

# 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 henceforth be referred to as "target devices".  
Green are the notes for the AP.

Deactivate Wifi on the PC and copy the «Installation\_Directory» 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 and two short network cables. PoE (Y cable) for the AP.

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 the our directory).

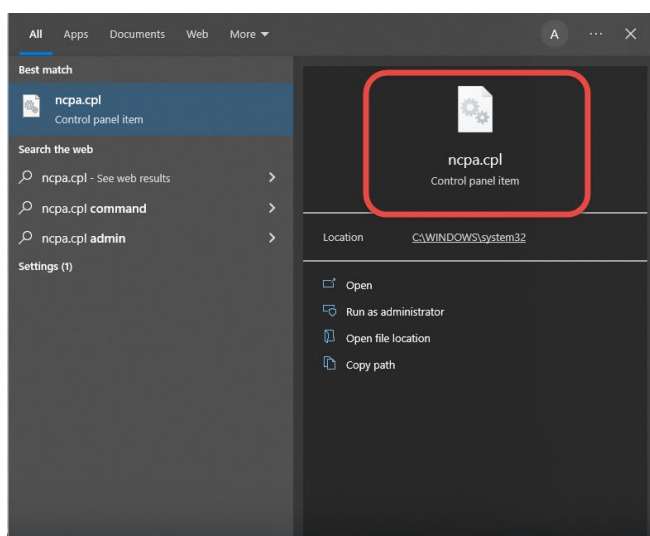
Rename the .elf file to rb.elf and save it in the «Files» folder of the PXE server (overwrite if necessary). In our directory, this is already done.

### Change PC to a fix IP address

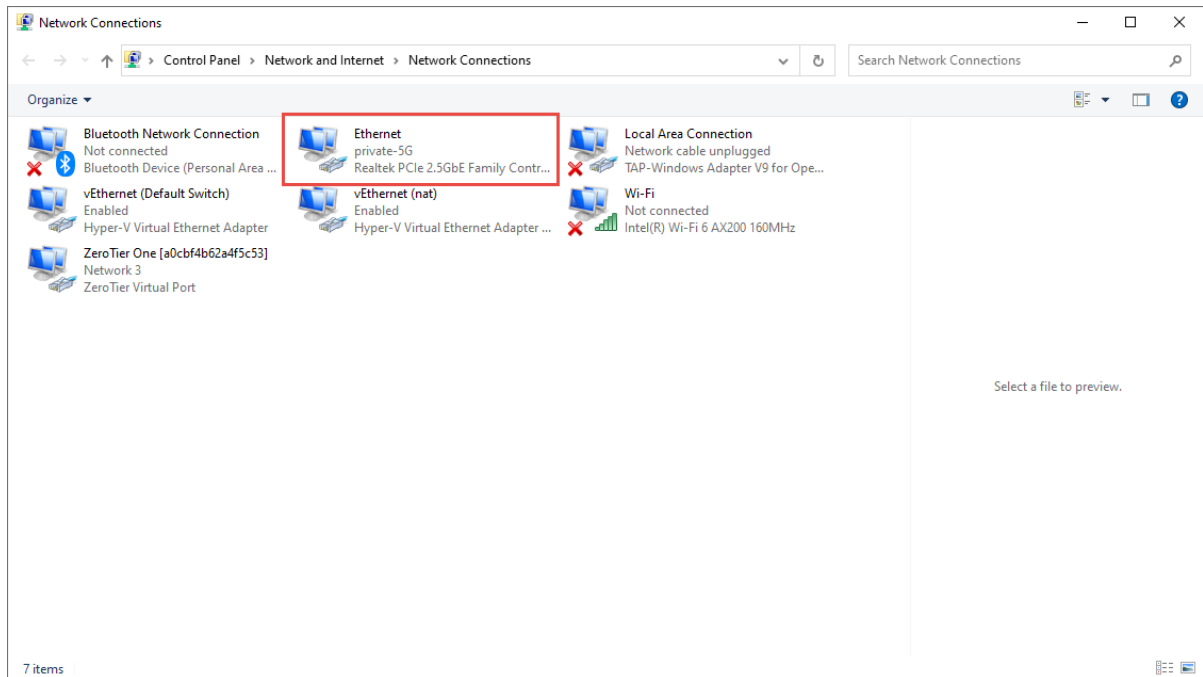
Type

ncpa.cpl

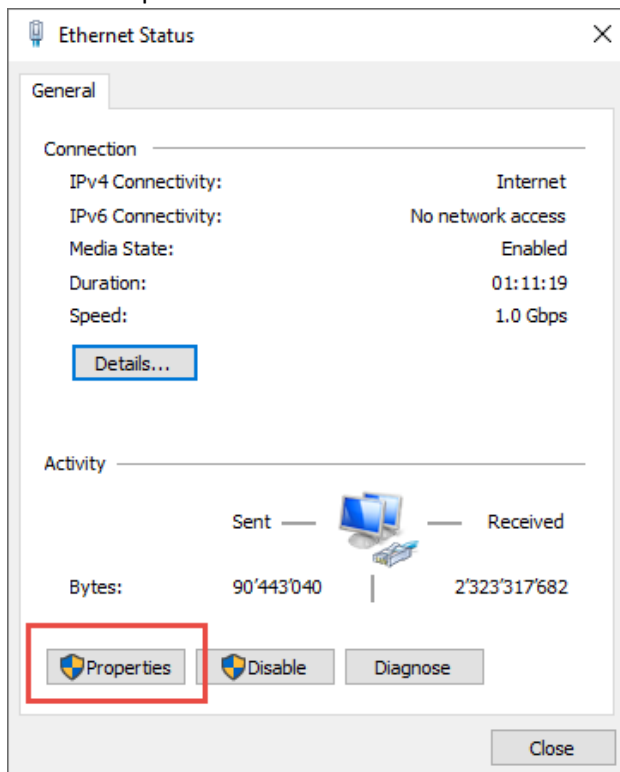
into Windows search



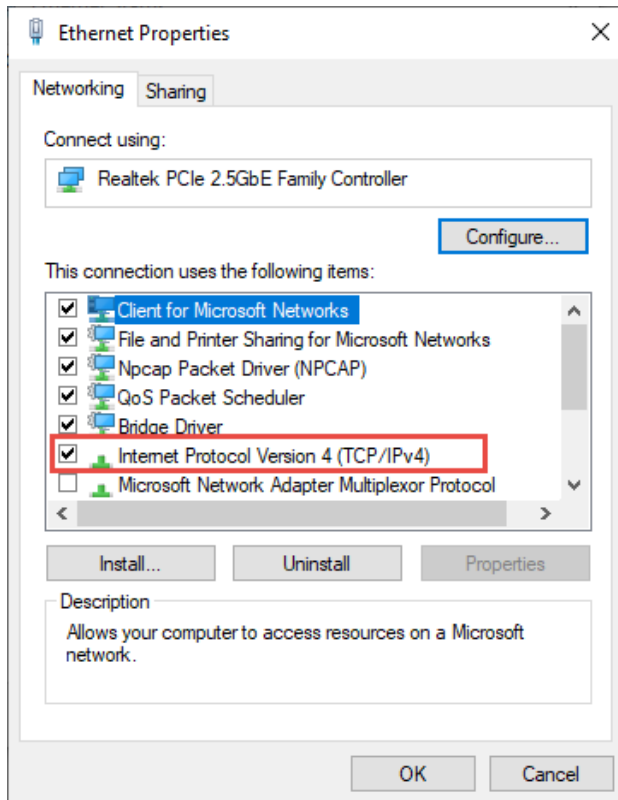
## Select "Ethernet"



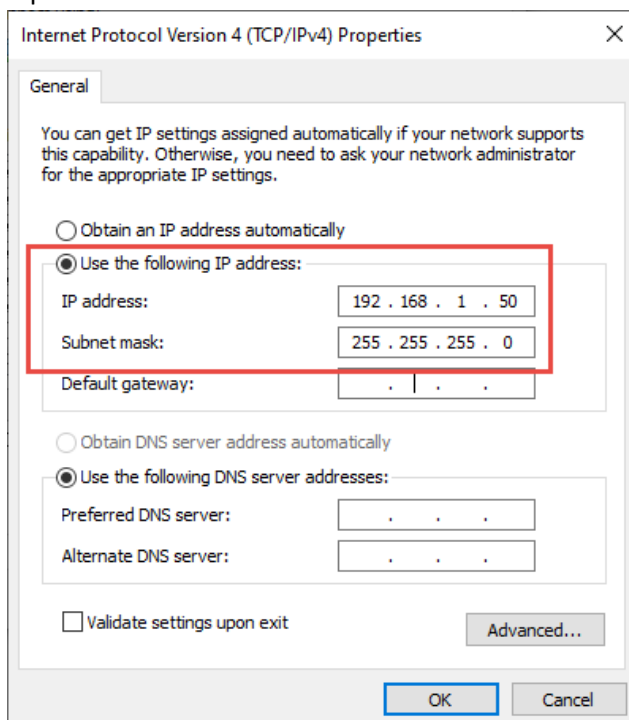
## Select «Properties»:



Select IPV4:



Input IP address 192.168.1.50:

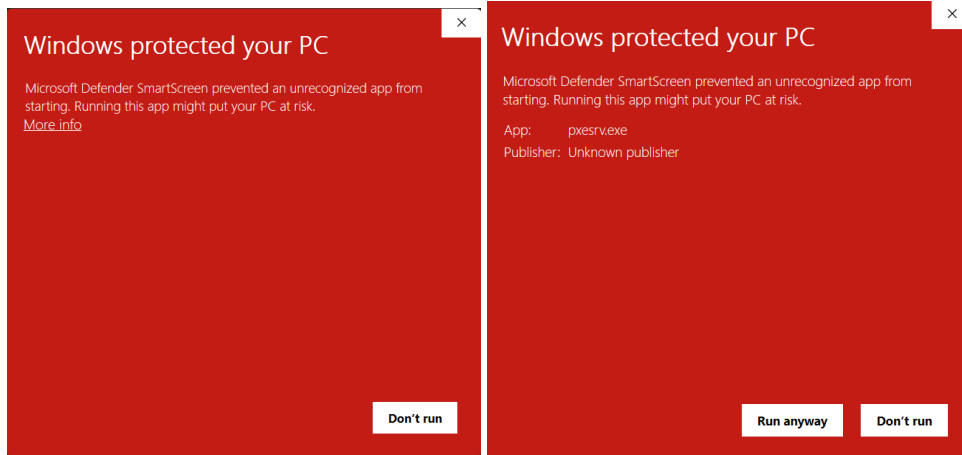


Flash elf file to target device

Connect port 1 of the hap router (labelled 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 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:



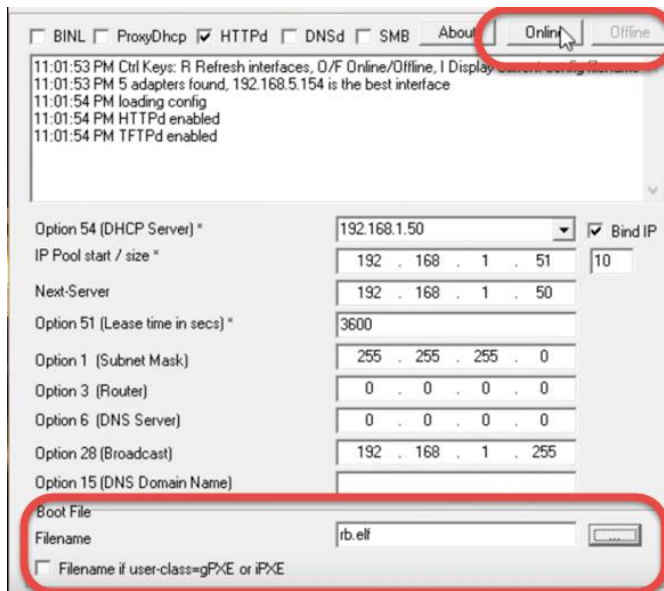
Press «More info» and let the program run.

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 further 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 «automatic IP address». Plug the Ethernet cable into **port 2** on your router. After about 2 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 browser and enter 192.168.1.1. The picture should look something like this.



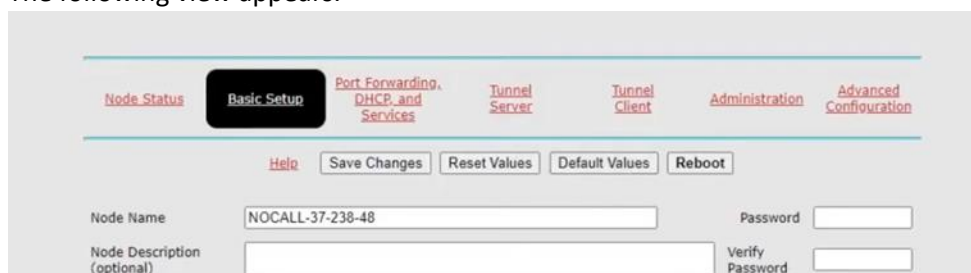
**If not, back to start**

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 in this mask 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="-10-v3"/>	DHCP Start <input type="text" value="242"/>	
Channel Width <input type="text" value="-2 (2397)"/>	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 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.

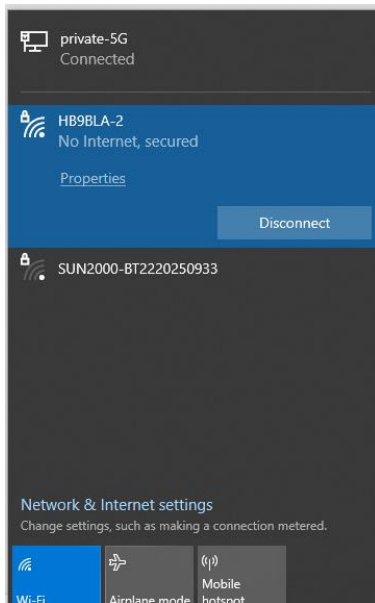
Set up a tunnel to the AREDN network (only necessary if you connect via Internet tunnel)

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 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-166-229-20M (tun)	freepbx	100%	100%		HP VOIP
HB9BLA-166-232 (tun.van)		100%	100%		
HB9BLA-166-232 (tun.van)	AREDN-WS-UP hb-aredn-srvt01	100%	100%		Telefonbuch Yealink-Phonebook CHAT4ALL
HB9BLA-166-232 (tun)		100%	100%		
Previous neighbors	15 minutes ago				
Remote Neighbor	LAN Hostname	ETX	Service Name		
HB9BLA-166-229-235 (dtd)		0.20			
PA3000-166-229-235 (tun)		0.20			
HB9BLA-166-229-232 (tun*2)		0.20			
HB9BLA-166-229-232 (tun*3)		0.20			
HB9BLA-166-229-232 (tun*2)	arednports00	0.20			
HB9BLA-166-229-232 (tun*1)		0.20			
HB9BLA-166-229-232 (tun*1)		0.20			
HB9BLA-166-229-232 (tun*1)		0.20			
HB9BLA-166-229-232 (tun*1)	413330	0.20	CHAT4ALL		
HB9BLA-166-229-232 (tun*1)	178230	0.20			
HB9BLA-166-229-232 (tun*1)		0.20	CHAT4ALL		
HB9BLA-166-229-232 (tun*2)		0.20			
HB9BLA-166-229-232 (tun*2)		0.20			
HB9BLA-166-229-232 (tun*2)	W70B T42G	0.20			
HB9BLA-166-229-232 (tun*1)		0.30			
HB9BLA-166-229-232 (tun*7)		0.30			
HB9BLA-166-229-232 (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

mesh gateway: none

gateway node:

SSID: AREDN-10-v3

channel: -2

channel width: 10 MHz

LAN address: 10.51.55.241 / 29

LAN AP SSID: HB9BLA-2

WAN address: 192.168.0.36 / 24

default gateway: 192.168.0.1

signal|noise|SNR: -78 | -85 | 7 dB

[Charts](#)

firmware version: 3.22.12.0

model: MikroTik RouterBOARD RB952Ui-5ac2nD

system time: Sat Mar 18 2023 07:50:37 CET

uptime: 0:25

load average: 0.00, 0.01, 0.05

available space: flash = 10476 KB

memory = 28440 KB

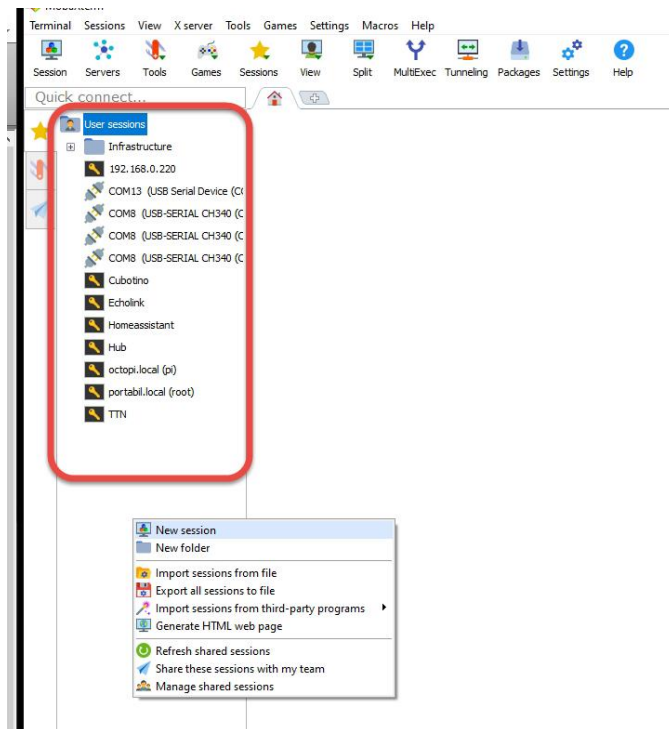
host entries: 38 nodes / 89 total devices

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

## Setting up the phone book

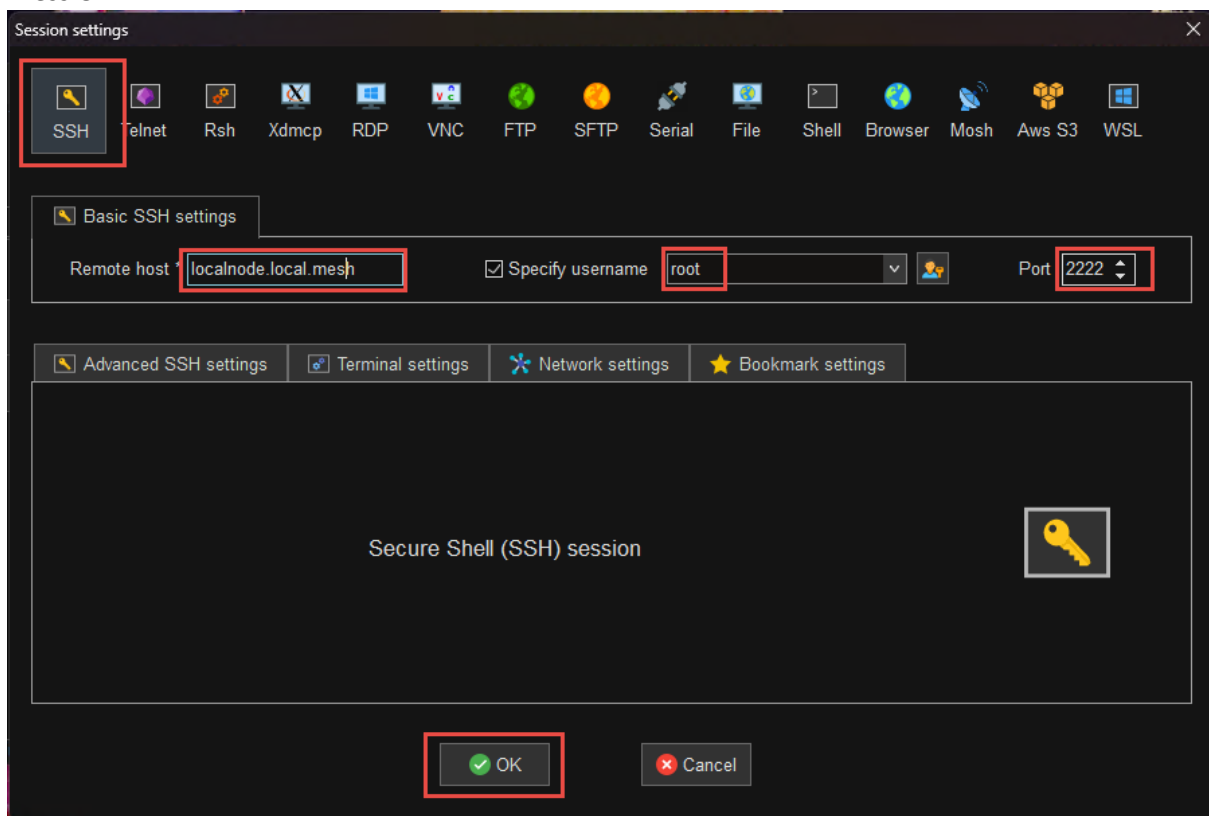
Start MobaXterm (it is already in the folder).

Press the right mouse button in the red framed area and press «New Session»

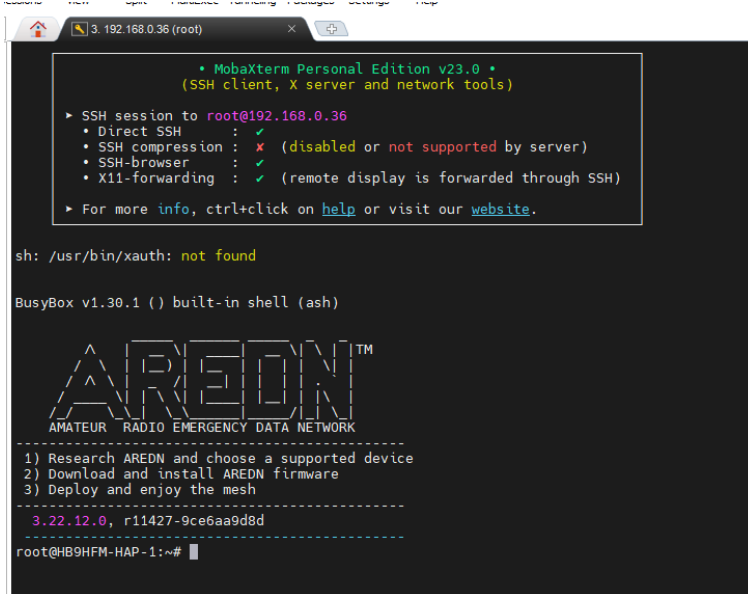


Fill in your router's address (localnode.local.mesh) and all other fields circled in red (port is 2222).

Press OK



After entering the password, you will see this screen:



Now enter this line (here with ctrl-C and in the MobaXterm window with ctrl-V):

```
curl -s -L http://hb-aredn-srvt01.local.mesh/phonebook/installpb.sh | sh
```

Press «Enter»

This command installs everything necessary.

Afterwards:

```
reboot
```

and wait a few minutes. Press R key until the prompt comes back.

Next command:

```
crontab -e
```

Check if this line exists (and delete duplicates)

```
*/30 * * * * curl --output /srv/tftp/phonebook.xml -O http://hb-aredn-srvt01.local.mesh/phonebook/installpb.sh
```

Exit with ctrl-C

Your phone book stored on your target device will now update every 30 minutes. It's stored on your router if you lose connection to the main server.

You have to do this work for all devices you intend to connect a telephone to. Otherwise, your telephone will not get its phone book and you cannot dial direct.

## Connect the phone to the router

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 router's configuration interface for 'Port Forwarding, DHCP, and Services'. The 'DHCP Address Reservations' section contains a table with the following data:

Hostname	IP Address	MAC Address	Do Not Persist	Del
441530	10.55.47.91	00:15:65:a7:6d:ba	<input type="checkbox"/>	
- IP Address - Add				

The 'Port Forwarding' section contains a table with the following data:

Interface	Type	Outside Port	LAN IP	LAN Port	Del
WAN	Both	5060	441530	5060	
- IP Address - Add					

Red arrows point to the '441530' values in both tables, with the label 'Your telephone number'. Another red arrow points to the 'From telephone' label above the DHCP table.

Save changes.

The setup of the target device is now finished.

## Yealink Telefon

### Flash

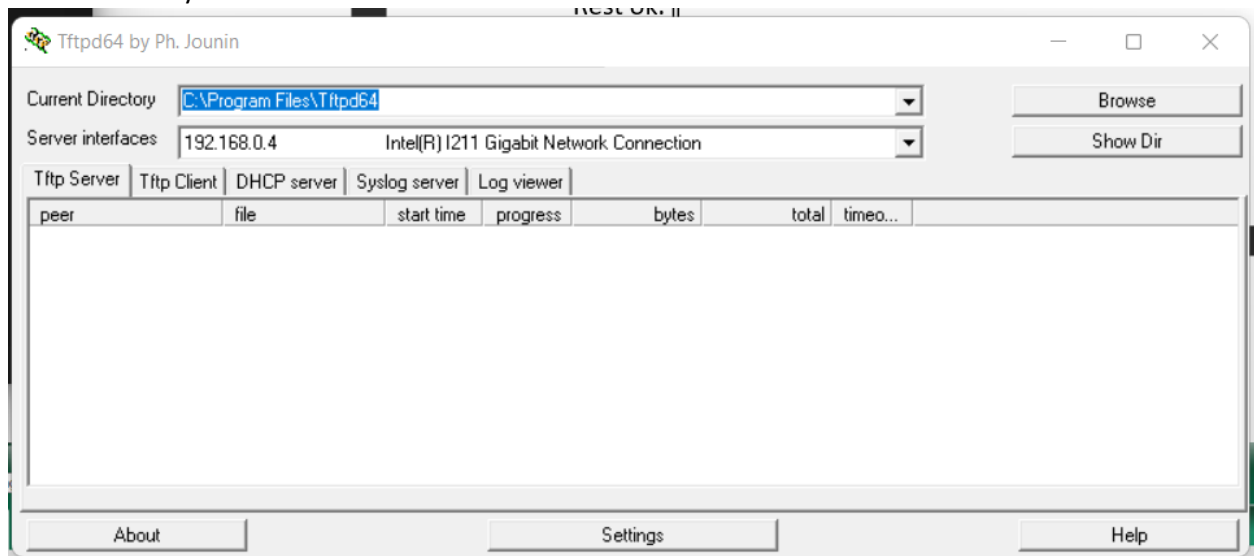
Continue to «Configure phone» if you already can access your phone's setup with admin/admin.

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. Chose the ethernet adapter of your PC and connect your telephone to the home network.

Chose 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 only want to work with direct addressing, you do not need a PBX and also do not need to configure the account(s) and disable all.

Account 1:

Enter credentials and IP address (SIP server) provided by your PBX operator

Yealink T46G

Log Out

Status Account Network DSSKey Features Settings Directory Security

Register

Basic

Codec

Advanced

Account Account 2

Register Status Register Failed

Line Active Enabled ?

Label HP ?

Display Name HB9BLA ?

Register Name 441530 ?

User Name 441530 ?

Password \*\*\*\*\* ?

Enable Outbound Proxy Server Disabled ?

Outbound Proxy Server Port 5060 ?

Transport UDP ?

NAT Disabled ?

STUN Server Port 3478 ?

SIP Server 1 ?

Server Host 10.166.12.173 Port 5160 ?

Server Expires 3600 ?

Server Retry Counts 3 ?

SIP Server 2 ?

Server Host Port 5060 ?

Server Expires 3600 ?

Server Retry Counts 3 ?

Confirm Cancel

NOTE

**Display Name**  
SIP service subscriber's name which will be used for Caller ID display.

**Register Name**  
SIP service subscriber's ID used for authentication.

**User Name**  
User account, provided by VoIP service provider.

**NAT Traversal**  
Defines the STUN server will be active or not.

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HP Account

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

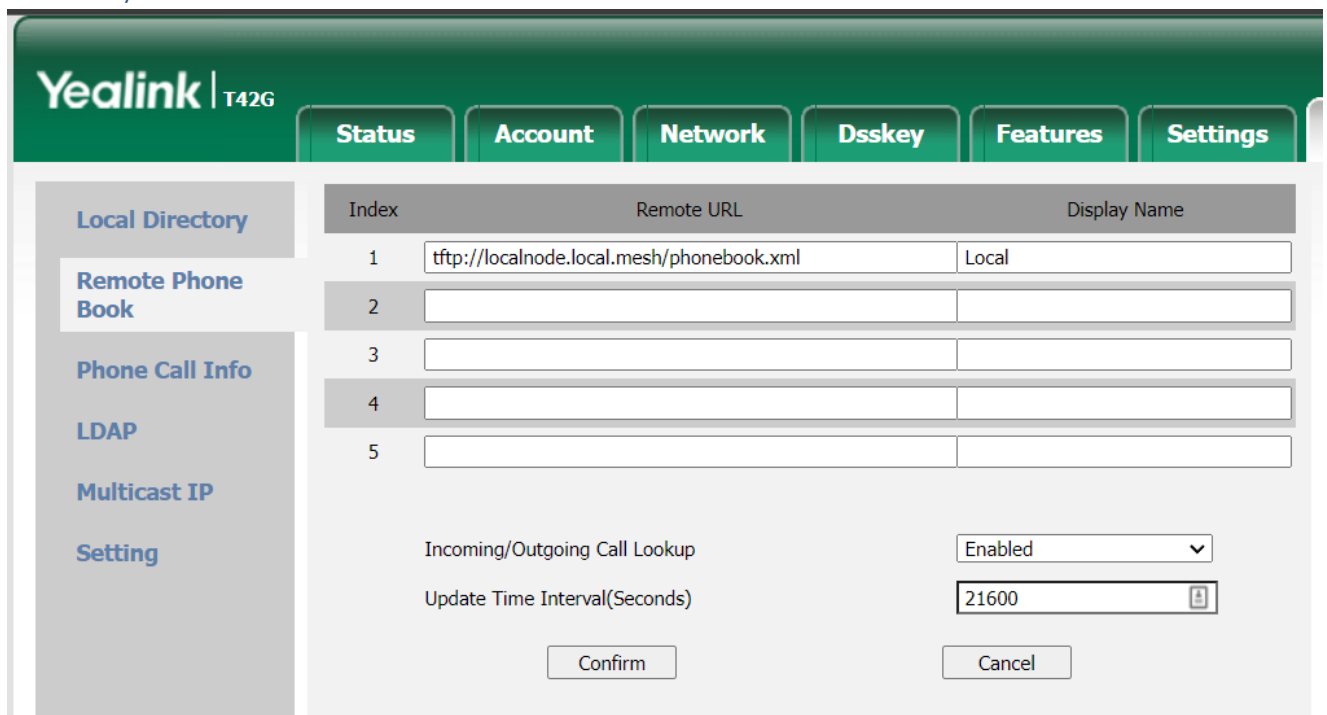
SIP server 1

Server Host: Given by the PBX Operator

port 5060 (default)

Rest ok. Press "confirm"

## Directory



The screenshot shows the 'Directory' settings page for a Yealink T42G device. The top navigation bar includes 'Status', 'Account', 'Network', 'Dsskey', 'Features', and 'Settings'. The left sidebar lists 'Local Directory', 'Remote Phone Book', 'Phone Call Info', 'LDAP', 'Multicast IP', and 'Setting'. The main content area has a table with columns 'Index', 'Remote URL', and 'Display Name'. The first row is pre-filled with '1', 'tftp://localnode.local.mesh/phonebook.xml', and 'Local'. Below the table, there are settings for 'Incoming/Outgoing Call Lookup' (set to 'Enabled') and 'Update Time Interval(Seconds)' (set to '21600'). 'Confirm' and 'Cancel' buttons are at the bottom.

Index	Remote URL	Display Name
1	tftp://localnode.local.mesh/phonebook.xml	Local
2		
3		
4		
5		

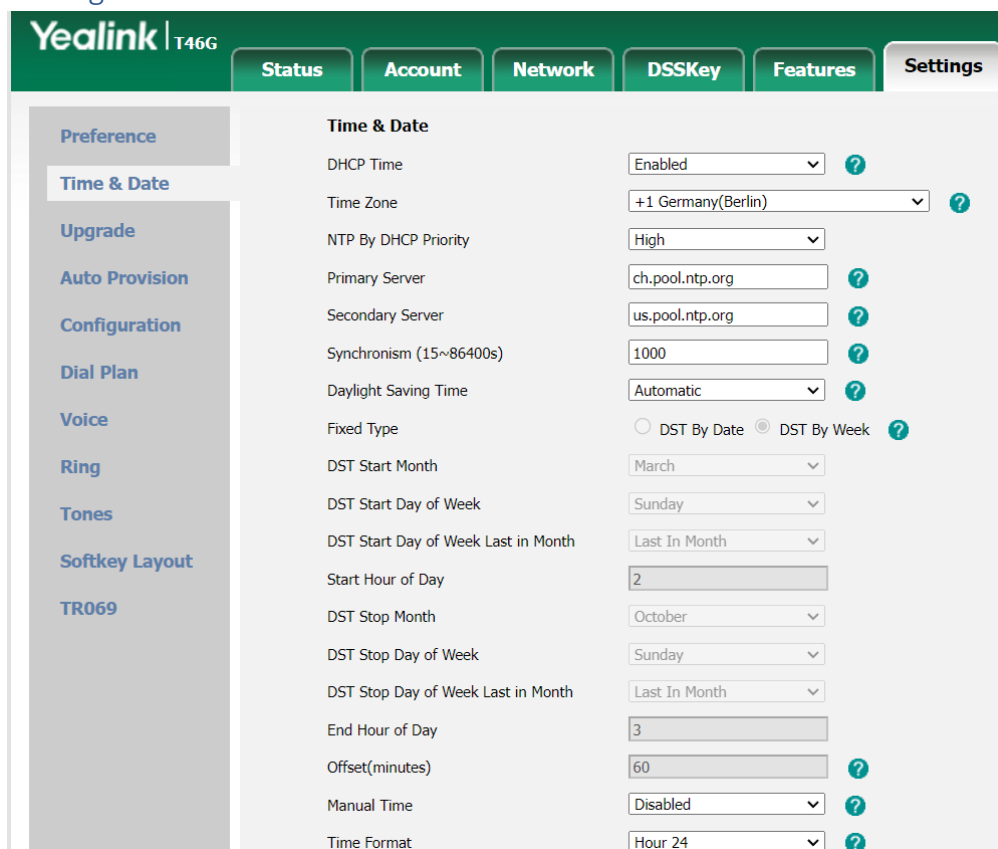
Incoming/Outgoing Call Lookup: Enabled  
Update Time Interval(Seconds): 21600

Confirm Cancel

tftp://localnode.local.mesh/phonebook.xml

You can name your phone book as you wish.

## Settings



The screenshot shows the 'Settings' page for a Yealink T46G device. The top navigation bar includes 'Status', 'Account', 'Network', 'DSSKey', 'Features', and 'Settings'. The left sidebar lists 'Preference', 'Time & Date', 'Upgrade', 'Auto Provision', 'Configuration', 'Dial Plan', 'Voice', 'Ring', 'Tones', 'Softkey Layout', and 'TR069'. The main content area is titled 'Time & Date' and contains various settings: 'DHCP Time' (Enabled), 'Time Zone' (+1 Germany(Berlin)), 'NTP By DHCP Priority' (High), 'Primary Server' (ch.pool.ntp.org), 'Secondary Server' (us.pool.ntp.org), 'Synchronism (15~86400s)' (1000), 'Daylight Saving Time' (Automatic), 'Fixed Type' (DST By Week), 'DST Start Month' (March), 'DST Start Day of Week' (Sunday), 'DST Start Day of Week Last in Month' (Last In Month), 'Start Hour of Day' (2), 'DST Stop Month' (October), 'DST Stop Day of Week' (Sunday), 'DST Stop Day of Week Last in Month' (Last In Month), 'End Hour of Day' (3), 'Offset(minutes)' (60), 'Manual Time' (Disabled), and 'Time Format' (Hour 24). Each setting has a help icon (?) next to it.

**Time & Date**

DHCP Time: Enabled  
Time Zone: +1 Germany(Berlin)  
NTP By DHCP Priority: High  
Primary Server: ch.pool.ntp.org  
Secondary Server: us.pool.ntp.org  
Synchronism (15~86400s): 1000  
Daylight Saving Time: Automatic  
Fixed Type: ☐ DST By Date ☒ DST By Week  
DST Start Month: March  
DST Start Day of Week: Sunday  
DST Start Day of Week Last in Month: Last In Month  
Start Hour of Day: 2  
DST Stop Month: October  
DST Stop Day of Week: Sunday  
DST Stop Day of Week Last in Month: Last In Month  
End Hour of Day: 3  
Offset(minutes): 60  
Manual Time: Disabled  
Time Format: Hour 24

Chose the appropriate NTP server and time zone for your country



## Directory

Yealink T42G

Log Out

English(English)

StatusAccountNetworkDsskeyFeaturesSettingsDirectorySecurity

Local Directory

Remote Phone Book

Phone Call Info

LDAP

Multicast IP

Setting

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

Enabled

Confirm

Cancel

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.

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

## Autoprovisioning

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

DHCP Active

Custom Option(128~254)

DHCP Option Value

Server URL

User Name

Password

Attempt Expired Time(s)

Common AES Key

MAC-Oriented AES Key

Zero Active

Wait Time(1~100s)

Power On

Repeatedly

Interval(Minutes)

Weekly

Weekly Upgrade Interval(0~12week)

Inactivity Time Expire(0~120min)

Time

Day of Week

Flexible Auto Provision

Flexible Interval Days

Flexible Time

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

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

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