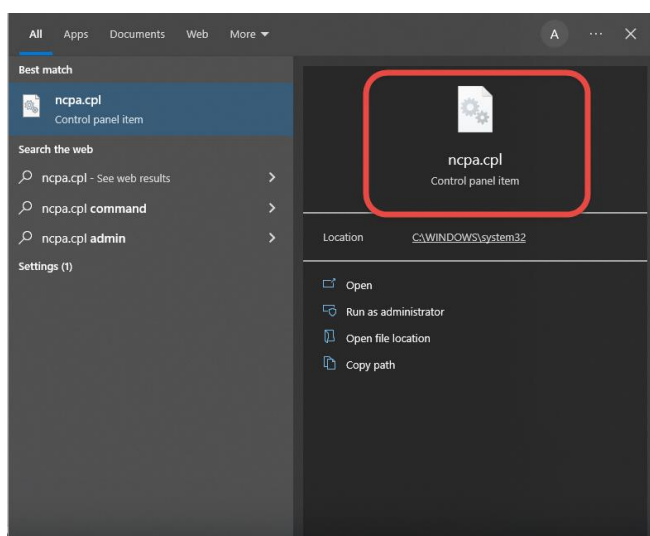
Rename the .elf file to rb.elf and save it in the «Files» folder of the PXE server (overwrite if necessary). In our directory, this is already done.

Change PC to a fixed IP address

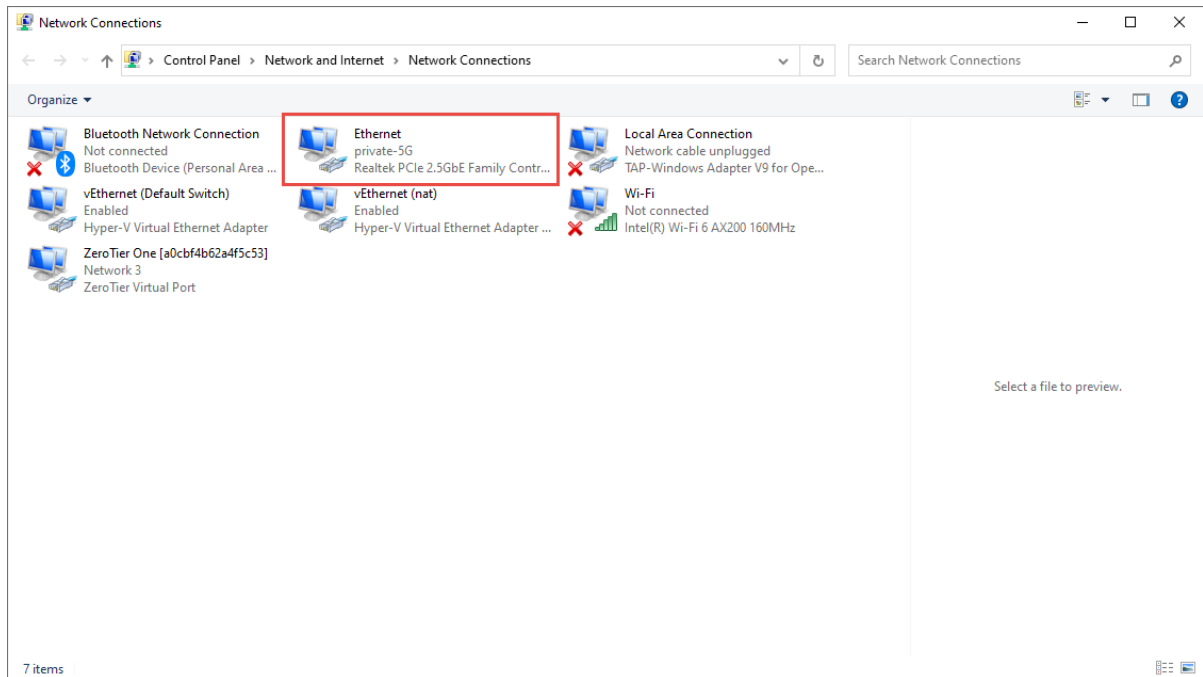
Type

ncpa.cpl

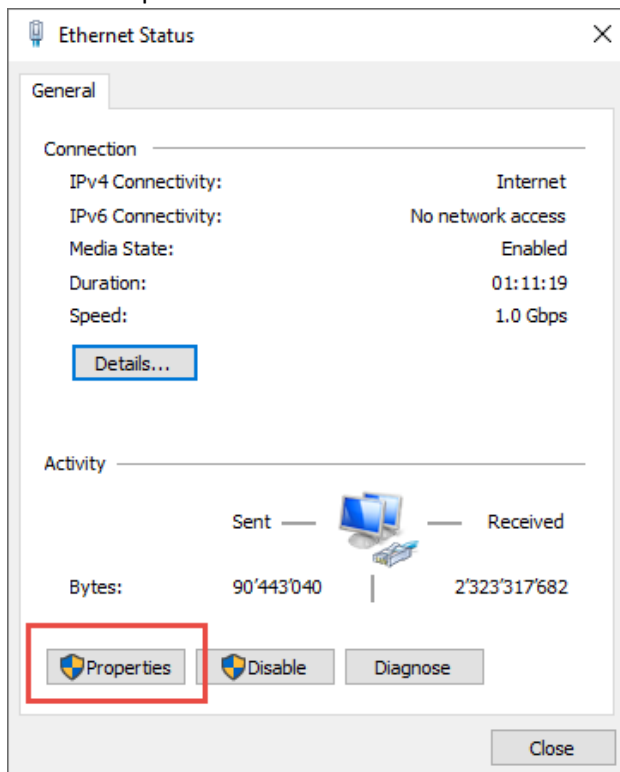
into Windows search



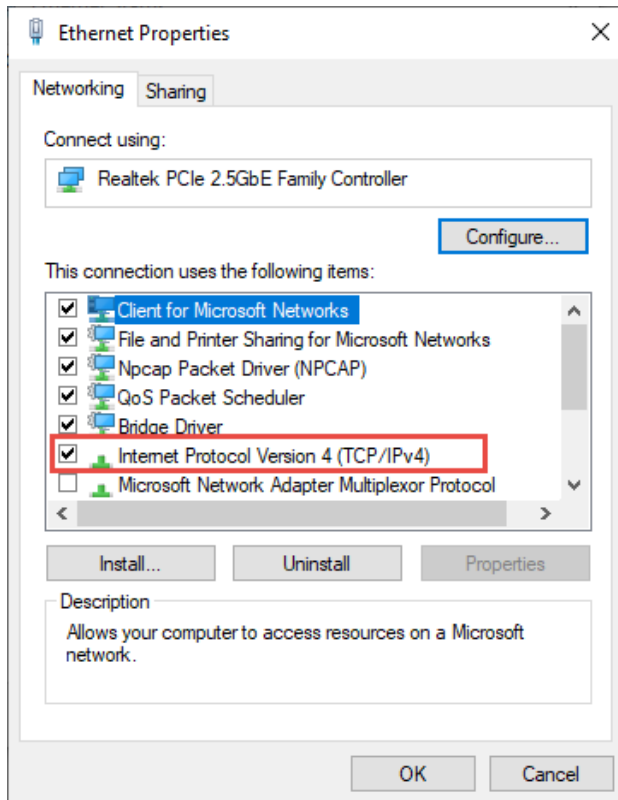
Select "Ethernet"



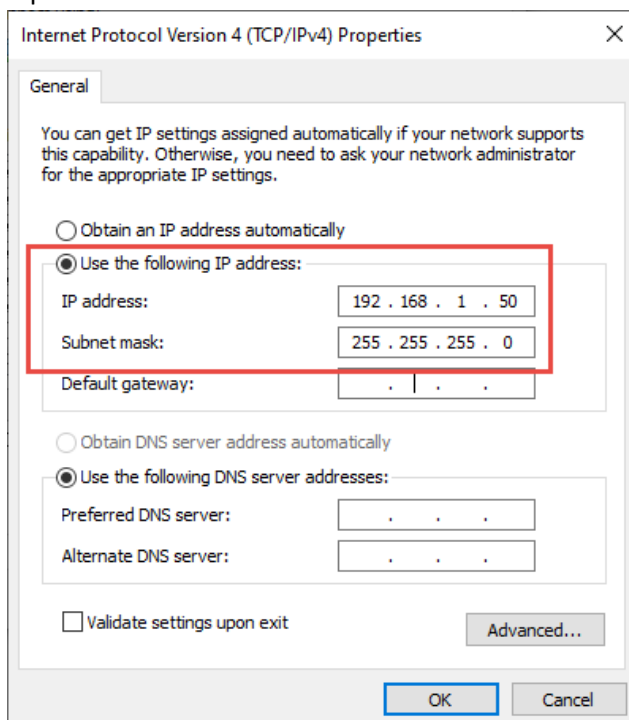
Select «Properties»:



Select IPV4:



Input IP address 192.168.1.50:

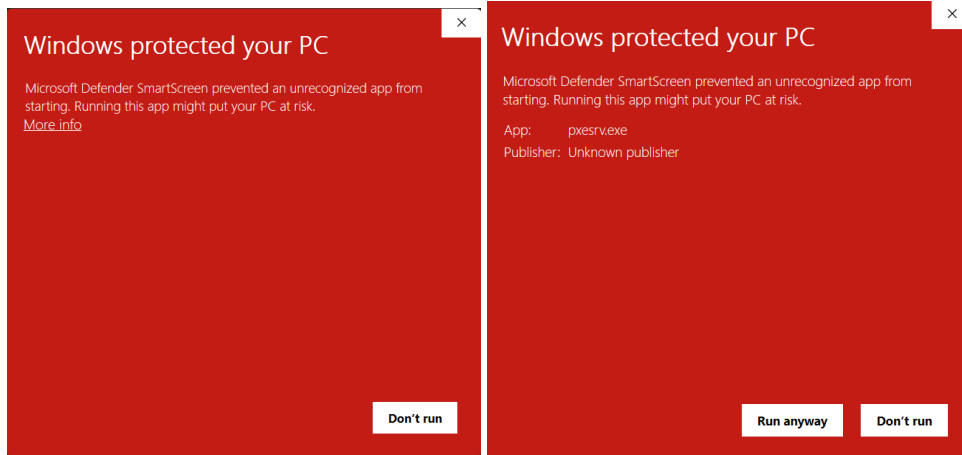


Flash elf file to target device

Connect port 1 of the hap router (labeled with Internet) to the PC, supply the router with power and wait until the top red LED is off and the green LED above with the number 1 flickers. Possibly Windows detects a new network. Then a larger blue window will appear on the right side of the screen, mentioning the new network. Confirm with OK. The whole thing takes about 3 minutes.

Do the same with the AP. Use the PoE injector (Y-cable) for the power supply. The power supply unit of the router also works here (both are 24V).

Start Tiny PXE Server (double click on the pxesrv.exe file in the «pxesrv» directory). You might get this warning:



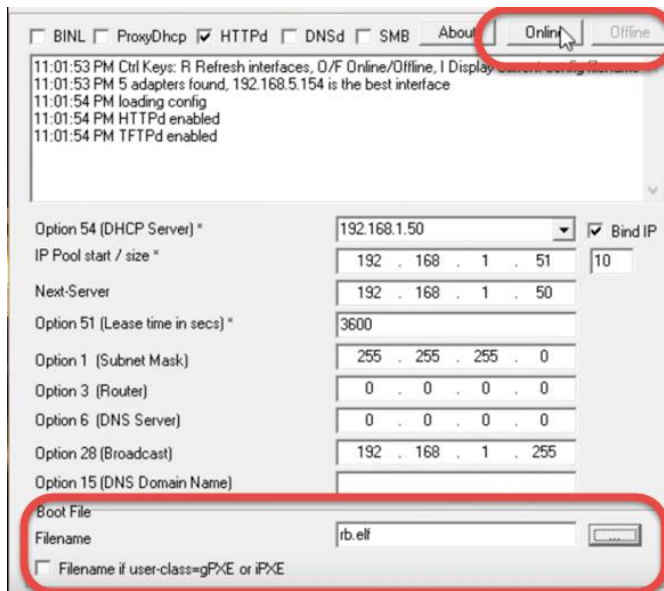
Press «More info» and let the program run.

Now de-energize the target device (pull the power cable).

In the Tiny PXE Server window, select the IP address entered on the Ethernet adapter from the drop-down box (192.168.1.50). If this IP address cannot be selected, close the Tiny PXE Server and start it again. If it still doesn't work, check the IP4 adapter settings and start again.

Find and select rb.elf in the «Boot File» section. This file can be found in the «...\pxesrv\files» folder.

Uncheck «Filename if user class...». No additional settings are necessary.



Now switch the Tiny PXE Server to «Online» in the upper right corner.

Then press the reset button in the target device with a pointed object (e.g., paper clip or toothpick) and then plug in the power cable to the target device. Check the log window. Immediately after the bottom line says "Do ReadFile:rb.elf" release the reset button and switch the Tiny PXE Server

to "Offline." This procedure takes about 20 seconds. The target device now boots with the AREDN firmware. Don't keep the reset button pressed for too long, or you'll have to start over!

Switch the Ethernet adapter on the PC back to the "automatic IP address." Plug the Ethernet cable into **port 2** on your router. After about two minutes, the process should be finished.

With the AP, the Ethernet cable remains in the only socket. The rest is the same

Optional: Check with ipconfig whether our PC has received «local.mesh».

Flash AREDN Firmware

Now open a browser and enter 192.168.1.1. The picture should look something like this.



If not, back to start

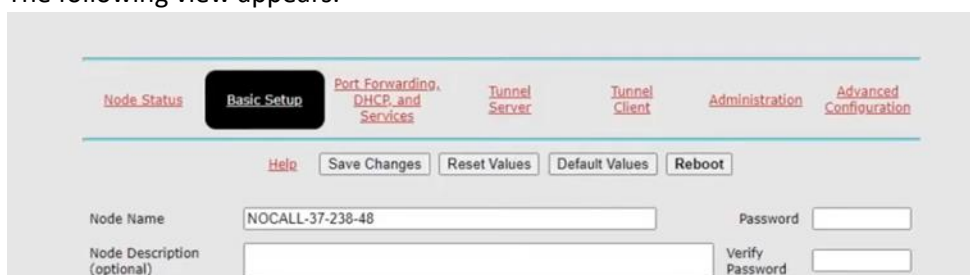
Now let's install the actual firmware on the target device.

Click on setup and enter username/password:

User: root

Password: hsmm

The following view appears:



Click on «Administration»



Now uncheck «Keep current setup» (or similar) and select the firmware.

Names of the files as discussed above (file names similar to «aredn-3.22.12.0-ar71xx-mikrotik-rb-nor-flash-16M-ac-squashfs-sysupgrade.bin»):

The router's filename contains a 16M-ac .

The filename of the AP contains a 16M with no ac.

Click «Upload.» The actual firmware is now loaded into the target device. The target device boots several times, and it takes about 10 minutes.

Once the software has been installed, Windows can again bring up a blue window on the right-hand side.

Configure AREDN

Open the browser and enter the following line <http://localnode.local.mesh:8080> (or 192.168.1.1)

If there is no answer, the process is not yet complete. Try again and again. If you still can't connect after 15 minutes, go back and start again.

The necessary settings can be made under «Basic Setup.»

User: root

Password: hsmm

Node Status **Basic Setup** [Port Forwarding, DHCP, and Services](#) [Tunnel Server](#) [Tunnel Client](#) [Administration](#) [Advanced Configuration](#)

[Help](#) [Save Changes](#) [Reset Values](#) [Default Values](#) [Reboot](#)

Node Name Password

Node Description (optional)

Verify Password

Mesh RF (2GHz)	LAN	WAN
Enable <input checked="" type="checkbox"/>	LAN Mode <input type="text" value="5 host Direct"/>	Protocol <input type="text" value="DHCP"/>
IP Address <input type="text" value="10.198.102.254"/>	IP Address <input type="text" value="10.51.55.241"/>	DNS 1 <input type="text" value="8.8.8.8"/>
Netmask <input type="text" value="255.0.0.0"/>	Netmask <input type="text" value="255.255.255.248"/>	DNS 2 <input type="text" value="8.8.4.4"/>
SSID <input type="text" value="AREDN"/>	DHCP Server <input checked="" type="checkbox"/>	
Channel <input type="text" value="-2 (2397)"/>	DHCP Start <input type="text" value="242"/>	
Channel Width <input type="text" value="10 MHz"/>	DHCP End <input type="text" value="246"/>	

Power & Link Quality

Tx Power Max Distance km Min SNR dB Min Quality % [Apply](#)

LAN Access Point

Enable ☒ AP band SSID Channel Encryption Password

Optional Settings

Latitude [Find Me!](#) [Apply Location Settings](#) [Show Map](#) [Upload data to AREDN Servers](#)

Longitude Grid Square

Timezone NTP Server NTP Updates

- A new password must be set before the first save. Otherwise, the changes will not be saved
- For the node name, please enter your call sign and an additional designation

Only on the hap router:

- Also, enter your call sign for SSID, and set a password. Remember this SSID name and the password, you will need it later to connect the WLAN. Tick «LAN Access Point»
- Fill in «Optional Settings»

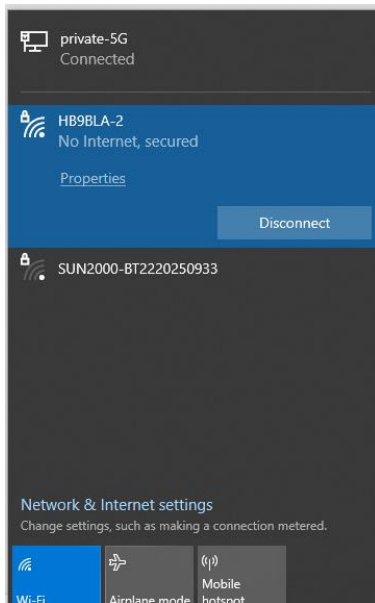
Then reboot the target device.

Set up a tunnel to the AREDN network (only necessary if you connect via an Internet tunnel)

This chapter only applies to the hap router.

Connect port 1 (Internet) to the Internet.

From now on, you can access the router via Wi-Fi from your PC by looking for the right WLAN and connecting your PC to the router:



You should get the tunnel data from your tunnel server responsible:

Server: his server address

PwD: The password he assigned to your tunnel

Network: The address of your tunnel

Enabled?	Server	PwD	Network	Active	Action
<input checked="" type="checkbox"/>			?		Del

Contact Info/Comment (Optional):

Tick «enable» and press «Save changes.»

Your tunnel should be active after a short time (blue cloud with an arrow).

You are now connected to the AREDN network. Go to «Node-Status» / «Mesh Status» and enjoy the success.



HB9BLA-166-229-235 mesh status

Location: ▾

[Help](#) [Refresh](#) [Auto](#) [Quit](#)

Node Name	Lan Hostname	Service Name			
HB9BLA-166-229-235	441530				
Current Neighbor	Lan Hostname	LQ	NLQ	TxMbps	Service Name
HB9BLA-166-229-235 (dtd)		100%	100%		
HB9BLA-166-229-235 6G159-20M (tun)	freepbx	100%	100%		HP VOIP
HB9BLA-166-229-235 232 (tun.van)		100%	100%		
HB9BLA-166-229-235 232 (tun.van)	AREDN-WS-UP hb-aredn-srvt01	100%	100%		Telefonbuch Yealink-Phonebook CHAT4ALL
HB9BLA-166-229-235 (tun)		100%	100%		
Previous neighbors	15 minutes ago				
Remote	LAN Hostname	ETX	Service Name		
HB9BLA-166-229-235 6G169-120		0.20			
PA3000 (tun)		0.20			
HB9BLA-166-229-235 8 (tun*2)		0.20			
HB9BLA-166-229-235 (tun*3)		0.20			
HB9BLA-166-229-235 2)	arednports00	0.20			
HB9BLA-166-229-235 17-97 (tun*1)		0.20			
HB9BLA-166-229-235 (tun*1)		0.20			
HB9BLA-166-229-235 (tun*1)		0.20			
HB9BLA-166-229-235 (tun*1)	413330	0.20	CHAT4ALL		
HB9BLA-166-229-235 (tun*1)	178230	0.20			
HB9BLA-166-229-235 6155-120 (tun*1)		0.20	CHAT4ALL		
HB9BLA-166-229-235 N-2G11-OMNI (tun*2)		0.20			
HB9BLA-166-229-235 R-HB3XRV (tun*2)	W70B T42G	0.20			
HB9BLA-166-229-235 8 (tun*1)		0.30			
HB9BLA-166-229-235 R-HB9FRR (tun*7)		0.30			
HB9BLA-166-229-235 R-HB9FRR (tun*2)		0.30			

Note the LAN address:

HB9HFM-HAP-1

Location: ▾

[Help](#) [Refresh](#) [Mesh Status](#) [Neighbor Status](#) [WiFi Scan](#) [Setup](#) [Select a theme ▾](#)

mesh RF address: 10.198.102.254 / 8 signal|noise|SNR: -78 | -85 | 7 dB [Charts](#)

mesh gateway: none firmware version: 3.22.12.0

gateway node: model: MikroTik RouterBOARD RB952Ui-5ac2nD

SSID: AREDN-10-v3

channel: -2 system time: Sat Mar 18 2023 07:50:37 CET

channel width: 10 MHz uptime: 0:25

LAN address: 10.51.55.241 / 29

LAN AP SSID: HB9BLA-2

load average: 0.00, 0.01, 0.05

WAN address: 192.168.0.36 / 24 available space: flash = 10476 KB

default gateway: 192.168.0.1 memory = 28440 KB

host entries: 38 nodes / 89 total devices

Part of the AREDN™ Project. For more details please [see here](#)

Setting up the phone book

The installation of the phonebook is described in the document "Installation of phonebook replication on hap router.pdf". It can be done before or after you set up your phone.

Connect the phone to the router

First, you need an official telephone number. It is your PLZ plus 30 if you are the first AREDN user in your PLZ. Please check the phonebook:

https://docs.google.com/spreadsheets/d/1g33BHSXMC8T4Cmfz_Zq-XxtPP17dtEBexF2i4KKe_Mc/edit?usp=sharing

and enter your information at the bottom. It will be reviewed and accepted.

Now connect your phone to the router and wait until it has received an IP address. Make a note of its MAC address ("Menu" button on the phone and then "Info" button)

Go back to the router setup and go to port forwarding. Fill in everything as shown below:

The screenshot shows the AREDN router configuration interface. The top navigation bar includes links for Node Status, Basic Setup, Port Forwarding, DHCP, and Services (highlighted), Tunnel Server, Tunnel Client, Administration, and Advanced Configuration. Below the navigation bar, there are buttons for Help, Save Changes, Reset Values, and Refresh. The main content area is divided into several sections:

- DHCP Address Reservations:** This section contains a table with columns for Hostname, IP Address, MAC Address, and a checkbox for 'Do Not propagate'. A red arrow points to the 'Your telephone number' field in the Hostname column, which contains the value '441530'. Another red arrow points to the 'From telephone' label above the 'Do Not propagate' checkbox.
- Advertised Services:** This section contains a table with columns for Name, Link, and URL. It includes a dropdown menu for 'HB9BLA-166-229-235' and an 'Add' button.
- Current DHCP Leases:** This section displays a table of current DHCP leases, including the hostname 'DESKTOP-HB9BLA', IP address '10.55.47.92', and MAC address '10:05:01:4f:8a:57'. It also shows a lease for '441530' with IP '10.55.47.91' and MAC '00:15:65:a7:6d:ba'. There are 'Add' buttons for each entry.
- Port Forwarding:** This section contains a table with columns for Interface, Type, Outside Port, LAN IP, and LAN Port. A red arrow points to the 'Your telephone number' field in the LAN IP column, which contains the value '441530'. The table shows a rule for 'WAN' interface, 'Both' type, '5060' outside port, and '5060' LAN port.
- DNS Aliases:** This section contains a table with columns for Alias Name and IP Address. It includes a dropdown menu for 'IP Address' and an 'Add' button.

At the bottom of the interface, there is a footer that reads: "Part of the AREDN™ Project. For more details please [see here](#)".

Save changes.

The setup of the target device is now finished.

Yealink Telephone

Flash

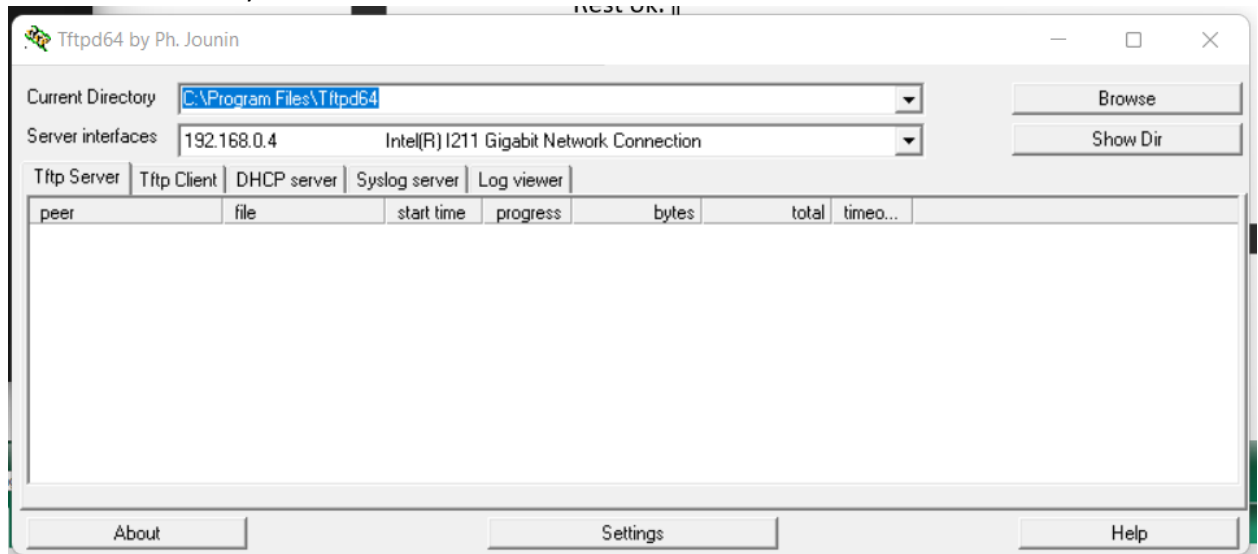
Continue to «Configure phone» if you already can access your phone's setup with admin/admin.

Download corresponding files from: <http://yealink.provu.co.uk/fw/recovery/> or from the Yealink support site

(<https://support.yealink.com/en/portal/docList?archiveType=software&productCode=9f64db103d0b41be> for the T46, for example)

Install and start TFTPd64. Choose the ethernet adapter of your PC and connect your telephone to the home network.

Choose the directory with the downloaded files.



Power the Yealink with the speaker button pressed, wait till you can enter an IP address, and fill in the IP address of the TFTP server (IP of PC above). Make sure you use a free IP address in the same subnet for the telephone (e.g., 192.168.0.230)

The telephone loads the files and updates.

Then do a factory reset by holding down the OK button for 10 seconds

Now you can continue with the standard setup in the next chapter

Configure phone

Enter the IP address of the telephone in the browser (to be found on the telephone under Menu→Status).

Username: admin

Password: admin

Set a new password if you want.

We now go through the individual menu items.

Accounts

The accounts are used to work with a PBX. The provider of the PBX has to enable your telephone number and provide you with the address and credentials.

If you have no access to a PBX, or only want to work with direct addressing, you have to install SIPProxy (see Document “Installation of phonebook replication on hap router.pdf”). Sipserver 1 is then “localnode.local.mesh”. User and password are not important in this case.

Account 1:

If you have access to a PBX, Enter credentials and IP address (SIP server) provided by your PBX operator

Account (example)

Line Activity: Enabled
 Label: Name of PBX (you are free to choose)
 Display Name: Your callsign
 Register name: Your telephone number
 User Name: Given by the PBX Operator
 Password: Given by the PBX operator
 SIP server 1
 Server Host: Given by the PBX Operator
 port 5060 (default)

Rest OK. Press "confirm"

Directory

Index	Remote URL	Display Name
1	http://localnode.local.mesh/phonebook_yealink_direct.xml	Direct
2	http://localnode.local.mesh/phonebook_yealink_pbx.xml	via PBX
3		
4		
5		

Incoming/Outgoing Call Lookup:

Update Time Interval(Seconds):

NOTE
Remote Phone Book
It is a centrally maintained phone book, stored in the remote server.
Users only need the access URL of the remote phone book. The IP phone can establish a connection with the remote server and download the phone book, and then display the remote phone book entries on the phone user interface.
[Click here to get more product documents.](#)

Here are the entries for copy-paste

```
http://localnode.local.mesh/phonebook_yealink_direct.xml  
http://localnode.local.mesh/phonebook\_yealink\_pbx.xml
```

Directory Settings

You can name your phone book as you wish.

Directory
Disabled: Local Directory, History
Enabled: Remote Phone Book

Search Source List In Dialing
Disabled: Local Directory
Enabled: Remote Phonebook, History

Recent Call In Dialing:

NOTE
Directory
It provides easy access to frequently used lists.
Search Source in Dialing
It allows the IP phone to automatically search entries from the search source list based on the entered string, and display results on the pre-dialing screen.
Recent Call In Dialing
It allows users to view the placed calls list when the phone is on the pre-dialing screen.
[You can click here to get more guides.](#)

Integrate your remote phonebook. Otherwise, it is not shown in the display

Settings

Yealink | T46G

StatusAccountNetworkDSSKeyFeaturesSettings

PreferenceTime & DateUpgradeAuto ProvisionConfigurationDial PlanVoiceRingTonesSoftkey LayoutTR069

Time & Date

DHCP TimeEnabledTime Zone+1 Germany(Berlin)NTP By DHCP PriorityHighPrimary Serverch.pool.ntp.orgSecondary Serverus.pool.ntp.orgSynchronism (15~86400s)1000Daylight Saving TimeAutomaticFixed TypeDST By DateDST By WeekDST Start MonthMarchDST Start Day of WeekSundayDST Start Day of Week Last in MonthLast In MonthStart Hour of Day2DST Stop MonthOctoberDST Stop Day of WeekSundayDST Stop Day of Week Last in MonthLast In MonthEnd Hour of Day3Offset(minutes)60Manual TimeDisabledTime FormatHour 24

Chose the appropriate NTP server and time zone for your country

Auto provisioning

Yealink

T42G

Log Out

English(English)

Status

Account

Network

Dsskey

Features

Settings

Directory

Security

Preference

Time & Date

Call Display

Upgrade

Auto Provision

Configuration

Dial Plan

Voice

Ring

Tones

Softkey Layout

TR069

Voice Monitoring

SIP

Power Saving

Auto Provision

PNP Active

☐ On
☒ Off

DHCP Active

☐ On
☒ Off

Custom Option(128~254)

DHCP Option Value

Server URL

User Name

Password

.....

Attempt Expired Time(s)

5

Common AES Key

.....

MAC-Oriented AES Key

.....

Zero Active

Disabled

Wait Time(1~100s)

5

Power On

☐ On
☒ Off

Repeatedly

☐ On
☒ Off

Interval(Minutes)

1440

Weekly

☐ On
☒ Off

Weekly Upgrade Interval(0~12week)

0

Inactivity Time Expire(0~120min)

0

Time

00 : 00 -- 00 : 00

☐ Sunday
☐ Monday
☐ Tuesday
☐ Wednesday
☐ Thursday
☐ Friday
☐ Saturday

Day of Week

☐ Sunday
☐ Monday
☐ Tuesday
☐ Wednesday
☐ Thursday
☐ Friday
☐ Saturday

Flexible Auto Provision

☐ On
☒ Off

Flexible Interval Days

30

Flexible Time

02 : 00 -- : :

Auto Provision Now

Confirm

Cancel

NOTE

Auto Provision

The IP phone can interoperate with provisioning server using auto provisioning for deploying the IP phones.

When the IP phone triggers to perform auto provisioning, it will request to download the configuration files from the provisioning server. During the auto provisioning process, the IP phone will download and update configuration files to the phone flash.

You can click here to get more guides.

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Set everything to "off."

Now your phone is configured, and you can make your first call.

Configure Access point for telephone usage

If you want to connect your telephone directly to an access point (without a hap router), you need to set "Provide default route to LAN devices" to on

Node Status	Basic Setup	Port Forwarding, DHCP, and Services	Tunnel Server	Tunnel Client	Administration	Advanced Configuration
Help Reboot Reset to Firstboot						
Setting	Value	Actions				
Link Quality Settings						
Enable Link Quality Management <small>aredn.@lqm[0].enable</small>	OFF <input checked="" type="checkbox"/> ON	Save Setting Set to Default				
SNR Margin in dB above Min SNR a signal must reach to be re-activated <small>aredn.@lqm[0].margin_snr</small>	1	Save Setting Set to Default				
Min Distance in meters beyond which a neighbor RF link is allowed <small>aredn.@lqm[0].min_distance</small>	0	Save Setting Set to Default				
Default Distance in meters to use when actual distance cannot be calculated <small>aredn.@lqm[0].auto_distance</small>		Save Setting Set to Default				
Quality Margin percentage increase before neighbor can be re-activated <small>aredn.@lqm[0].margin_quality</small>	1	Save Setting Set to Default				
Ping Penalty quality percentage to add when neighbor cannot be pinged <small>aredn.@lqm[0].ping_penalty</small>	5	Save Setting Set to Default				
User Blocked comma-separated list of blocked MACs <small>aredn.@lqm[0].user_blocks</small>		Save Setting Set to Default				
User Allowed comma-separated list of always allowed MACs <small>aredn.@lqm[0].user_allows</small>		Save Setting Set to Default				
WAN Settings						
Allow other MESH nodes to use my WAN - not recommended and OFF by default <small>aredn.@wan[0].olard_gw</small>	OFF <input type="checkbox"/> ON	Save Setting Set to Default				
Allow my LAN devices to access my WAN - ON by default <small>aredn.@wan[0].lan_dhcp_route</small>	OFF <input checked="" type="checkbox"/> ON	Save Setting Set to Default				
Provide default route to LAN devices even when WAN access is disabled <small>aredn.@wan[0].lan_dhcp_defaultroute</small>	OFF <input checked="" type="checkbox"/> ON	Save Setting Set to Default				

Otherwise, it will not work. This is not needed for the hap routers.