

# GUIA DE CONFIGURAÇÃO DE CELULAS HAMNET

## WINBOX

Para configurar os dispositivos Mikrotik recomendamos a utilização do programa Winbox. Este software para Windows está disponível na página de Downloads da Mikrotik, com o seguinte link : <https://mikrotik.com/download>.

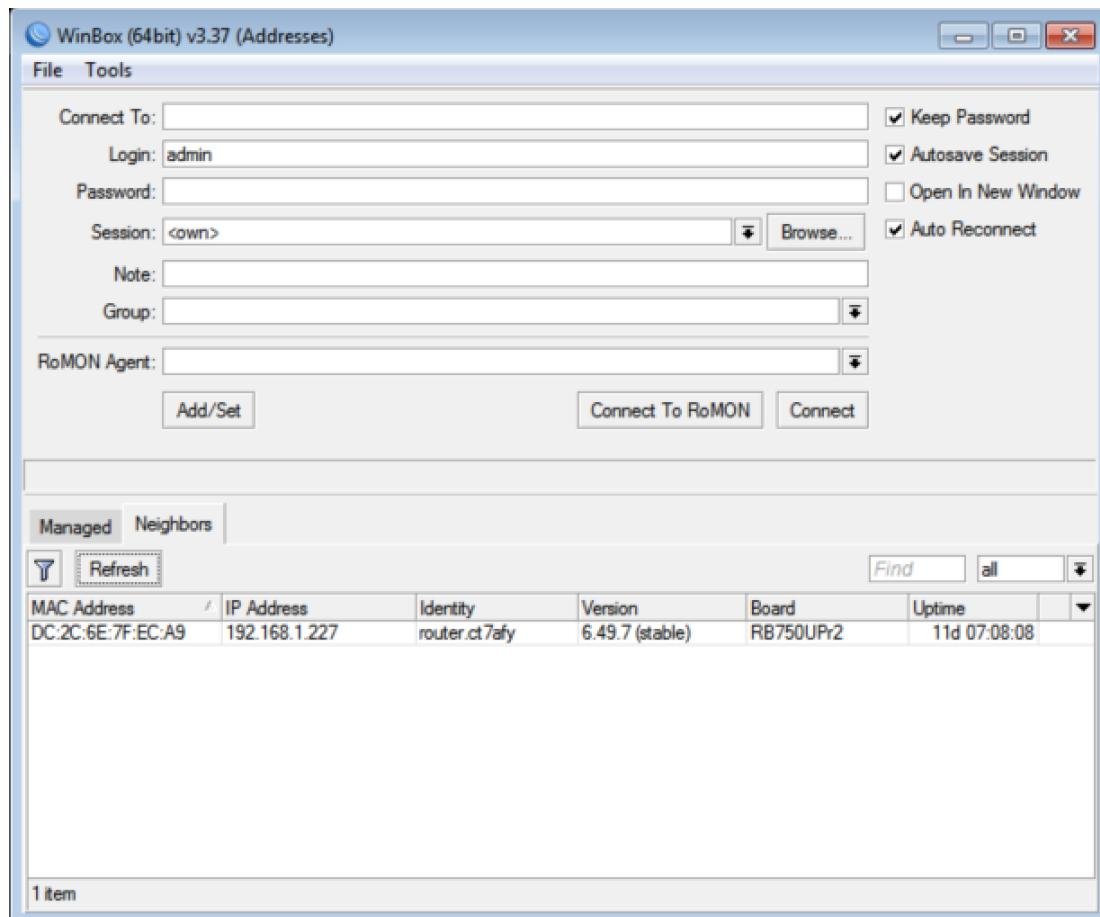
A versão a utilizar depende se a versão de Windows que está a utilizar é de 32 ou 64 bits.

The screenshot shows the RouterOS download page with a blue header bar containing the text "Software". Below the header, there are several navigation links: "Downloads", "Changelogs", "Download archive", "RouterOS", "The Dude", and "Mobile apps". The main content area is titled "Upgrading RouterOS". It contains a paragraph about upgrading RouterOS, a link to documentation, and instructions for managing the router using the web interface or Winbox. On the right side, there is a screenshot of a computer monitor displaying the WinBox interface, which includes tabs for "WinBox" and "Bandwidth Test". Below the tabs, there are two download links: "WinBox 3.37 (64-bit)" and "WinBox 3.37 (32-bit)".

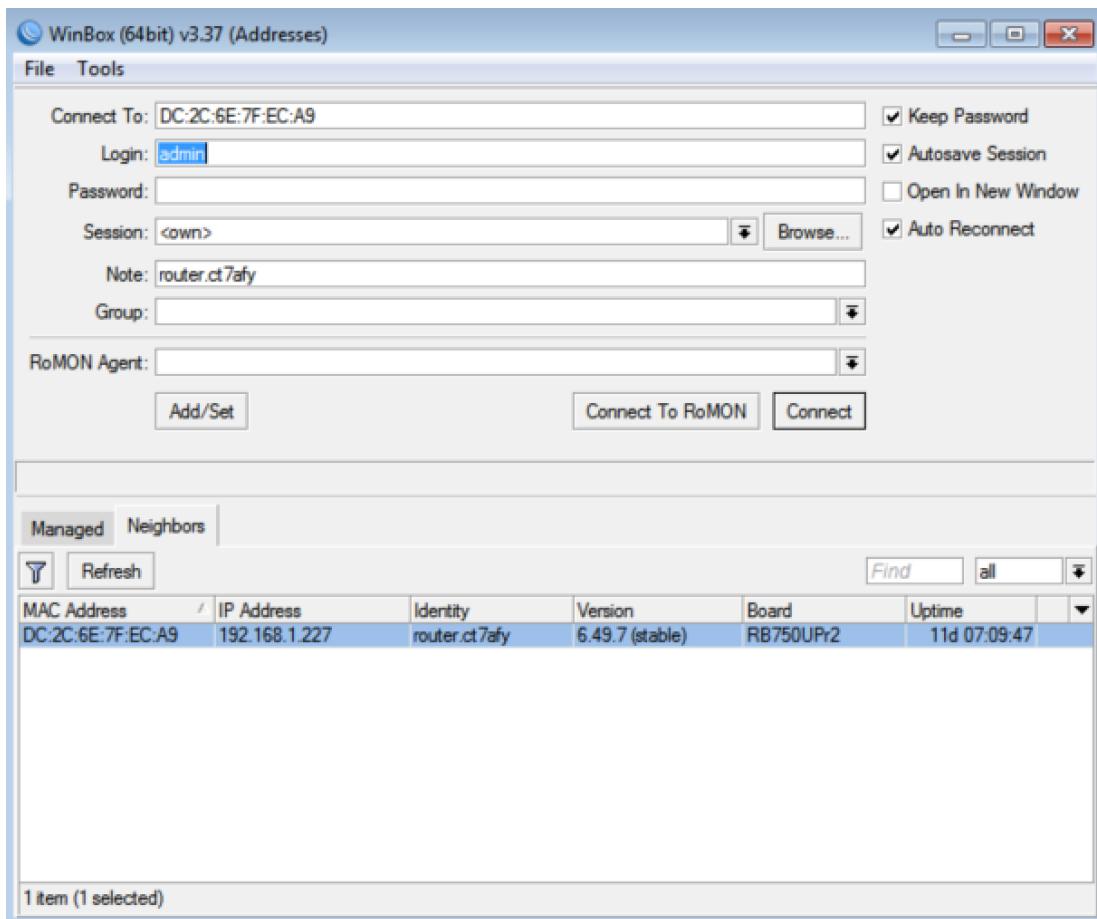
## CONFIGURAÇÃO EQUIPAMENTOS UTILIZANDO WINBOX

Para conseguir configurar os dispositivos com o WINBOX deverá ligá-los na mesma rede onde está ligado o computador que está a executar o programa WINBOX que acabou de ir buscar.

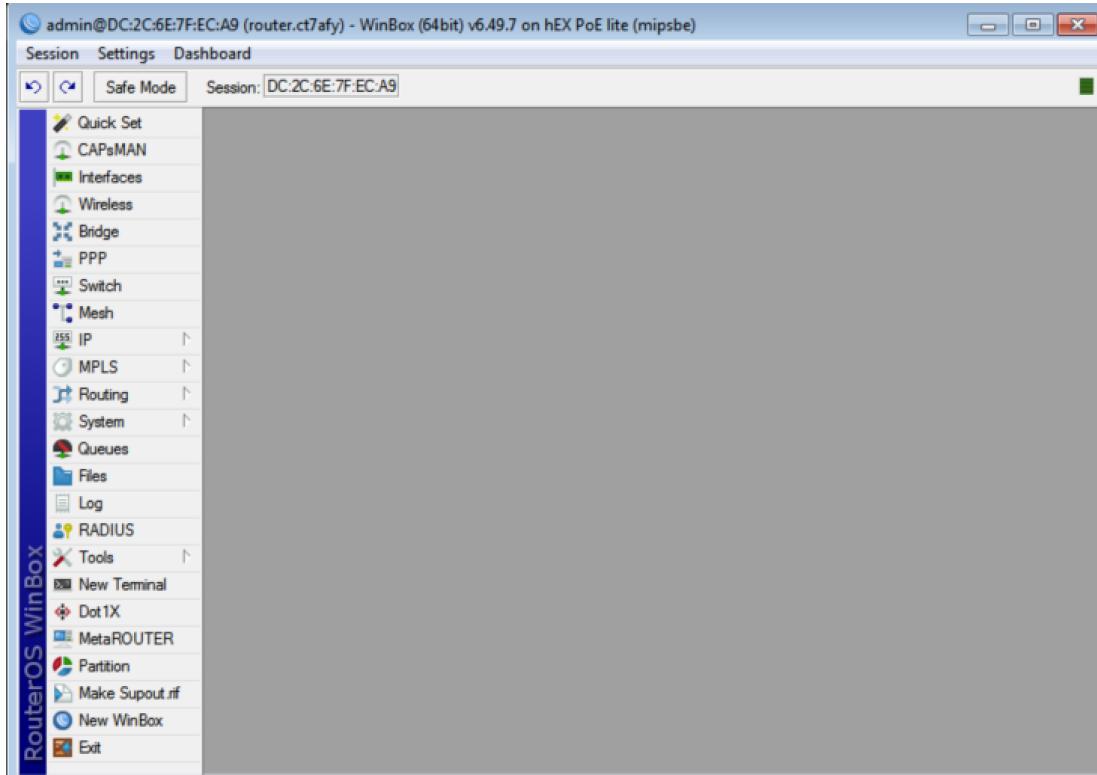
Ao executar o programa aparecerá um ecrã idêntico a este.



Clique no Mac Address do dispositivo que pretende configurar,



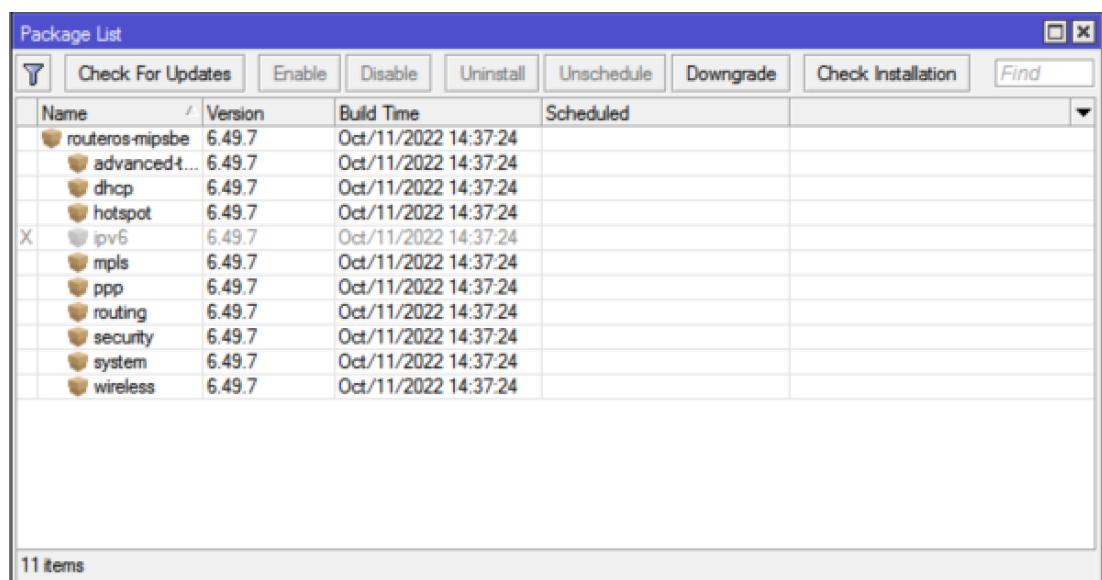
E clique em **Connect**



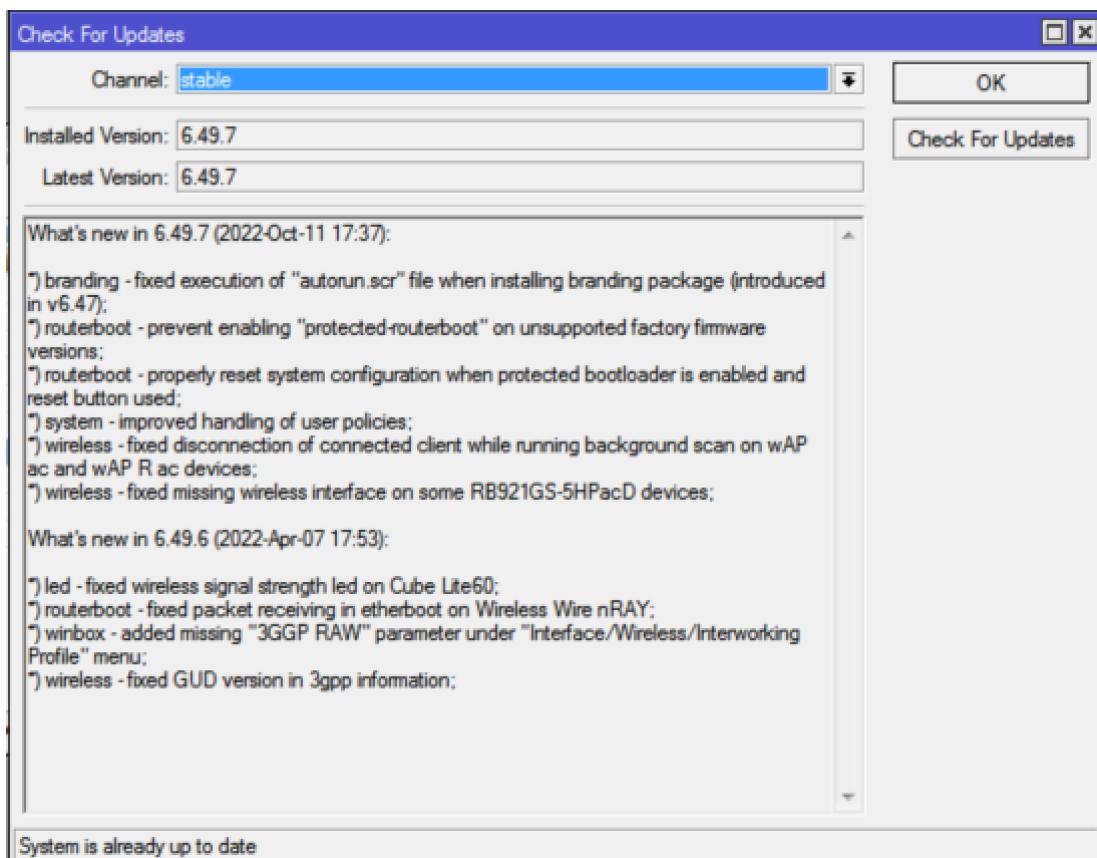
## ACTUALIZAÇÃO DE SOFTWARE E FIRMWARE

Antes de começarmos a configurar os vários dispositivos devemos atualizar os mesmos para a versão 6.49.7. Não é recomendável atualizar para a versão 7.

Existem duas formas de o fazer. A primeira consiste em selecionar no menu da esquerda **System, Packages** e pressionar o botão **Check for Updates**.



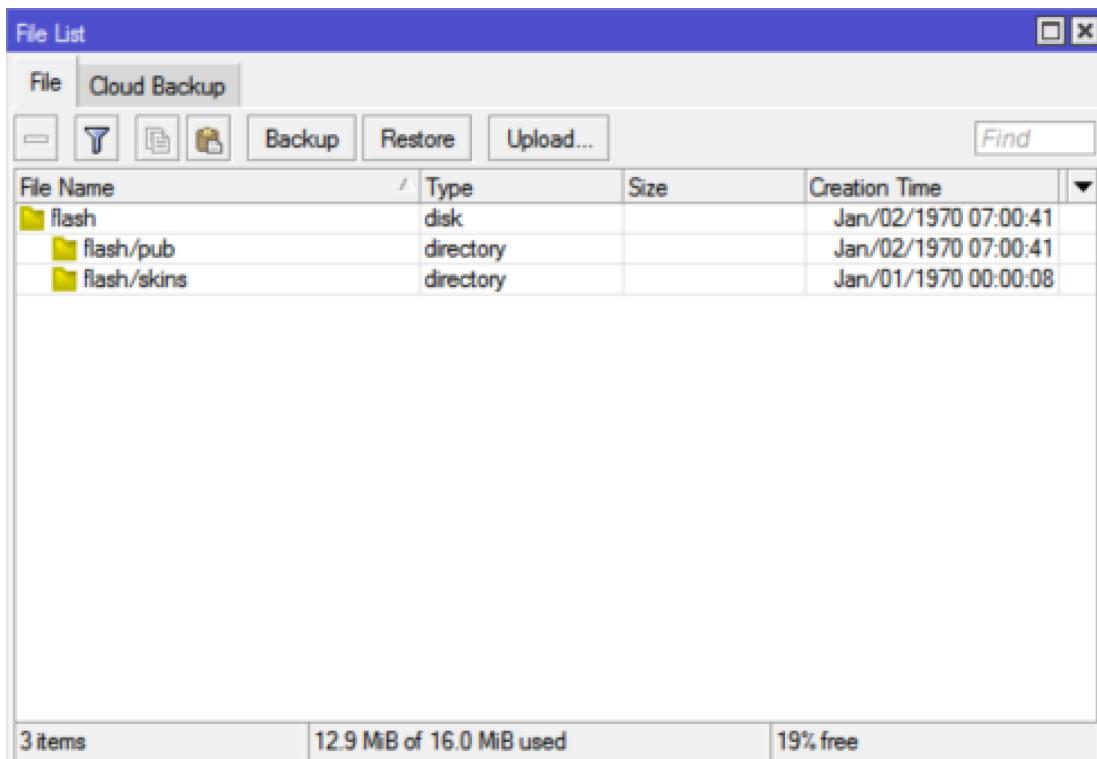
Se o Software instalado não for o 6.49.7, selecione esta versão (em stable) e clique em **Download & Install**.



A segunda opção consiste em fazer o download do software no site da Mikrotik. O ficheiro que deverá ir buscar é o Main Package MIPSBE 6.49.7 Stable.

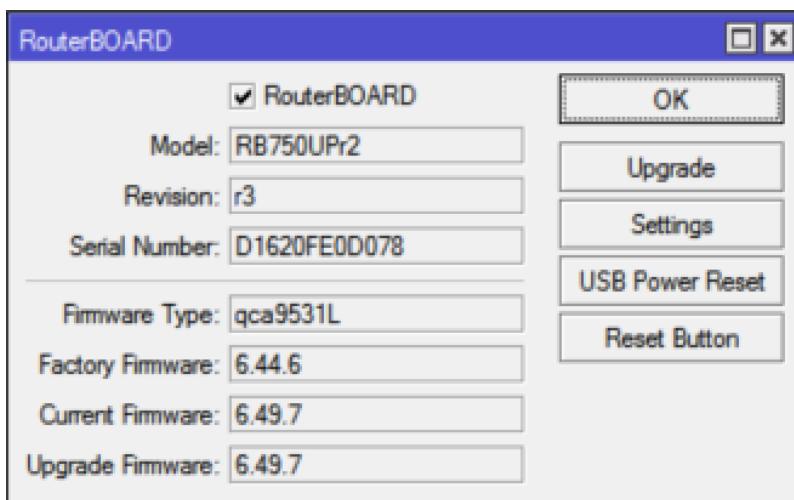
	6.48.6 Long-term	6.49.7 Stable
<b>ARM</b>		
Main package	<a href="#">[ ]</a>	<a href="#">[ ]</a>
Extra packages	<a href="#">[ ]</a>	<a href="#">[ ]</a>
The Dude server	<a href="#">[ ]</a>	-
<b>ARM64</b>		
Main package	<a href="#">[ ]</a>	<a href="#">[ ]</a>
Extra packages	<a href="#">[ ]</a>	<a href="#">[ ]</a>
The Dude server	<a href="#">[ ]</a>	-
<b>MIPSBE</b>		
Main package	<a href="#">[ ]</a>	<a href="#">[ ]</a>
Extra packages	<a href="#">[ ]</a>	<a href="#">[ ]</a>
<b>MMIPS</b>		
Main package	<a href="#">[ ]</a>	<a href="#">[ ]</a>
Extra packages	<a href="#">[ ]</a>	<a href="#">[ ]</a>
The Dude server	<a href="#">[ ]</a>	-
<b>SNIPS</b>		
Main package	<a href="#">[ ]</a>	<a href="#">[ ]</a>
Extra packages	<a href="#">[ ]</a>	<a href="#">[ ]</a>
<b>TILE</b>		
Main package	<a href="#">[ ]</a>	<a href="#">[ ]</a>
Extra packages	<a href="#">[ ]</a>	<a href="#">[ ]</a>
The Dude server	<a href="#">[ ]</a>	-
<b>PPC</b>		

Em seguida copiar ou arrastar o ficheiro para a página de configuração **Files**.



E fazer reboot do dispositivo (utilizando a opção **System, Reboot**) para que o software seja atualizado.

Deverá de seguida atualizar a versão de firmware do equipamento através da opção **System, RouterBoard** e premir o botão **Upgrade**.

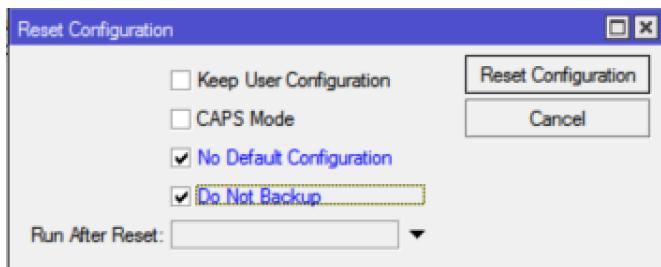


## ELIMINAR CONFIGURAÇÃO DEFAULT

Antes de iniciar a configuração dos equipamentos é necessário apagar a configuração 'por defeito' existente no equipamento.

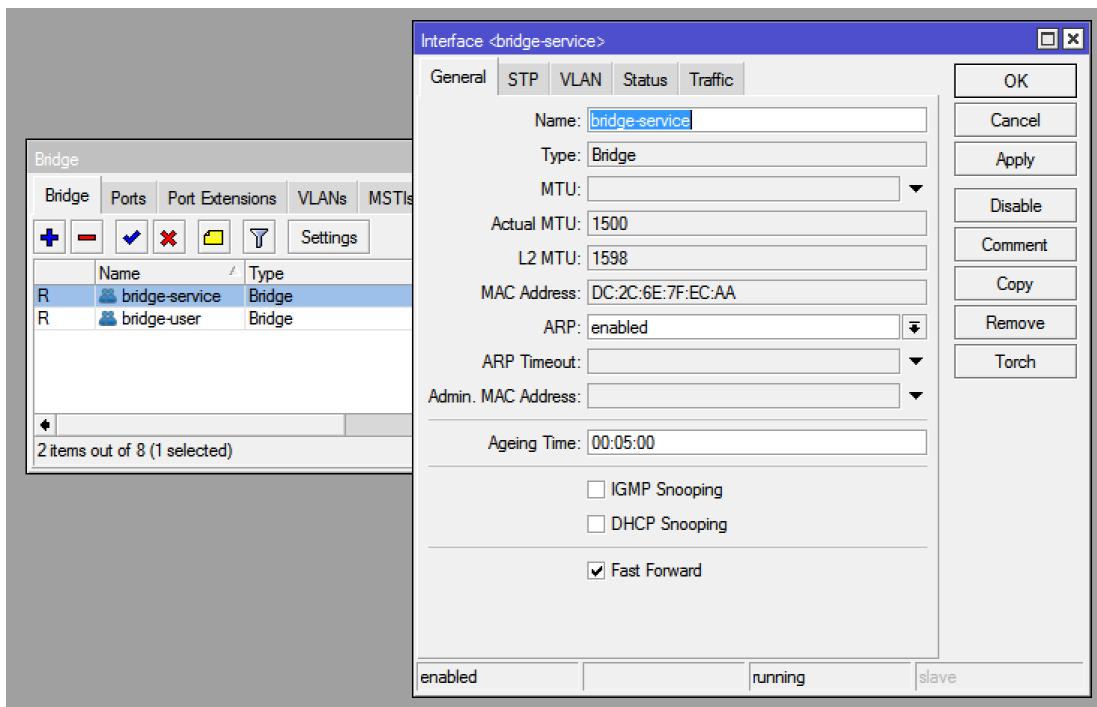
Para tal dever-se-á selecionar as opções **System** e **Reset configuration**.

Neste ecrã apresentado deverá ser preenchido como na figura e ser premido o botão **Reset Configuration**.



## CONFIGURAÇÃO DO ROUTER MIKROTIK

O primeiro passo para configurar o router consiste na criação de duas bridges, uma para os endereços para os serviços e outra para os utilizadores:

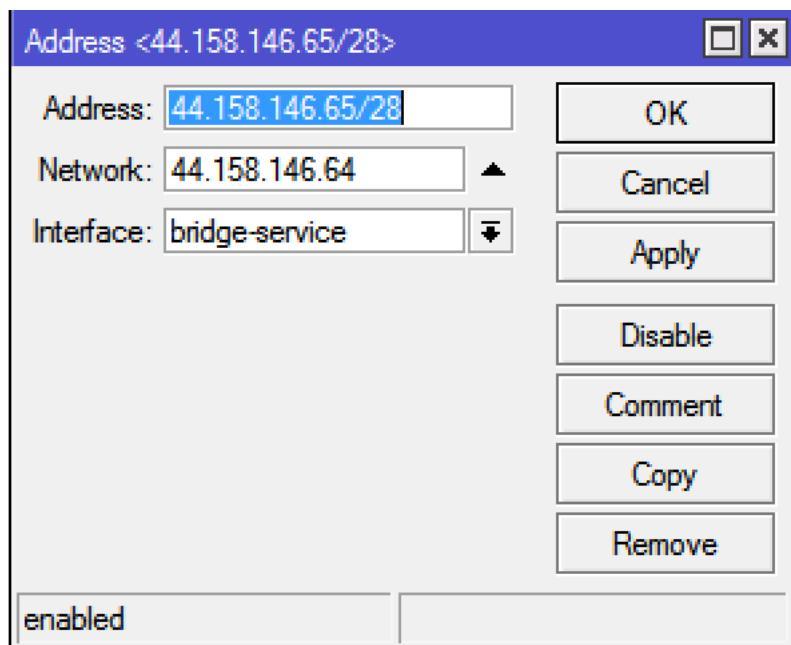


Em seguida tem de se atribuir os endereços IP às interfaces.

Para tal deverá selecionar no menu da esquerda **IP**, seguido de **Addresses**.

	44.158.146.65...	44.158.146.64	bridge-service
	44.158.146.81...	44.158.146.80	bridge-user
	44.158.147.30...	44.158.147.24	ether5

Clicar no sinal + e adicionar os endereços IP para os serviços, utilizadores e antena Wifi, esta ultima que vai ficar ligada na porta 5.



Address <44.158.146.81/28>

Address:	44.158.146.81/28	OK
Network:	44.158.146.80	Cancel
Interface:	bridge-user	Apply
Disable		
Comment		
Copy		
Remove		
enabled		

Address <44.158.147.30/29>

Address:	44.158.147.30/29	OK
Network:	44.158.147.24	Cancel
Interface:	ether5	Apply
Disable		
Comment		
Copy		
Remove		
enabled		

Para atribuir as Bridges às portas clicar no separador **Ports**

Bridge									
Bridge	Ports	Port Extensions	VLANs	MSTIs	Port MST Overrides	Filters	NAT	Hosts	MDB
#	Interface	Bridge	Horizon	Trusted	Priority (h...)	Path Cost	Role	Root Pat...	
0 I	ether4	bridge-user		no	80	10	disabled port		
1 IH	ether2	bridge-service		no	80	10	disabled port		
2 H	ether3	bridge-service		no	80	10	designated port		

3 items

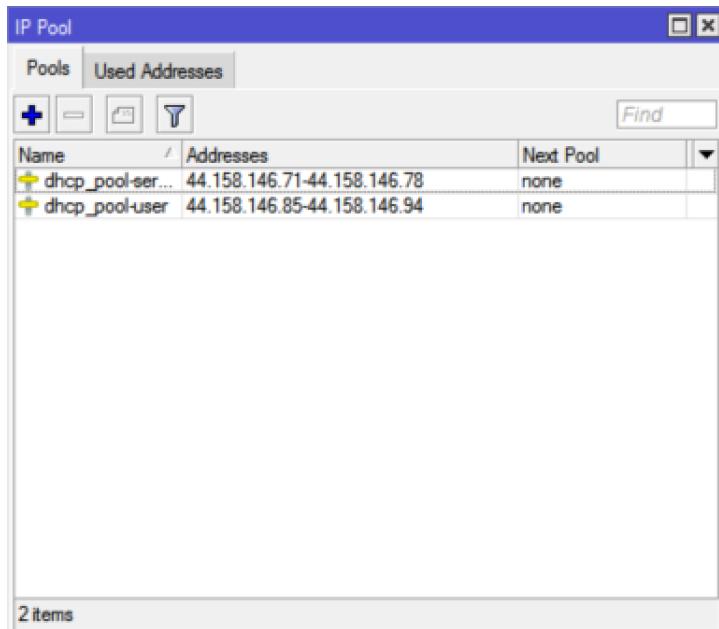
Clicar em + para as bridges às portas.

Bridge Port <ether3>

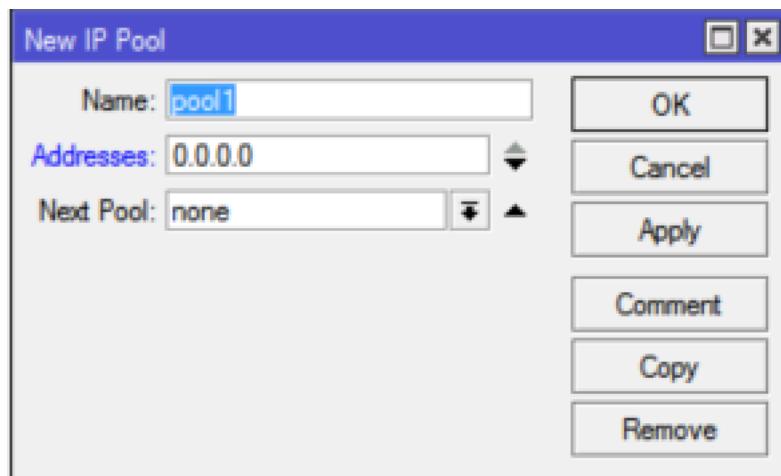
General	STP	VLAN	Status	
Interface: <input type="text" value="ether3"/>				<input type="button" value="OK"/>
Bridge: <input type="text" value="bridge-service"/>				<input type="button" value="Cancel"/>
Horizon: <input type="text"/>				<input type="button" value="Apply"/>
Learn: <input type="text" value="auto"/>				<input type="button" value="Disable"/>
<input checked="" type="checkbox"/> Unknown Unicast Flood <input checked="" type="checkbox"/> Unknown Multicast Flood <input checked="" type="checkbox"/> Broadcast Flood <input type="checkbox"/> Trusted				<input type="button" value="Comment"/>
<input checked="" type="checkbox"/> Hardware Offload				<input type="button" value="Copy"/>
Multicast Router: <input type="text" value="Temporary Query"/>				<input type="button" value="Remove"/>
<input type="checkbox"/> Fast Leave				
enabled	inactive	Hw. Offload		

Em seguida temos de configurar o router como Servidor DHCP para que o este atribua automaticamente os endereços IPs para estas duas categorias de uso.

Começamos por criar os dois intervalos de endereços (address pool) selecionando o menu **IP e Pool**.



Premir + para aparecer a seguinte janela e preencher os valores para os dois ranges de IP para DHCP.



Em seguida selecionar no menu, **IP** seguido de **DHCP Server**.

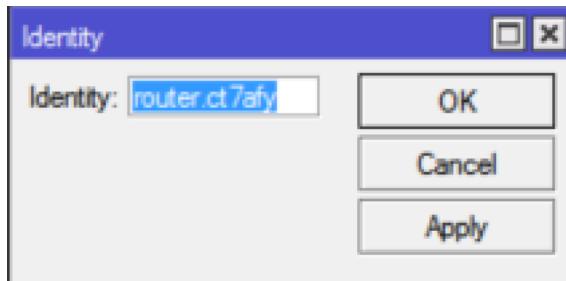
DHCP Server																											
DHCP	Networks	Leases	Options	Option Sets	Vendor Classes	Alerts																					
				DHCP Config	DHCP Setup	<input type="text" value="Find"/>																					
<table border="1"> <thead> <tr> <th>Name</th><th>Interface</th><th>Relay</th><th>Lease Time</th><th>Address Pool</th><th>Add AR...</th><th></th></tr> </thead> <tbody> <tr> <td>dhcp-service</td><td>bridge-service</td><td></td><td>00:10:00</td><td>dhcp_pool-se...</td><td>no</td><td></td></tr> <tr> <td>dhcp-user</td><td>bridge-user</td><td></td><td>00:10:00</td><td>dhcp_pool-user</td><td>no</td><td></td></tr> </tbody> </table>							Name	Interface	Relay	Lease Time	Address Pool	Add AR...		dhcp-service	bridge-service		00:10:00	dhcp_pool-se...	no		dhcp-user	bridge-user		00:10:00	dhcp_pool-user	no	
Name	Interface	Relay	Lease Time	Address Pool	Add AR...																						
dhcp-service	bridge-service		00:10:00	dhcp_pool-se...	no																						
dhcp-user	bridge-user		00:10:00	dhcp_pool-user	no																						
2 items																											

Clicar em + e criar as configurações dhcp-service e dhcp-user como no exemplo em baixo.

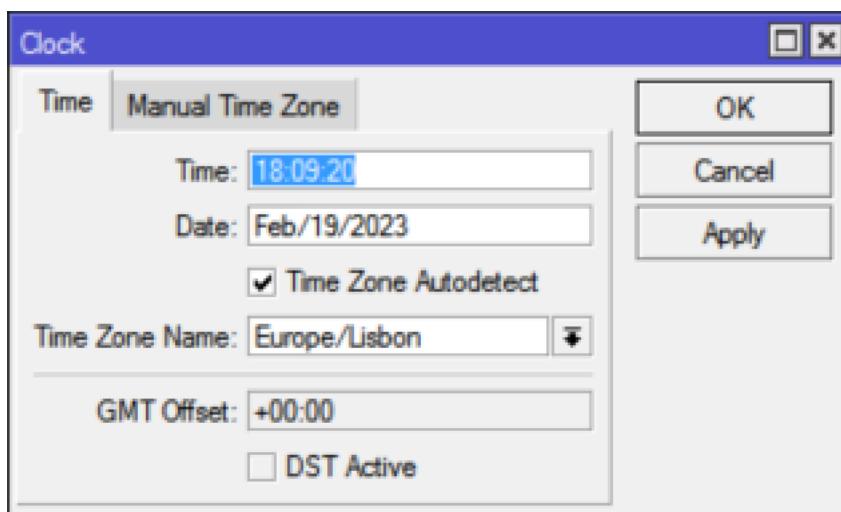
New DHCP Server

Generic	Queues	Script	
<input type="text" value="Name: dhcp-service"/> <input type="text" value="Interface: bridge-service"/> <input type="text" value="Relay:"/> <input type="text" value="Lease Time: 00:10:00"/> <input type="text" value="Bootp Lease Time: forever"/> <input type="text" value="Address Pool: dhcp_pool-service"/> <input type="text" value="DHCP Option Set:"/>  <input type="text" value="Src. Address:"/> <input type="text" value="Delay Threshold:"/>  <input type="text" value="Authoritative: yes"/> <input type="text" value="Bootp Support: static"/> <input type="text" value="Client MAC Limit:"/> <input type="text" value="Use RADIUS: no"/>  <input type="checkbox"/> Always Broadcast <input type="checkbox"/> Add ARP For Leases <input checked="" type="checkbox"/> Use Framed As Classless <input checked="" type="checkbox"/> Conflict Detection		<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Apply"/> <input type="button" value="Disable"/> <input type="button" value="Copy"/> <input type="button" value="Remove"/>	
enabled			

Para atribuir um nome ao router selecionar **System**, e **Identity**.  
Preencher o nome no campo respetivo.



Selecionar **Lisbon** a configuração do relógio em **System, clock**.



Para terminar configurar o roteamento BGP em Instances, network e Peers

BGP							
Instances		VRFs	Peers	Networks	Aggregates	VPN4 Routes	Advertisements
							<input type="text" value="Find"/>
Name	/ AS	Router ID	Out Filter	Confeder...	Confeder...	Cluster ID	

1 item (1 selected)

### BGP Instance <default>

Name:	<input type="text" value="default"/>	<input type="button" value="OK"/>
AS:	<input type="text" value="4226830012"/>	<input type="button" value="Cancel"/>
Router ID:	<input type="text"/>	<input type="button" value="Apply"/>
<input type="checkbox"/> Redistribute Connected <input type="checkbox"/> Redistribute Static <input type="checkbox"/> Redistribute RIP <input type="checkbox"/> Redistribute OSPF <input type="checkbox"/> Redistribute Other BGP		<input type="button" value="Disable"/>
		<input type="button" value="Comment"/>
		<input type="button" value="Copy"/>
		<input type="button" value="Remove"/>
Out Filter:	<input type="text"/>	<input type="button" value="▼"/>
Confederation:	<input type="text"/>	<input type="button" value="▼"/>
Confederation Peers:	<input type="text"/>	<input type="button" value="▼"/>
Cluster ID:	<input type="text"/>	<input type="button" value="▼"/>
Routing Table:	<input type="text"/>	<input type="button" value="▼"/>
<input checked="" type="checkbox"/> Client To Client Reflection <input type="checkbox"/> Ignore AS Path Length		
enabled		

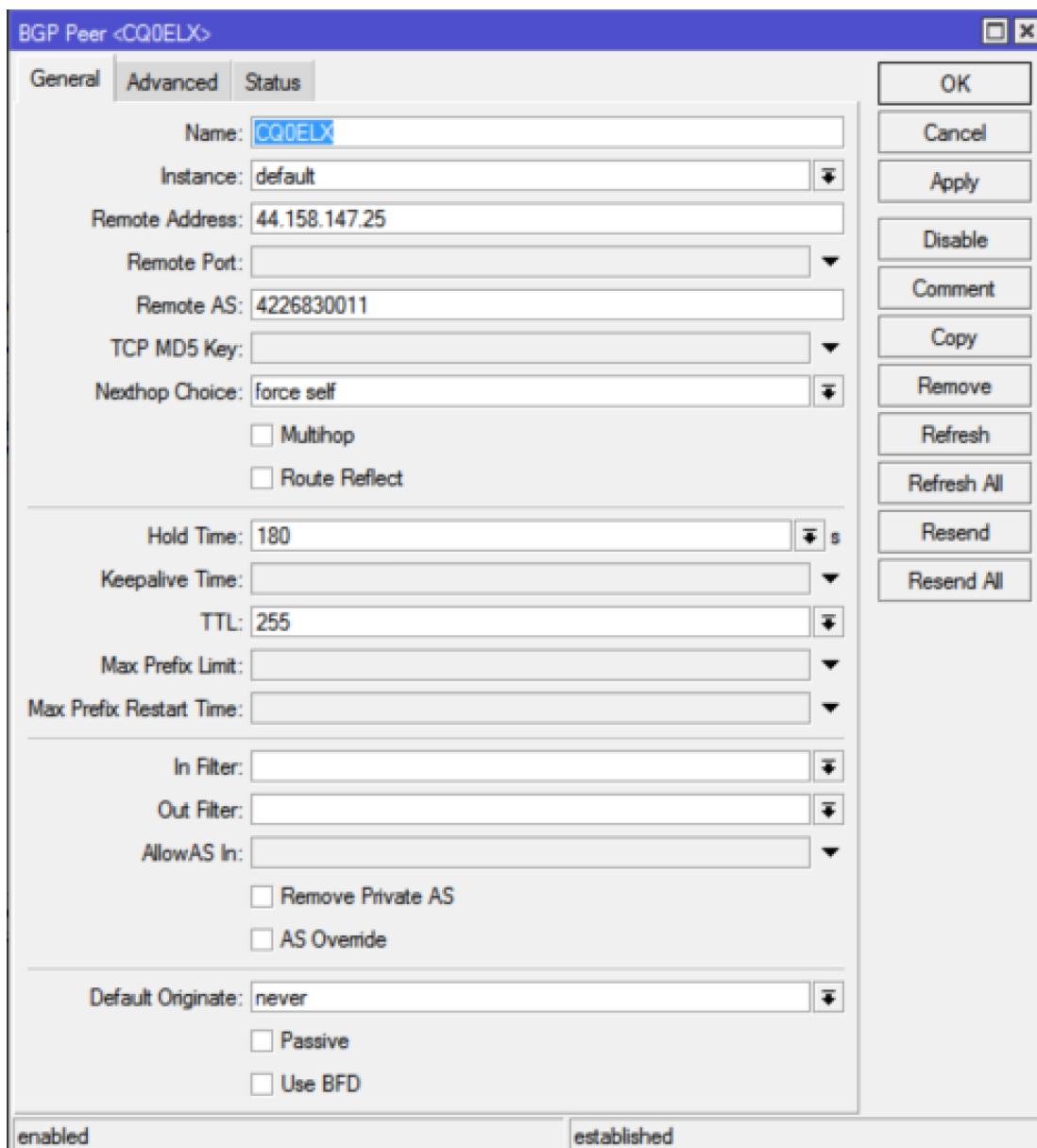
BGP

Instances	VRFs	Peers	Networks	Aggregates	VPN4 Routes	Advertisements
						<input type="text" value="Find"/>
Network	/	Synchroni...				
44.158.146.64/27		no				
44.158.147.24/29		yes				

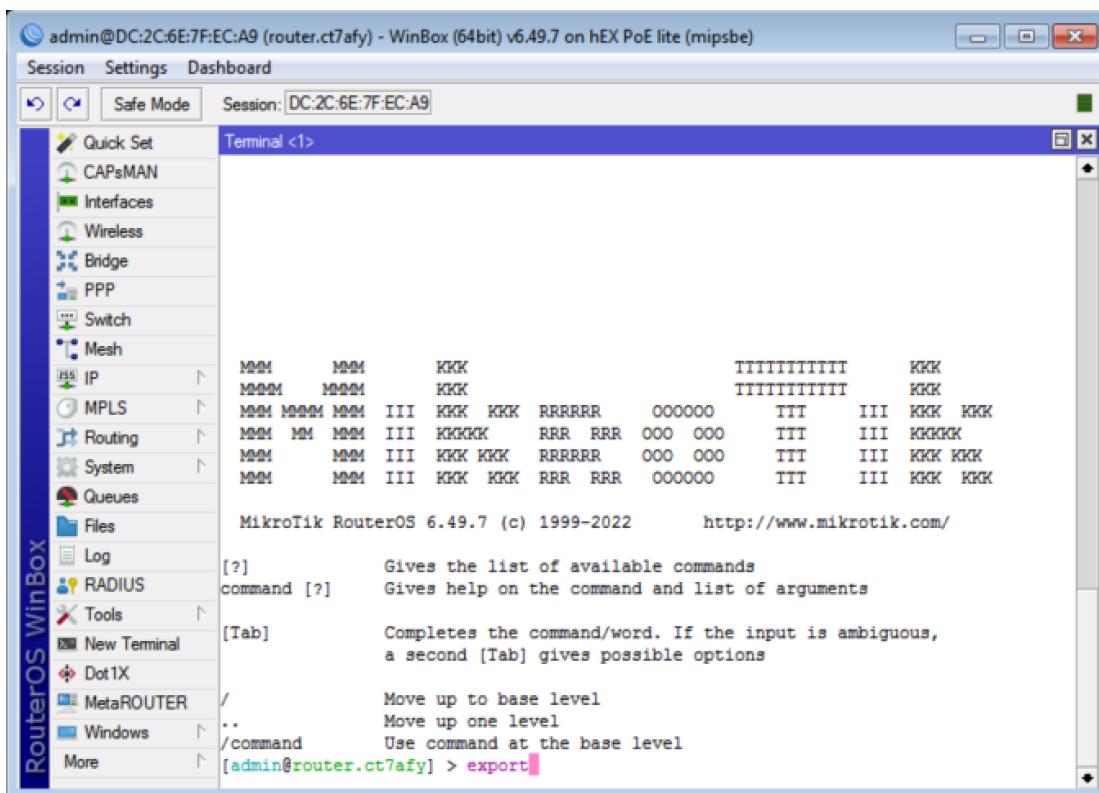
2 items

BGP

Instances	VRFs	Peers	Networks	Aggregates	VPN4 Routes	Advertisements
						<input type="text" value="Find"/>
			Refresh	Refresh All	Resend	Resend All
Name	/	Instance	Remote Address	Remote AS	M...	R...
CQ0ELX		default	44.158.147.25	4226830011	no	no
				255	44.158.147.25	21d 12:5...
						2 established



Para visualizar a configuração do equipamento em forma de comandos de texto deverá abrir um terminal através do menu **New Terminal** e escrever **export**.



Deverá obter algo parecido com isto:

```

[admin@router.ct7afy] > export
# feb/01/2023 14:54:10 by RouterOS 6.49.7
# software id = D0G1-P4XM
#
# model = RB750UPr2
/interface bridge
add name=bridge-service
add name=bridge-user
/ip pool
add name=dhcp_pool-service ranges=44.158.146.71-44.158.146.78
add name=dhcp_pool-user ranges=44.158.146.85-44.158.146.94
/ip dhcp-server
add address-pool=dhcp_pool-service disabled=no interface=bridge-service
name=dhcp-service
add address-pool=dhcp_pool-user disabled=no interface=bridge-user
name=dhcp-user
/routing bgp instance
set default as=4226830012
/interface bridge port
add bridge=bridge-user interface=ether4
add bridge=bridge-service interface=ether2
add bridge=bridge-service interface=ether3

```

```
/ip address
add address=44.158.146.65/28 interface=bridge-service
network=44.158.146.64
add address=44.158.146.81/28 interface=bridge-user
network=44.158.146.80
add address=44.158.147.30/29 interface=ether5 network=44.158.147.24
/ip dhcp-server network
add address=44.158.146.64/28 dns-server=44.158.146.65
gateway=44.158.146.65
add address=44.158.146.80/28 dns-server=44.158.146.81
gateway=44.158.146.81
/ip dns
set allow-remote-requests=yes
/routing bgp network
add network=44.158.146.64/27 synchronize=no
add network=44.158.147.24/29
/routing bgp peer
add name=CQ0ELX nexthop-choice=force-self remote-address=44.158.147.25
remote-as=4226830011
/system clock
set time-zone-name=Europe/Lisbon
/system identity
set name=router.ct7afy
```

Por ultimo deverá alterar a password do equipamento, se ainda não o fez, através do menu **System, Password**

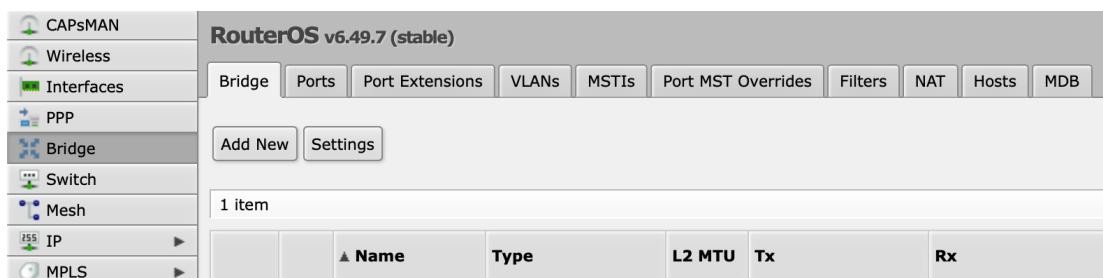


## CONFIGURAÇÃO DOS LINKS MIKROTIK

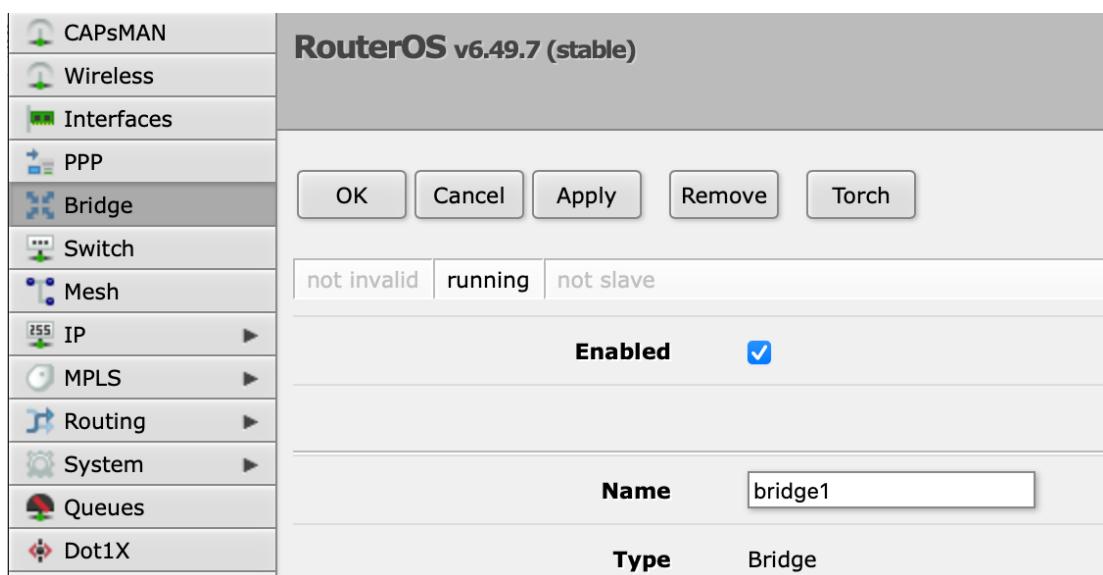
Um dos links é configurado como Acess Point e o outro de Station.

O primeiro passo consiste em criar uma Bridge entre a porta Wan e Lan.

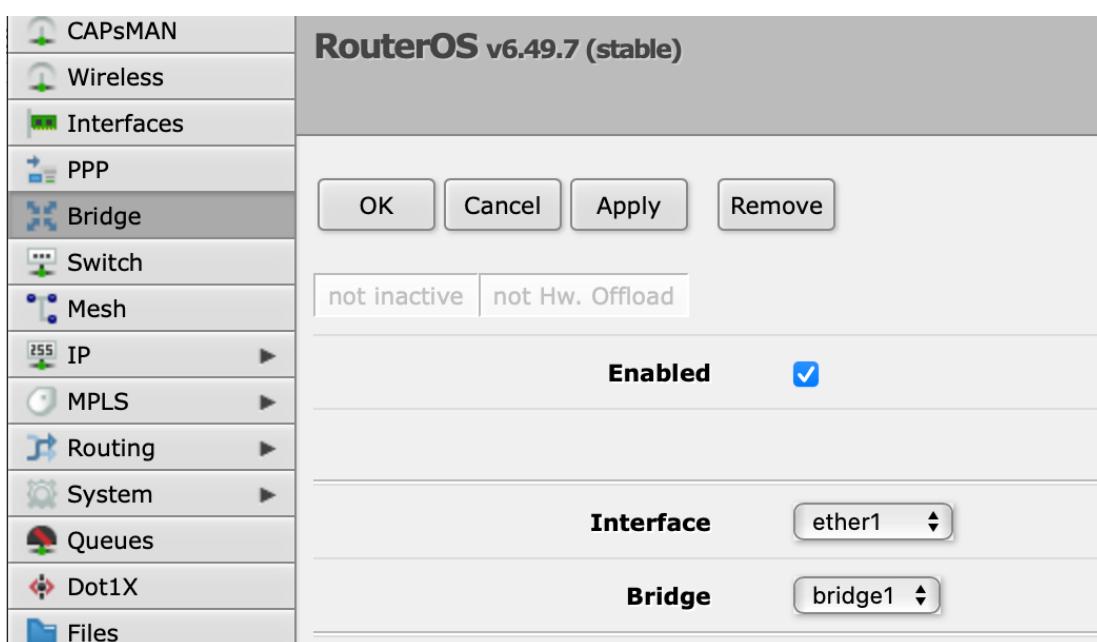
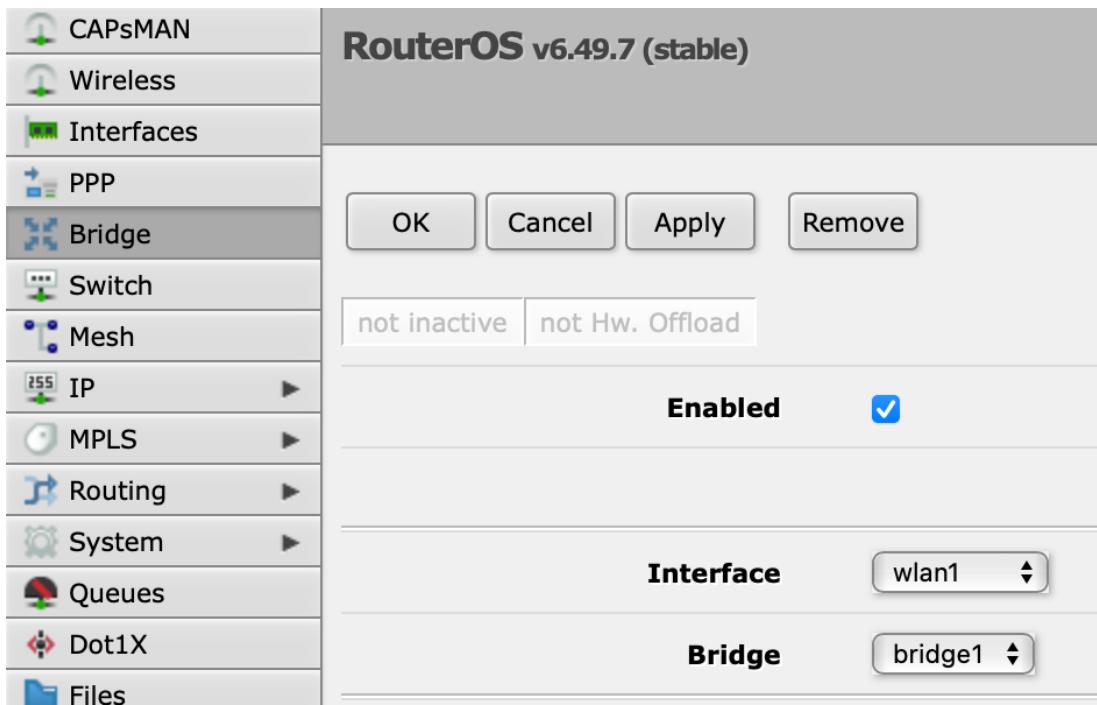
Para tal deverá ser selecionada a opção do menu **Bridge**



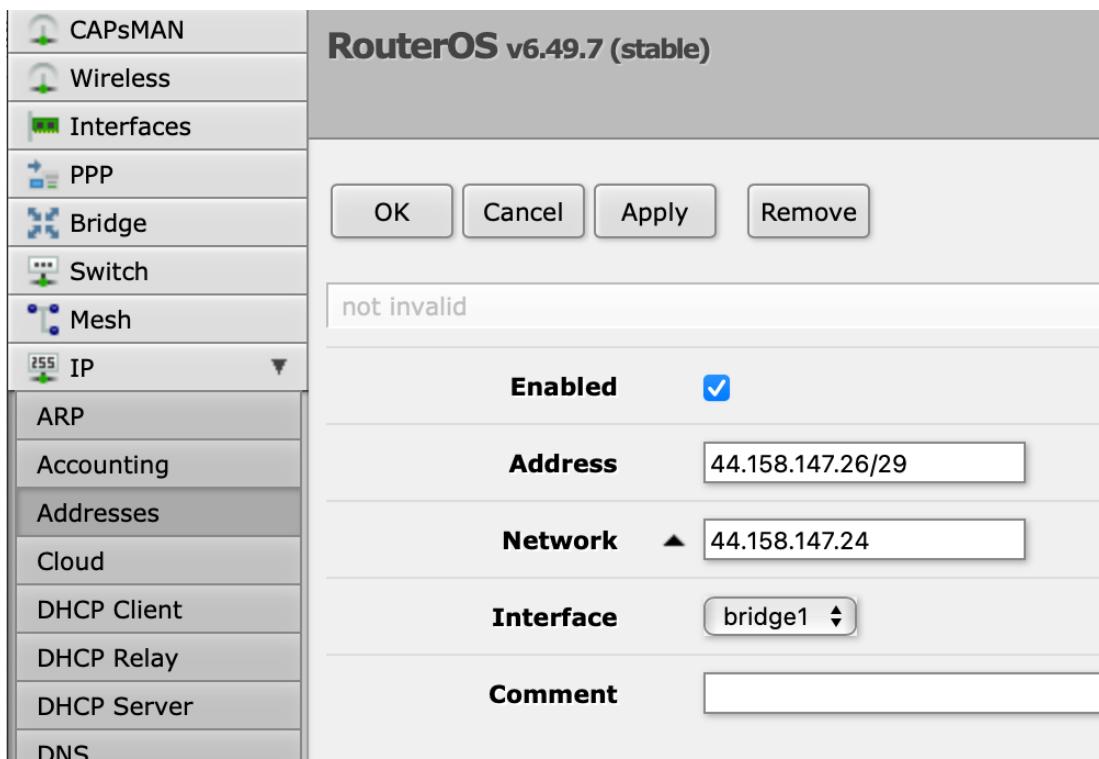
Seguido de **Add New** e atribuir um nome à Bridge.



Em seguida associar as portas wlan1 e ether1 à bridge criada.



De seguida atribuímos os endereços a utilizar em **IP, Addresses**.

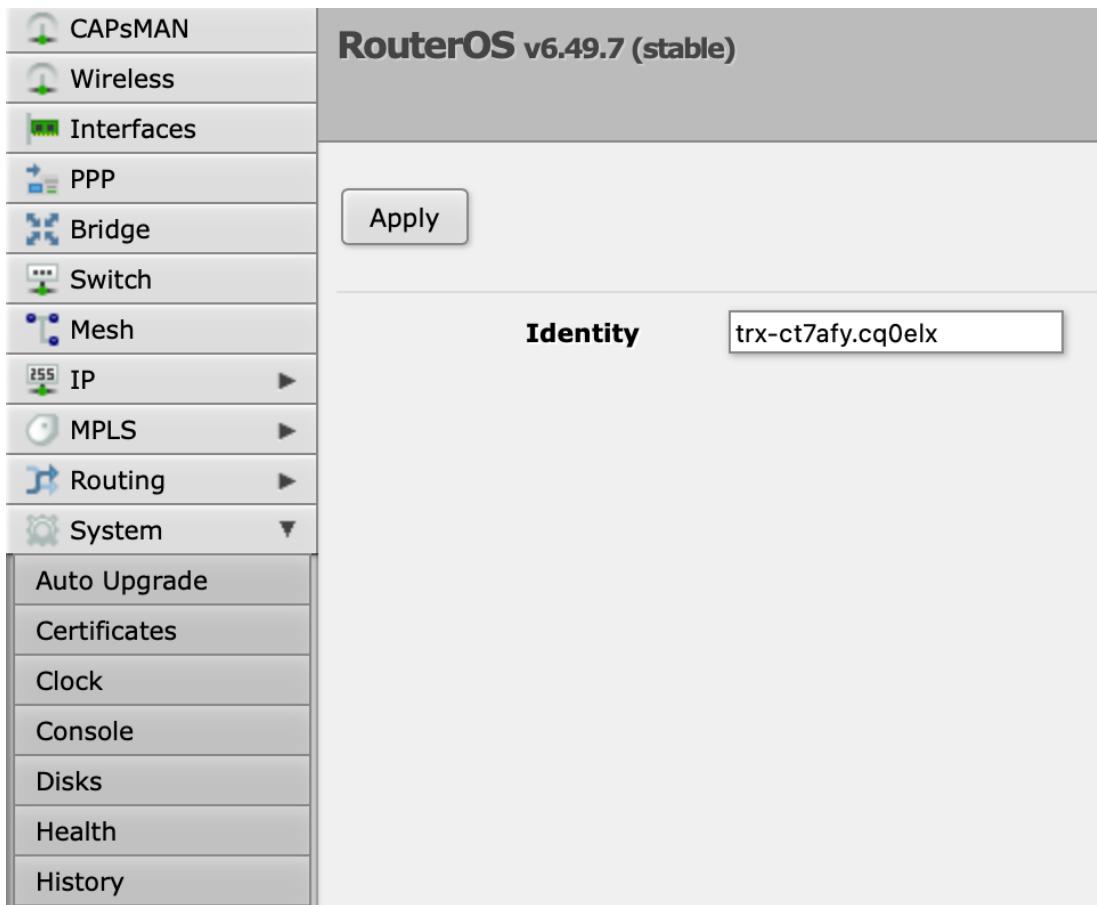


Para definir o endereço DNS em **IP**, **DNS**

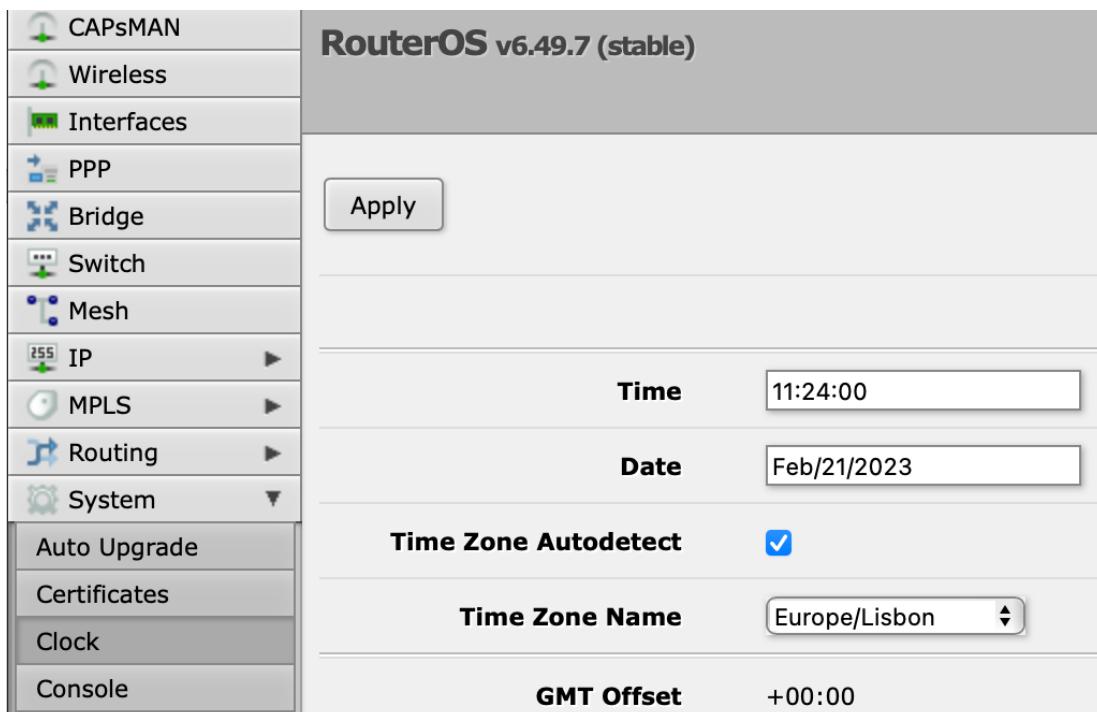
The screenshot shows the RouterOS v6.49.7 (stable) web interface. On the left is a sidebar with various network configuration options like CAPsMAN, Wireless, Interfaces, PPP, Bridge, Switch, Mesh, and IP (selected). The main panel displays the 'Dynamic Servers' configuration for DNS. It includes fields for 'Servers' (set to 44.158.147.25), 'Use DoH Server' (selected), 'Verify DoH Certificate' (unchecked), 'Allow Remote Requests' (unchecked), 'Max UDP Packet Size' (4096), 'Query Server Timeout' (2.000 s), 'Query Total Timeout' (10.000 s), 'Max. Concurrent Queries' (100), 'Max. Concurrent TCP Sessions' (20), 'Cache Size' (2048 KiB), 'Cache Max TTL' (7d 00:00:00), and 'Cache Used' (25 KiB).

## Definir o nome em **System, Identity**

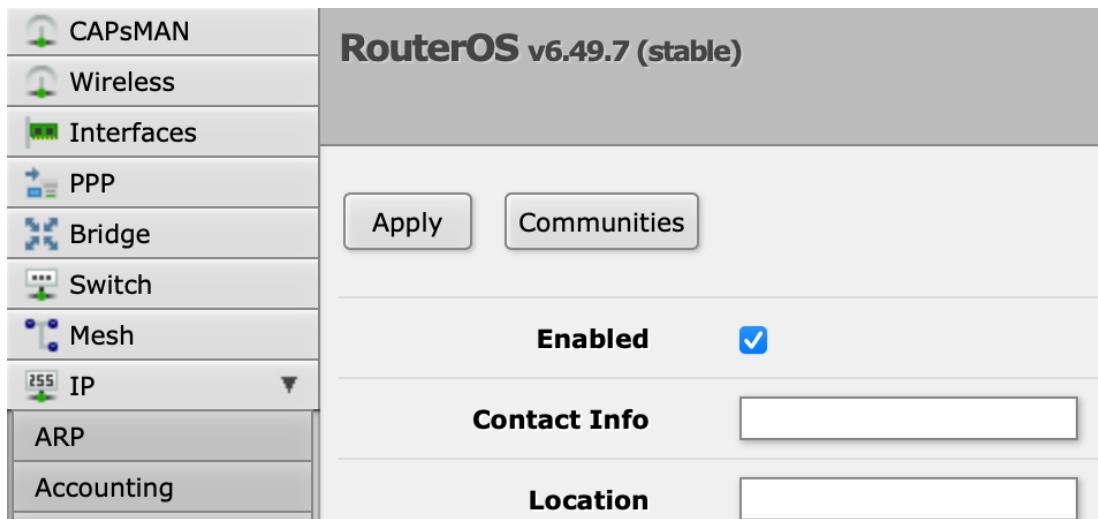
No nome deverá ser utilizado o prefixo `trx-`, seguido do nome da célula onde o link se está a ligar e separado de um ponto da célula onde está instalado.



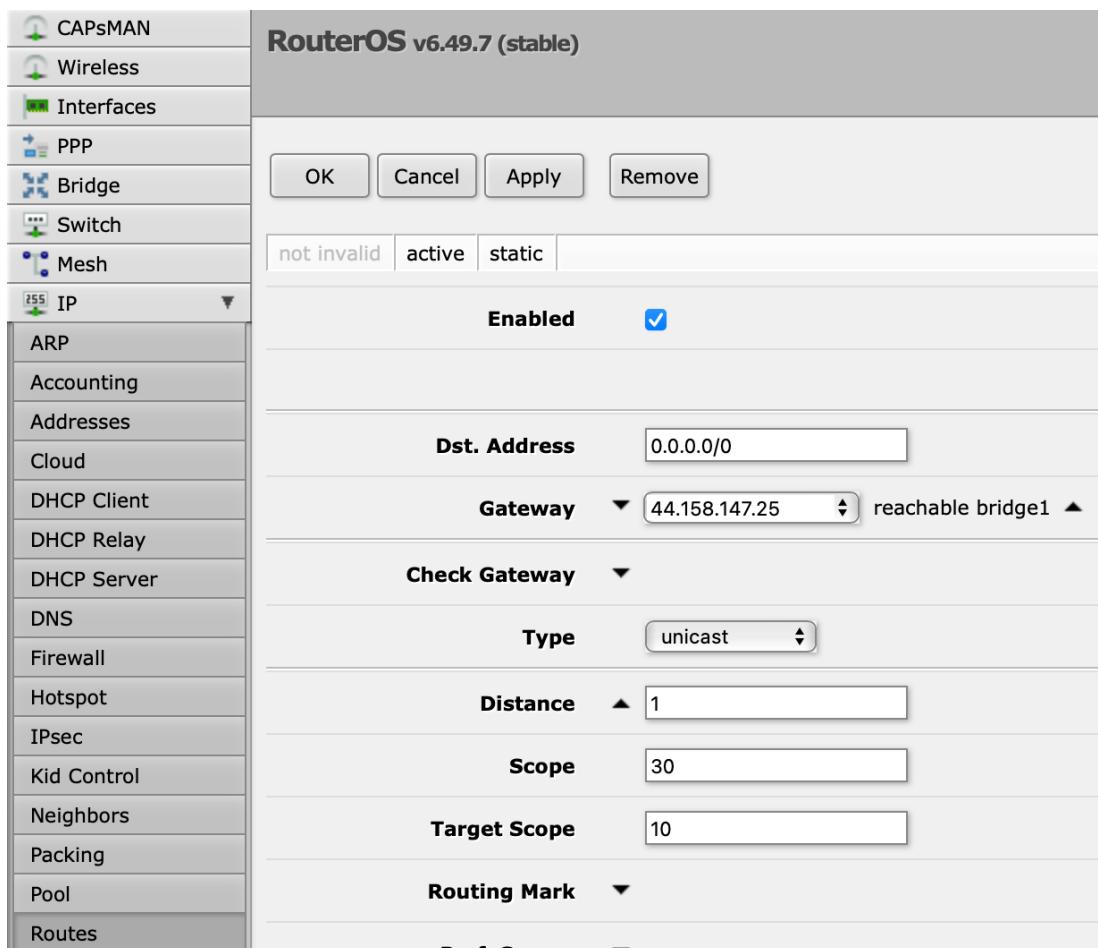
Para definir a time zone, selecionar System e Clock



Para ativar SNMP, selecionar IP, SNMP e clicar em **enabled**



Para definir a rota selecionar IP seguido de Route



Em seguida criar o perfil de segurança em Wireless e tab **Security Profiles**

O campo **WPA2 Pre-Shared Key** deverá ser preenchido com **amateurradio**

Para terminar criar a interface Wireless com **Add New**

**RouterOS v6.49.7 (stable)**

**Wireless**

**Enabled**

**Name** wlan1

**Type** Wireless (Atheros AR9888)

**MTU** 1500

**Actual MTU** 1500

**L2 MTU** 1600

**MAC Address** E4:8D:8C:F8:88:43

**ARP** enabled

**ARP Timeout** ▾

**Mode** station bridge

**Band** 5GHz-A/N/AC

**Channel Width** 20MHz

**Frequency** 5735 MHz

**SSID** HAMNET-CT7AFY-CQ0ELX

**Security Profile** hamnet-ism

**Frequency Mode** superchannel

**Country** no\_country\_set

**Installation** outdoor

**OK** **Cancel** **Apply** **Advanced Mode** **WPS Accept** **WPS**

connected to ess | not invalid | running | slave

This screenshot shows the 'Wireless' configuration page in RouterOS. The left sidebar lists various network-related sections. The main area displays configuration for a wireless interface named 'wlan1'. Key settings shown include the interface name, type (Atheros AR9888), MTU (1500), L2 MTU (1600), MAC address (E4:8D:8C:F8:88:43), and ARP settings (enabled). Advanced options like mode (station bridge), band (5GHz-A/N/AC), channel width (20MHz), frequency (5735 MHz), SSID (HAMNET-CT7AFY-CQ0ELX), security profile (hamnet-ism), and frequency mode (superchannel) are also visible. Buttons at the top right allow saving changes or switching to advanced mode.

O modo a selecionar deverá ser **station bridge**.

Selecionar **Nstreme**

**Enable Nstreme**

A configuração em modo terminal deverá ser idêntica a esta :

```
[admin@trx-ct7afy.cq0elx] > export
# feb/01/2023 15:10:25 by RouterOS 6.49.7
# software id = U68Z-5C2M
#
# model = 911G-5HPacD
/interface bridge
add name=bridge1
/interface wireless security-profiles
set [ find default=yes ] supplicant-identity=MikroTik
add authentication-types=wpa2-psk mode=dynamic-keys name=hamnet-ism
supplicant-identity="" wpa2-pre-shared-key=amateururradio
/interface wireless
set [ find default-name=wlan1 ] band=5ghz-a/n/ac country=no_country_set
disabled=no disconnect-timeout=15s frequency=5735 frequency-
mode=superchannel hw-retries=15 mode=station-bridge radio-name=CQ0ELX
scan-list=5735 security-profile=hamnet-ism ssid=HAMNET-CT7AFY-CQ0ELX
/interface wireless nstreme
set wlan1 enable-nstreme=yes
/interface bridge port
add bridge=bridge1 interface=wlan1
add bridge=bridge1 interface=ether1
/ip address
add address=44.158.147.26/29 interface=bridge1 network=44.158.147.24
/ip dns
set servers=44.158.147.25
/ip route
add distance=1 gateway=44.158.147.25
/snmp
set enabled=yes
/system clock
set time-zone-name=Europe/Lisbon
/system identity
set name=trx-ct7afy.cq0elx
```

A configuração do outro link deverá ser idêntico com a diferença de que deverá ser configurado como **AP Bridge**

**RouterOS v6.49.7 (stable)**

**Wireless**

**OK Cancel Apply Advanced Mode WPS Accept WPS Client**

**running ap not invalid running slave**

**Enabled**

**Name** wlan1

**Type** Wireless (Atheros AR9888)

**MTU** 1500

**Actual MTU** 1500

**L2 MTU** 1600

**MAC Address** E4:8D:8C:FA:55:31

**ARP** enabled

**ARP Timeout** ▾

**Mode** ap bridge

**Band** 5GHz-A/N/AC

**Channel Width** 20MHz

**Frequency** 5735 MHz

**SSID** ▲ HAMNET-CT7AFY-CQ0ELX

**Security Profile** hamnet-ism

**WPS Mode** push button

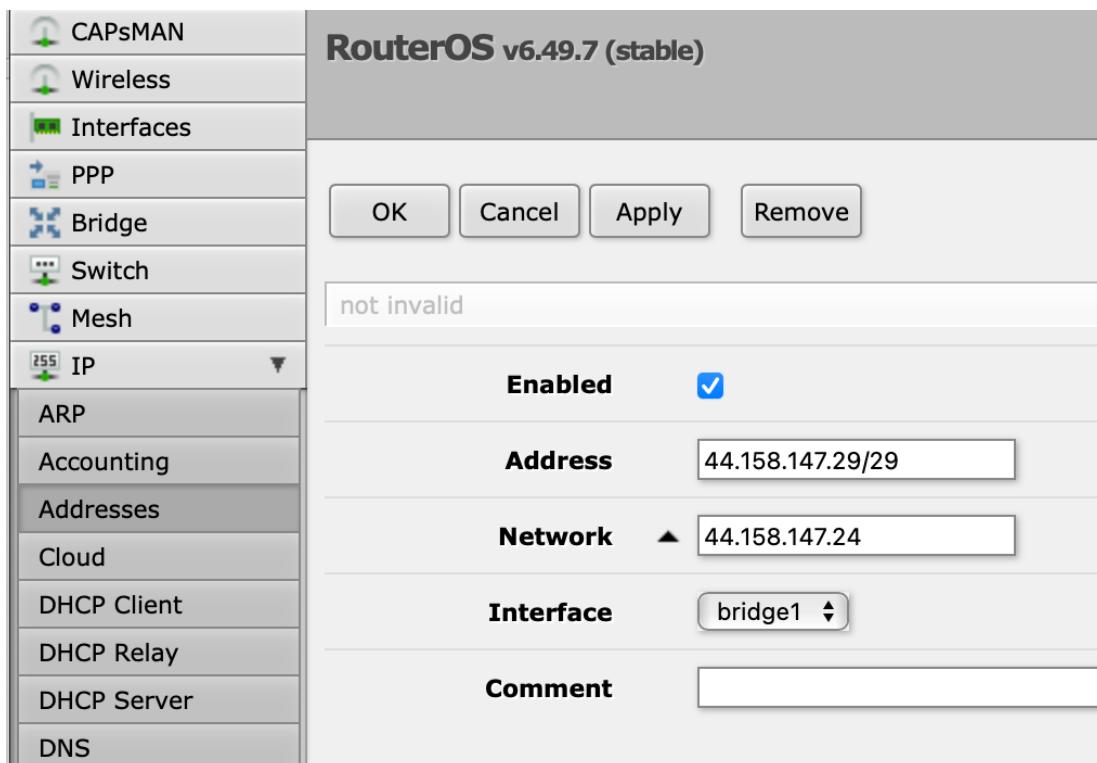
**Frequency Mode** superchannel

**Country** no\_country\_set

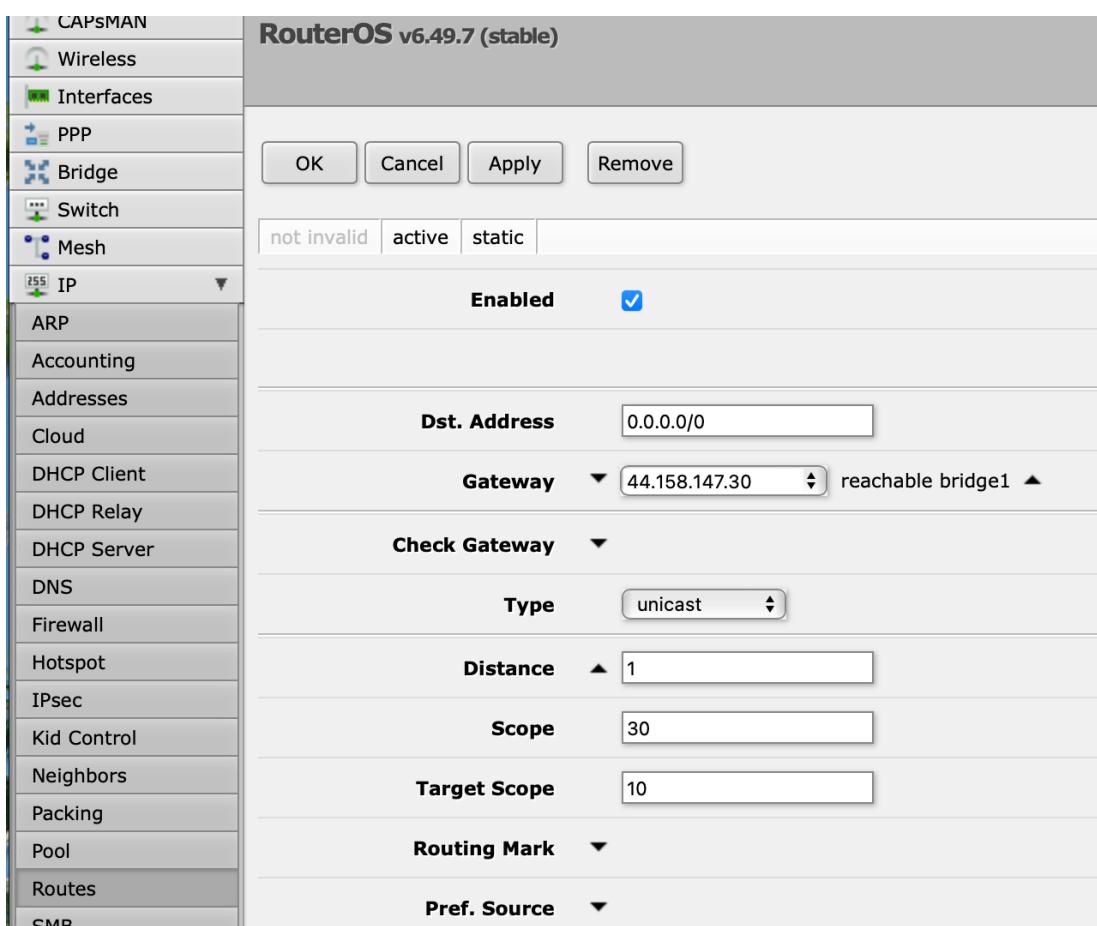
**Installation** outdoor

This screenshot shows the 'Wireless' configuration page in RouterOS. The left sidebar lists various system and network management options. The main panel displays configuration for a wireless interface named 'wlan1'. Key settings include: Enabled (checked), Type set to 'Wireless (Atheros AR9888)', MTU set to 1500, Actual MTU at 1500, L2 MTU at 1600, MAC Address E4:8D:8C:FA:55:31, ARP set to 'enabled', and Mode set to 'ap bridge'. Other parameters like Band (5GHz-A/N/AC), Channel Width (20MHz), Frequency (5735 MHz), SSID (HAMNET-CT7AFY-CQ0ELX), Security Profile (hamnet-ism), WPS Mode (push button), Frequency Mode (superchannel), Country (no\_country\_set), and Installation (outdoor) are also visible.

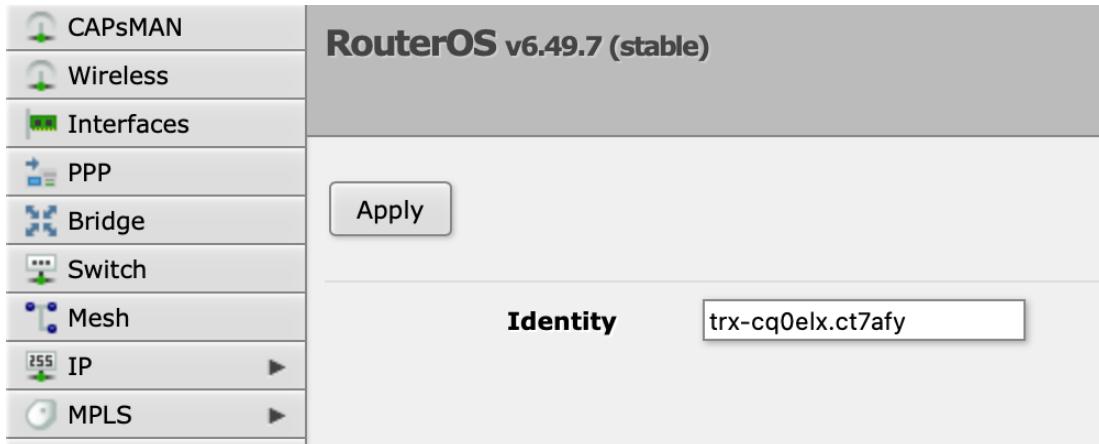
O endereço deverá ser ajustado ao novo link, neste caso 44.158.147.29/29



O endereço da gateway alterado em IP, Routes



E finalmente o nome do equipamento.



A configuração em modo terminar deverá ser idêntica a esta :

```
[admin@trx-cq0elx.ct7afy] > export
# feb/01/2023 15:12:43 by RouterOS 6.49.7
# software id = 6GQA-2AF4
#
# model = 911G-5HPacD
/interface bridge
add name=bridge1
/interface wireless security-profiles
set [ find default=yes ] supplicant-identity=MikroTik
add authentication-types=wpa2-psk mode=dynamic-keys name=hamnet-ism
supplicant-identity="" wpa2-pre-shared-key=amateururradio
/interface wireless
set [ find default-name=wlan1 ] band=5ghz-a/n/ac country=no_country_set
disabled=no disconnect-timeout=15s frequency=5735 frequency-
mode=superchannel hw-retries=15 mode=ap-bridge radio-name=CT7AFY
scan-list=5735 security-profile=hamnet-ism ssid=HAMNET-CT7AFY-CQ0ELX \
    wds-mode=dynamic
/interface wireless nstreme
set wlan1 enable-nstreme=yes
/interface bridge port
add bridge=bridge1 interface=wlan1
add bridge=bridge1 interface=ether1
/ip address
add address=44.158.147.29/29 interface=bridge1 network=44.158.147.24
/ip dns
set servers=44.158.147.30
/ip route
```

```
add distance=1 gateway=44.158.147.30
/snmp
set enabled=yes
/system clock
set time-zone-name=Europe/Lisbon
/system identity
set name=trx-cq0elx.ct7afy
```

Não esquecer de no final alterar as passwords de ambos os links  
conforme descrito na configuração do Router.