# **RouterOS 101**

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### Preliminaries

- Download this presentation from https://www.rmham.org/course-syllabus/
- Download WinBox from https://mikrotik.com/download
- Put your laptop in airplane mode
  - Prevents you from configuring the wrong device
- Check your worksheet

### What is RouterOS?

- Linux based software for IP routing
  - Runs all Mikrotik hardware
    - Routers
    - Radios
  - Can also be run on x86 hardware
- License level
  - 3 for client only devices
  - 4-6 routers, access points, controllers
  - Included with all Mikrotik hardware
    - Free lifetime updates

### Advantages of RouterOS

- Same software on all hardware
  - Radios and routers
- Any interface can perform any function
  - Hardware acceleration on some ports
- By defaults all ports are routed
  - Radios can be a bridge or a router
- Easy to configure
  - Great GUI and command line tools

### Connecting to the Internet

- The configuration shown here is for when the router is on a trusted network.
- Security is a complex topic
  - Use a strong password
    - Disable admin and add a new full user
  - Use a good firewall
    - Quickset has an OK firewall
    - NAT does not protect the router itself
    - RMHAM use DevDB to maintain firewalls
  - Disable services you do not need
    - Limit services you must have

### **Accessing RouterOS**

- WinBox
  - Convenient GUI
  - MAC address access
- WebFig
  - Browser based GUI using HTTP
- Command line
  - ssh access or mactelnet
- API

- Convenient for programs like DevDB

# WinBox

- Windows executable but runs well under WINE
- Best for initial configuration
  - Convenient GUI
  - Access device via MAC address
- Great for management
  - GUI for advanced configuration
  - Graphing and dynamic tables
  - Remote access via RoMON
- CLI and API (DevDB) convenient for some things

### Setup using WinBox

- Reset device
  - Remove configuration or do hard reset
- Basic configuration with WinBox
  - Assign ports, IP addresses
- Advanced configuration
  - Command line often most convenient
  - RMHAM use DevDB for "standard" configuration
- Quick Set is sometimes OK
  - Hard to undo its quirks

### **Configuration Overview**

- Initial Configuration for all devices
  - Reset device and erase configuration
  - Set system ID and password
  - Label interfaces
  - Create bridge and map ports
  - Set IP addresses
  - Configure routing
  - Configure DNS
  - Update software
- Rest of configuration depends on application

# Mikrotik hAP Mini

#### RB931-2nD

- 650 MHz SMIPS CPU
- 32MB RAM, 16MB flash
- RouterOS 4
- 3xEthernet
  - 10/100
- 2.4GHz wifi
  - 802.11b/g/n
- MicroUSB for power (5V)



### WinBox via Ethernet

- Connect via ethernet
  - May need static IP address depending on OS
  - Click refresh
  - Click on MAC Address
  - Login=admin
  - Password=blank
- Connect

8	00 W	/inBox ((	64bit) v	3.31 (Address	es)							
File	ile Tools											
	Connect To:	CC:2D:E0:4	E:13:8B							<ul> <li>Keep Pas</li> </ul>	sword	
	Login: admin							[	✓ Autosave Session			
	Password:								[	Open In New Window		
	Session:	<own></own>						<b>∓</b> Brows	e			
	Note:	MikroTik										
	Group:								₹			
Ro	MON Agent:								-			
	lonning	Add/Set				C	onnect To R	toMON Conn	ect			
Ma	anaged Ne	ighbors										
7	Refresh								[	Find	all	₹
MAC	C Address	IP Ad	Idress	Identity		Δ	Version	Board	Uptir	ne		-
CC:	2D:E0:4E:13:	.8B 192.1	168.88.1	MikroTik			6.48.5 (lo	RB931-2nD		00:06:19		

# **Reset configutation**

- Cleans out all accumulated crud in the configuration
- ALWAYS reset the configuration on a new or repurposed router pr radio

ad	min@CC:2D:E0:33	:E4:B2 (MikroTik) - WinBox (64bit) v6.48.5 on h – 🛛 🛛 🛛
Ses	ssion Settings Dashb	oard
6	C Safe Mode	Session: CC:2D:E0:33:E4:B
	Quick Set CAPsMAN Interfaces Wireless	Reset Configuration     Image: Configuration       Keep User Configuration     Reset Configuration
	Bridge	✓ No Default Configuration       ✓ Do Not Backup       Run After Reset:
	IPv6 ▷ Routing ▷	
	System  Queues Files	
/inBox	Cog	
RouterOS V	Make Supout.rif Manual New WinBox Exit	

# Hard Resetting the Device

- Hold RESET button while applying power
  - Not the MODE button
- Release RESET when green USR LED starts flashing
  - About 5 seconds
- This procedure resets the device to factory defaults
  - Clears configuration
  - Resets passwords



### **Remove configuration**

#### Start with a clean slate, not a canned configuration

admin@CC:2D	0:E0:4E:13:8B (MikroTik) - WinBox (64bit) v6.48.5 on hAP mini (smips)
Session Settings Dash	board
Safe Mode	Session: CC:2D:E0:4E:13:8
Vuick Set         CAPsMAN         Im Interfaces         Wireless         Bridge         PPP         Switch         Mesh         IP         Mesh         IP         NPLS         Poucues         Files         Log         PRADIUS         New Terminal         Make Supout.rif         New WinBox         Exit	RouterOS Default Configuration The following default configuration has been installed on your router: * * * * * * * * * * * * *

### **Quick Set**

- Set working configutation
  - CPE WiFi for WAN
  - AP Ether1 for WAN
  - PTP Bridge AP and CPE
- Could make a mess when used multiple times
- Make sure you change the default password
- We will not use Quick Set today so you can get exposed to RouterOS

### Quick Set - CPE

🕽 🗐 🗊 admin(	CC:2D:E0:4E:13:8B (MikroTik) - WinBox (64bit) v6.48.5 on hAP mini (smips)	
ssion Settings Dasl	board	
C <sup>4</sup> Safe Mode	Session: CC:2D:E0:4E:13:8	
🖉 Quick Set	CPE  Quick Set	
CAPSMAN		
Interfaces	– Info – Configuration – Configuration –	ОК
Q Wireless	WLAN MAC Address: CC:2D:E0:4E:13:8E Mode:      Router      Bridge	Cancel
👯 Bridge	LAN MAC Address: CC:2D:E0:4E:13:8A	Apply
and the second s	- Wireless Network	
The Switch	- Wireless Address Acquisition: O Static O Automatic O PPPoE	
° 🕻 Mesh	Band: ZGHZ-B/G Renew Release Release	
™ IP D	Channel Width: 20MHz   Netmask:	
MPLS D	Country: etsi Gateway:	
J Routing ▷	Address 🛆 Network Channel Proto 🔻	
System	P 00:26:F2:8E:6D:2F T3153DXC 2462/20/gn(18d 802.1 ◆ Upload: unlimited ◆ Dits/s	
P Queues	P         02:31:92:23:9E:C4         2447/20/gn(18d         802.1         Download:         unlimited         ▼ bits/s	
Files	P 04:BF:6D:A8:EF:D3 Cooper 2462/20/gn(18d 802.1 P 09:36:97:76:70:EF Contuned 2413/20/gn(18d 802.1	
	P 3C:37:86:DB:02:69 NETGEA 2452/20-eC/gn(1 802.1 IP Address: 192.168.3.1	
	P 40:8B:07:AD:F9:E5 Houston 2437/20/gn(18d 802.1 Netmask: 255.255.255.0 (/24)	
New Terminal	P 44:A5:6E:1A:A5:40 NETGEA 2462/20/gn(18d 802.1	
Make Supout.rif	5A:EF:68:FE:E4:C1 etf_actio 2417/20/gn(18d 802.1	
New WinBox	6C:3B:6B:6A:A7:7E KD0NFS 2412/20/g(18dBm) 802.1	
K Exit		
_	Port Mapping	
💻 Windows 🗈 🗈	✓ Bridge All LAN Ports	
	Signal Strength: -60 dB	
	Pouter Identity MikroTik	
	Network Name: Houston	
	WiFi Password: Hide Reset Configuration	
	Connect Password:	
	Confirm Password:	
	active	

### Set System Identity

- System > Identity
  - Set it to your callsign or something unique
  - Always double check that you are in the correct device before making changes
- System > Password
  - Set something you can remember but type

6	🔎 💷 admir	@۱	DCC:2D:E0:4E:13:8B (AC0KQ) - WinBox (64bit) v6.48.5 on hAP mini (sm
Ses	sion Settings Da	shb	poard
5	Carl Safe Mode		Session: CC:2D:E0:4E:13:8I
	🖋 Quick Set		
	CAPSMAN		
	Interfaces		
$\times$	Q Wireless		
Q	255 IP	Þ	Identity
Ľ	MPLS	Þ	Identity: ACOKQ OK
$ \ge$	r Routing		
S	System	Þ	Cancel
16	Tools		Apply
e l	Windows		
no	More		
Ř		-	

Change
Cancel

### **Rename interfaces**

- Name interfaces based on what is connected
  - WAN is used by DevDB for firewall
  - Name changes propagate (can be done any time)
  - Note wlan1 is disabled; ether2-DMR is running
  - Disable pwr-line1 with X

©●◎ admin@CC:2D:E0:4E:13:8B (AC0KQ) - WinBox (64bit) v6.48.5 on hAP mini (smips)											
Session Settings Das	Session Settings Dashboard										
Safe Mode		Session: CC:2D:E0:4E:13:8I									
🖉 Quick Set			Interface <e< th=""><th colspan="4">Interface <ether3></ether3></th><th></th><th></th></e<>	Interface <ether3></ether3>							
CAPSMAN			General	Ethernet Loo	p Protect Overall Stats		ОК				
Interfaces	1		r -								
Wireless		Interface Interface List Ethernet FoIP Tunnel		Name	ether3-LAN		Cancel				
😹 Bridge	- Ir			Туре	Ethernet		Apply				
'a PPP		+ ▼ □ V X □ V Detect Internet		MTU	1500				Find		
T Switch		Name 🛆 Type Ad	1	Actual MTU:	1500		Disable	Packet (p/s) FF	Tx FP Rx 🔻		
" Mesh		ether1-WAN Ethernet		Actual Price	1500		Comment	0	0 bps		
255 IP		ether3     Ethernet		L2 MIU:	1598		Torch	10	0 bps		
MPLS D	,	pwr-line1 PWR		Max L2 MTU:	2028		Torch	0	0 bps		
Routing		X 🙌 wlan1 Wireless (Atheros AR		MAC Address	: CC:2D:E0:4E:13:8C		Cable Test	0	0 bps		
System				ARP	: enabled	₹	Blink				
							DITIK				
			-	ART IIIICOUL	· [		Reset MAC Address				
	_	•	-				Reset Counters		•		
	-4	5 items (1 selected)									
Tools D											
B Windows	2										
More N	2		enabled		running sl	lave	no link				

### Add a bridge

- The bridge is a new interface
  - We use it for interfaces that must always be up
- Used to group directly connected ports
  - Typically the local network (LAN)

admin@CC:2D:E0:4E:13:8B (AC0KQ) - WinBox (64bit) v6.48.5 on hAP mini (smips)										
Session Settings Dashboard										
Safe Mode	Session: CC:2D:E0:4E:13:8		=							
🖌 🖉 Quick Set	Bridge	New Interface								
CAPSMAN	Bridge Ports Port Extensions VLANs MSTIs P	General STP VLAN Status Traffic	ок							
Interfaces										
Q Wireless	F K K K K Settings	Name: bridge1	Cancel							
Bridge	Name 🕹 Type L2 M	Type: Bridge	Apply F 🔻							
The PPP		MTU:	Dicable							
T Switch		Actual MTU:	Disable							
° 🕻 Mesh		L2 MTU:	Comment							
155 IP		MAC Address:	Сору							
MPLS D		ADD: enabled	Remove							
🧕 📝 Routing 🗈		AKP: enabled	Temore							
🚆 🔯 System 🗈		ARP Timeout:	Torch							
Sequences		Admin. MAC Address:								
က Files		Ageing Time: 00:05:00								
🔁 🗏 Log										
🖞 🗡 Tools 🗈		IGMP Snooping								
B Windows	•		•							
More D	0 items out of 5	enabled running slave								

### Add ports to bridge

- Bridged ports are on the LAN
  - Never add WAN port (it is routed)
  - Do NOT add wlan port for today's class
    - wifi often on LAN, but today we use it for PtP link
  - Bridge can be hardware accelerated

🕲 🖨 💷 admin@CC:2D:E0:4E:13:8B (AC0KQ) - WinBox (64bit) v6.48.5 on hAP mini (smips)										
Session Settings Dashboard										
Safe Mode	Session: CC:2D:E0:4E:13:8I	sion: CC:2D:E0:4E:13:8								
Quick Set     Quick Set     CAPsMAN     Interfaces     Wireless     Bridge     Switch     Switch     Mesh     Mesh	Bridge Bridge Ports Port Extensions VLANs Bridge Ports Port Extensions VLANs Figure Ports Port Port Port Port Port Port Port Port	New Bridge Port         General       STP       VLAN       Status         Interface:       Wan1       ▼         Bridge:       bridge1       ▼         Horizon:       ▼       ▼         Learn:       auto       ▼         Unknown Unicast Flood       ♥       Unknown Multicast Flood         ♥       Broadcast Flood       ♥	OK       OK       Cancel       Find       Apply       Disable       Comment       Copy       Remove							
System Files Queues Files Log Vindows More	2 items	Trusted  Multicast Router: Temporary Query  Fast Leave  Inactive Hw. Official								

### Set IP address of bridge

#### IP > Address +

- This is what we use to talk to the router
  - .1 is the router octet
  - /24 implies the network
  - Interface is bridge1
- Routable
- Needed for remote access
- Use IP from worksheet

G	admin@CC:2D:E0:4E:13:8B (AC0KQ) - WinBox (64bit) v6.48.5 on hAP mini (smips)									
Ses	Session Settings Dashboard									
5	C Safe Mode	Sessio	n: CC:2D:E0:4E:13:8I							
	🖋 Quick Set		Address List							
	CAPSMAN				Find					19
	Interfaces					Nev	w Address			
	Wireless		Address A N	etwork	Interrace	A	Address: 10.99.7.	1/24	ОК	
	Bridge	-				N	letwork:	-	Cancel	
	PPP					Int	erface: bridge1	Ŧ	Cuncer	
	T Switch	-				_			Apply	
	Mesh	-							Disable	
	P P								Comment	
X	Beuting									
ğ	Sustem								Сору	
Vir									Remove	
	Files	-				ena	bled			
õ	Log									
<u>le</u>	X Tools									
no	Windows		0 items							
Ř	More D			_						

### Set IP address for WAN

- How the router is know to the rest of the net
  - Associated with WAN interface
- Set value from worksheet
  - Connect to network via ethernet

C <sup>4</sup> Safe Mode	Session	n: CC:2D:E0:4E:13:8I			
Quick Set CAPsMAN	-	Address List			
Interfaces			Fina	New Address	
Q Wireless		Address A Network	Interface  bridge1	Address: 10.99.1.7/24	ок
👯 Bridge		10.00.7.0	bridger	Network:	Cancal
⇒ PPP				Interface: etherI-WAN	Cancel
🙄 Switch				Concrament V	Apply
* Mesh					Disable
255 IP					Comment
O MPLS	2				Comment
Routing	2				Сору
System	2				Remove
🜻 Queues	2			applied	
Files	-			enabled	
Log	-				
🗡 Tools	2				
Mindour	S				

### **Check connectivity**

- Ping 10.99.1.1
  - Class router IP
  - On 19.99.1.0/24 subnet
- Verifies that WAN is connected and works
- Ping 8.8.8.8
  - timeout
- Traceroute 8.8.8.8
  - goes nowhere

0	🕽 🗖 🗖 admin@	CC:2D:E0:4E:13:8B (/	4C0KQ) - W	/inBox (6	54bit) v	<b>6.48.5 on</b> h	
Se	ssion Settings Dash	board					
Ю	Carl Safe Mode	Session: CC:2D:E0:4E:13:8					
	💓 Quick Set	Ping					
	CAPSMAN	General Advanced				Start	
	Q Wireless	Ping To: 10.99.1.1				Stop	
	Bridge	lge Interface:				Close	
	Switch	ARP Ping	ARP Ping				
	° 🖁 Mesh	Timeout: 1000			ms		
	IP D						
$\ge$	MPLS     P			D 1 5 7	-		
L S	Contern N	0 10 99 1 1	Oms	Kepiy Size 1	64 Statu	IS V	4
<u> </u>	System /	1 10.99.1.1	Oms	50	64		
$ \geq$	P Queues	2 10.99.1.1	0ms	50	64		
S	Files	3 10.99.1.1	Oms	50	64		
Q	📃 Log	4 10.99.1.1	Oms	50	64		
fe	🔀 Tools 🛛 🗅	5 10.99.1.1	0ms	50	64		
DU	💻 Windows 🜓						
R	More D	6 items 6 of 6 packets re	0% packet loss	Min: 0 ms	Avg: 0 m	ns Max: 0 ms	

### **Default Route**

- There is no route to 8.8.8.8
  - Add default route 0.0.0/0
  - Note that 10.99.1.1 s reachable via the WAN subnet
- Send all packets not on known subnet to this address

- Try 8.8.8.8

<b>⊗⊜∎</b> admin@	CC:2D:E0:4E:13:8B (AC0KQ) - WinBox (64bit) v6.48.5 on hAP mini (smips)	
Session Settings Dashb	bard	
Safe Mode	Session: CC:2D:E0:4E:13:8	l de la companya de l
Quick Set  CAPsMAN  Interfaces  Wireless	Route List Routes Nexthops Rules VRF Rules VRF Rules VRF VR Rules VRF Rules VRF Rules VRF	
Bridge       PPP       Switch       Mesh	Dst. Address     ▲ Gateway       DAC     > 10.99.1.0/24       ether1-WAN reachable       DAC     > 10.99.7.0/24       bridge1 reachable	
🐺 IP 🛛 🖒	2 items New Route	
MPLS D	General Attributes	ок
System	Dst. Address: 0.0.0.0/0	Cancel
Queues	Gateway: 10.99.1.1	Apply
Files	Check Gateway: ping	Disable
AP RADIUS	Type: unicast	Comment
🔀 Tools 🗈 🕅	Distance:	Conv
🗙 💴 New Terminal		Сору
S Make Supout.rif	Scope: 30	Remove
C New WinBox	Target Scope: 10	
Exit	Routing Mark:	
S	Pref. Source:	
8	enabled	

### **Route Flags**

- A = Active
  - Turns blue if not active
- S = Static
  - You added it
- C = Connected
  - Interface on this device
- D = Dynamic
  - Added by RouterOS

Route Lis	st	
Routes	Nexthops Rule	s VRF
+ -		Find all ∓
	Dst. Address	Gateway 🔻
AS	0.0.0/0	10.99.1.1 reachable ether1-WAN
DAC	10.99.1.0/24	ether1-WAN reachable
DAC	10.99.7.0/24	bridge1 reachable
¢ 2 itoms		•
AS DAC DAC • 3 items	Dst. Address ▲	Gateway 10.99.1.1 reachable ether1-WAN ether1-WAN reachable bridge1 reachable

### Add DNS

- IP > DNS
- We will use Google DNS 8.8.8.8
  - Not needed for routing
  - Needed to update software

C <sup>a</sup> Safe M	ode	Session: CC:2D:E0:4E:13:8I		
Quick Set		DNS Settings		
Interfaces		Servers:	8.8.8.8	ОК
Wireless		Dynamic Servers:		Cancel
Bridge	_	Use DoH Server:	▼	Apply
T Switch	_		Verify DoH Certificate	Static
* Mesh			Allow Remote Requests	Cache
355 IP	Þ	Max UDP Packet Size:	4096	
O MPLS				
Routing		Query Server Timeout:	2.000 s	
System	1	Query Total Timeout:	10.000 s	
Queues		Max. Concurrent Oueries:	100	
Files		Max Concurrent TCD Services	20	
E Log		Max. concurrent TCP Sessions:	20	
	N		2040	

### **DHCP** Setup

Cancel

Next

Back

DHCP Setup

Select DNS servers

DNS Servers: 8.8.8.8

Back

Next

 Defaults should be OK except for Server Interface

DHCP Setup

Select network for DHCP address

DHCP Address Space: 10.99.7.0/24

Back

Next

Ŧ

Cancel

DHCP Setup

DHCP Server Interface: bridge1

Back

Next



\$

Cancel

DHCP Setup

Lease Time: 00:10:00

Back

Next

Cancel

ssion Settings Dash	board		
C <sup>4</sup> Safe Mode	Session: CC:2D:E0:4E:13:8I		-
🖋 Quick Set	DHCP Server		
CAPSMAN	DHCR Networks Leases Options Option	Sate Vander Clause Alerta	CP Setup
255 IP	Networks Leases Options Option	Sets Vendor Classes Alerts	er betap
MPLS D	🛨 📼 🧭 💥 🏹 DHCP Config D	ICP Setup Find Setup h	as completed successfully
📑 Routing	Name 🛆 Interface Rela	ay Lease Time Address Pc 🔻	
System	dhcp1 bridge1	00:10:00 dhcp_pool0	ОК
🔀 Tools 🗈 🗅			
	•	•	

Gateway for DHCP Network: 10.99.7.1

Cancel

DHCP Setup

### **Test Connectivity**

- Switch your computer interface to DHCP
  - Check your IP address
- Ping WAN of your router from your laptop
  - 10.99.X.1 (WAN IP address on Worksheet)
- From WinBox (the router)
  - Ping 10.99.1.1
  - Ping 8.8.8.8
- From your laptop
  - Ping 10.99.1.1
  - Ping 8.8.8.8

### **Network Address Translation**

- Pretends to be 10.99.X.1 on external requests
  - Commonly used to use only one IP for subnet
  - Not used internal to RMHAM network

CO admin(	@CC:2D:E0:4E:13:8	3B (AC0KQ) - WinBox (64t	oit) v6.4	48.5 on hAP min				
Session Settings Dasl	board							
Safe Mode	Session: CC:2D:E0:4E:13:8	31						All and a second
Safe Mode Quick Set CAPSMAN Interfaces Wireless Bridge Switch Switch Switch MPLS MPLS Routing Queues Files Log	Session: CC:2D:E0:4E:13:6	New NAT Rule General Advanced Extra Action Chain: srcnat Src. Address: Dst. Address: Protocol: Src. Port: Dst. Port: Dst. Port: In. Interface: Out. Interface List: In. Interface List:		Cancel Apply Disable Comment Copy Remove Reset Counters Reset All Counters	ıt. In▼	New NAT Rule         Advanced       Extra       Action       Statistics          Action:       masquerade	· · ·	OK         Cancel         Apply         Disable         Comment         Copy         Remove         Reset Counters         Reset All Counters
RADIUS Tools Mew Terminal Make Supout.rif New WinBox Exit Windows	♦     0 items	Out. Interface List: Packet Mark: Connection Mark: Routing Mark: Routing Table: enabled	· · · · · · · · · · · · · · · · · · ·		•	enabled		

### What we did so far

- Set device identity
- Create bridge with named interfaces
- Set bridge and WAN IP address/subnet
- Set DNS
- Set up routing
- Set up DHCP
- Set NAT for external connections
- We can now talk to the world

### Setting up a wireless bridge

- Connect to your neighbor using 2.4GHz
  - Bridged RF path instead of ethernet cable
  - Route traffic to limit traffic
  - Clever routing to do fail over
- RMHAM network links up to 80 miles
  - High power (2W) radios
  - High gain antennas (2' and 3' dishes)
  - nstreme to do long time of flight

### **Enable Advanced Mode**

Amateur bands require advanced mode

Sessio	on Settings Dashl	board											
5	Safe Mode	Session: 10.99.7.1											
2	🖗 Quick Set		Interface <	wlan1>									
4	CAPSMAN		General	Wireless	нт		ОК						
	Interfaces			Mode	: st	ation				Ŧ	Cancel		
Ļ	Wireless			Band	. 20	Hz-B/G				Ī	Analy		
	s bridge	Wireless Tables		Dana						÷1	Арріу		
	E PPP	WiFi Interfaces W60G Station Nstreme	Cha	annel Width:	20	MHZ				•	Enable		
	<sup>e</sup> Mesh			Frequency	: 24	12			<b>∓</b> _M⊦	-tz	Comment	nooper	
25	is IP			SSI	D: Mi	krotik						Ty	
	MPLS D	XS 🖗 wlan1 Wireless (Atheros	Sec	curity Profile	: de	fault				₹	Advanced Mode		
3	Routing		Frequ	uency Mode:	m	anual-tx	power			₹	Torch		
2	System			Country	: no	_country	y_set			₹	WPS Accept		
	Queues			Installation	: an	у				₹	WPS Client		
	Files					Default	Authentica	te		_			
	Log				•	Derduit	Authentice	ite .			Setup Repeater		
å	P RADIUS										Scan		
	Tools D										Freq. Usage		
<u></u>	New Terminal										Alian		
	Make Supout.rif										Aigi		
$\geq$	Manual										Sniff		
N	New WINDOX	•									Snooper		
2	Exit.	1 item out of 6 (1 selected)									Reset Configuration		
ľt,													
So l			dicabled		unnin	~			disabled				
			disabled	r	unnin	g	Isla	ive	disabled				

### **Enable Superchannel**

- Superchannel enables all frequencies the hardware is capable of in the **international version** of the hardware
  - The class hardware will show the frequencies, but are limited to only the ISM channels in firmware (not international version)

Session Settings Dash	nboard			
Safe Mode	Session: 10.99.7.1			
💓 Quick Set		Interface <wlan1></wlan1>		
CAPSMAN		General Wireless	Data Rates Advanced HT WDS	ок
Interfaces				
Q Wireless		Mode:	station	Cancel
👯 Bridge	Wireless Tables	Band:	2GHz-B/G ₹	Apply
at PPP	WiFi Interfaces WEOC Station Netromo	Channel Width:	20MHz F	Enable
🙄 Switch	Wood Station Instiente	Frequency:	2412 <b>T</b> MHz	Enable
°T <mark>°</mark> Mesh		SSID:	Mikrotik	Comment
🐺 IP 🗈 🕑	Name 🛆 Type	Radio Name:	CC2DE04E138E	Simple Mode
O MPLS ▷	XS 🙀 wlan1 Wireless (Atheros )	Con List:		
📑 Routing 🛛 🗅		Scan List:	derault 🔸 👻	Torch
🔯 System 🗅		Skip DFS Channels:	disabled F	WPS Accept
Queues		Wireless Protocol:	any 🔻	WPS Client
Files		Security Profile:	default 🗧	Cotor Descritor
📃 Log			[]	Setup Repeater
RADIUS		Frequency Mode:	superchannel	Scan
🔀 Tools 🛛 🗅		Country:	no_country_set	Erea Usage
o New Terminal		Installation:	any 🔻	Treq. osage
ё 📐 Make Supout.rif		W/MM Support:	dicabled	Align
Manual		whith Support.		Sniff
🔀 🕓 New WinBox		Station Roaming:	disabled +	Snooper
👸 🔣 Exit	•		✓ Default Authenticate	
a	1 item out of 6 (1 selected)			Reset Configuration
put		Multicast Helper:	default 🔻 🔻	
Ro		disabled	ning slave disabled	
		1	1	

### **Access Point Side**

Interface ·	<wlan]< th=""><th> &gt;</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>C</th><th>×</th></wlan]<>	>								C	×
General	Wire	eless (	Data Rates	Advanced	HT	WDS				ОК	
		Mode:	bridge					₹		Cancel	
		Band:	2GHz-B/G					₹		Apply	
C	nannel	Width:	20MHz					₹		Enable	
	Fre	quency:	2442				₹M	IHz		Comment	-
		SSID	AC0KQ-7								=
	Radio	Name:	CC2DE04E1	.38E			-			Simple Mode	-1
Skin (		annels:	disabled				•	▼ 		Torch	
Win	eless P	Protocol:	nstreme					Ŧ	1	WPS Accept	
S	ecurity	Profile:	default					Ŧ	•	WPS Client	
Interw	orking	Profile:	disabled					₹		Setup Repeater	
	WP	S Mode:	push buttor	1				₹		Scan	
Free	Juency	Mode:	superchann	el				∓		Freq. Usage	
		Country:	no_country	_set				₹		Align	
	Insta	allation:	any					₹		Sniff	
	Bridae	Mode:	enabled					∓		Snooper	
										Reset Configuration	1
	VLAI	Mode:	no tag					+	•		
disabled		ru	nning	slave			disa	bled			

- bridge is PtP access point
- Select freq for channel
- Set SSID to Callsign
  - IDs every packet
- Type in scan list freq
- Protocol nstreme
  - long distance
- no encryption on ham bands
- Radio name can be useful
  - MAC by default
- Apply and Enable

### **Client Side**

Interface	<wlan< th=""><th>1&gt;</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></wlan<>	1>								
General	Wire	eless	Data Rates	Advanced	нт	WDS	Nstrem	е		ОК
		Mode	e: station bri	dge				₹		Cancel
		Band	: 2GHz-B/G					₹		Apply
C	hannel	Width	20MHz					₹		Enable
	Fre	quency	2442				₹	MHz		Comment
		SSI	AC0KQ-7					-		Comment
	Radi	o Name	CC2DE036	7EDB						Simple Mode
	S	an List	: 2442				1	₽ \$		Torch
Skip	DFS Ch	annels	disabled					₹		WPS Accept
Wir	eless F	Protoco	: nstreme					₹		WPS Client
S	ecurity	Profile	: default					₹		Setup Repeater
Fre	equenc	y Mode	superchan	nel				₹		Fran
	(	Country	no_countr	y_set				₹		Scan
	Insta	allation	: any					₹		Freq. Usage
Ct-	tion D	anning	. anablad					-		Align
510	ILION K	barning	. enabled					•		Sniff
			<ul> <li>Default</li> </ul>	Authenticat	e					Snooper
Mu	Ilticast	Helper	: default					₹	•	Reset Configuration
disabled		r	unning	slav	/e		dis	abled		

- station bridge for PtP
- SSID. frequency, scan list and protocol must match
  - IDs as AP callsign
- Radio name can be useful
  - MAC by default
- Apply and Enable

### Radios should now link

- Check registration
  - signal strength in dBm
- If not check
  - Matching SSID, frequencies and protocol
  - Mode bridge one side and station bridge other side

Wireless Tables													
WiFi Interfaces	W60G Station	Nstreme	Dual	Access List	Regi	istration	С	onnect List	Security Profile	s Channels	Interwork	ing Profiles	
- 7 (© Re	set												Find
Radio Name	A MAC Address		Interfa	ce Uptime	A	۹P ۱	N	Last Activi	Tx/Rx Signal	Tx Rate	Rx Rate		•
😝 CC2DE04E138E	CC:2D:E0:4E:	13:8E	wlan1	00:0	3:08 y	/es r	10	0.910	-16/-19	11Mbps	1Mbps		 
1 item													

### Assign IP addresses to link

- Use a new subnet
  - 10.88.4.0/24
- Set .1 on bridge
  - 10.88.4.1/24
- Set .2 on station bridge
  - 10.88.4.2/24





### **Check Connectivity**

- Ping neighbor
  - wlan IP is reachable (10.88.4.x)
  - bridge IP is not (10.99.x.1)
- Need a route to the neighboring subnet
  - Destination is entire subnet 10.99.x.0/24
  - Gateway is neighboring wlan IP

							1		_
New Route								New Rout	te
General Attribute	es					ОК		General	At
Dst. Address: 10	0.99.8.0/24					Cancel		Dst. /	Addre
Gateway: 10	0.88.4.2	₹			•	Apply		G	Satew
Check Gateway: pi	ing				F 🔺	Disable		Check G	atewa
Type: ur	nicast				₹	Comment			Ту
Distance:						Сору		D	istano
Scope: 30	0					Remove			Scop
Target Scope: 10	0							Target	t Scop
Routing Mark:								Routin	ig Mar
Pref. Source:					] •			Pref.	Sourc
			 	[					
enabled				active				enabled	

New Route	
General Attributes	ОК
Dst. Address: 10.99.7.0/24	Cancel
Gateway: 10.88.4.1	Apply
Check Gateway: ping	Disable
Type: unicast	₹ Comment
Distance:	▼ Сору
Scope: 30	Remove
Target Scope: 10	
Routing Mark:	•
Pref. Source:	•
enabled active	

### Add second default route

- Where to send all non-local traffic
  - Gateway is the same (neighbor wlan IP)
- Distance 2 makes it the secondary choice
  - Primary 10.99.1.1 has distance 1

New Route							
General Attrib	utes						ОК
Dst. Address:	0.0.0/0						Cancel
Gateway:	10.88.4.2		₹			\$	Apply
Check Gateway:	ping					₹ ▲	Disable
Туре:	unicast					₹	Comment
Distance:	2						Сору
Scope:	30						Remove
Target Scope:	10						
Routing Mark:						•	
Pref. Source:						•	
enabled					active		

# Failover (traceroute to 8.8.8.8)

- Normal
  - Blue means it is not active
  - Primary is reachable
- Unplug WAN
  - Blue shows WAN and primary unreachable
  - Fail over to RF

Route List							
Routes Nexthops Rules VRF							
					all 🔻		
	Dst. Address	Gateway	Distance	Routing Mark	Pref. Sou 🔻		
AS	0.0.0/0	10.99.1.1 reachable ether1-WAN	1				
S	0.0.0/0	10.88.4.2 reachable bridge1	2				
DAC	10.88.4.0/24	bridge1 reachable	0		10.88.4.1		
DAC	10.99.1.0/24	ether1-WAN reachable	0		10.99.1.7		
DAC	10.99.7.0/24	bridge1 reachable	0		10.99.7.1		
AS	10.99.8.0/24	10.88.4.2 reachable bridge1	1				
◆							
6 items							

Route List							
Routes Nexthops Rules VRF							
					all	₹	
	Dst. Address	Gateway	Distance	Routing Mark	Pref. Sc	ou 🔻	
S	0.0.0/0	10.99.1.1 unreachable	1				
AS	0.0.0.0/0	10.88.4.2 reachable bridge1	2				
DAC	10.88.4.0/24	bridge1 reachable	0		10.88.4	1.1	
DC	10.99.1.0/24	ether1-WAN unreachable	255		10.99.1	1.7	
DAC	10.99.7.0/24	bridge1 reachable	0		10.99.7	7.1	
AS	10.99.8.0/24	10.88.4.2 reachable bridge1	1				
				-			
						•	
6 items	5						

### **Questions?**