

窮人的 Cisco,高CP值網路設備 MikroTik 簡介與基本操作

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✤RouterOS 基本功能與模擬器說明

✤RouterOS 防火牆、認證網頁功能CWP解說與實做

✤RouterOS 8大網管工具介紹



現代人沒有網路行嗎?

















MikroTik

◆ 1996年 成立於拉脫維亞(Latvia)首 都里加(Riga),主要從事「路由器」 和「無線ISP系統」開發

✤ 1997年 推出RouterOS軟體路由器 RouterOS是一套低成本高性能的路 由器作業系統

http://www.mikrotik.com/download

◆ 2002年 推出RouterBOARD硬體路 由器(<u>http://routerboard.com</u>)

❖ 企業口號: Routing the World





歐洲知名品牌MikroTik在145個國家或地區中有五百多家經銷商和 代理商,它們提供了產品銷售支援及MikroTik相關解決方案



MikroTik 用戶見面會(MUM)





☆會議內容主要是在介紹MikroTik RouterOS軟 體和RouterBOARD硬體

✤參與者提出問題、聆聽簡報與專家交談並觀看 MikroTik最新技術展示。

◆全世界到目前為止已經辦了150多場MikroTik 用戶會議。最大的活動有3000多名人員參加。

https://mum.mikrotik.com

MikroTik 學院







◆適用於大學、技術學校、學院、職業學校和其他 教育單位等教育機構的計劃

◆全球已有500多所大學和750名培訓講師加入

MikroTik 國際認證介紹





MikroTik 國際認證課程:

- MTCNA-網路助理
- MTCRE-路由工程師
- MTCINE-網路互連工程師
- MTCWE-無線工程師
- MTCTCE-流量控制工程師
- MTCUME-用戶管理工程師
- MTCIPv6E-IPv6工程師
- MTCSE-安全工程師 New
- MTCSWE-交換器工程師 New
- MTCEWE-企業無線工程師 New

為什麼要選擇使用MikroTik?



◆ 最佳價格及效能

◆ 耗電量低

- ✤數千頁的文件、範例,應用說明和指南
- ✤ RouterOS軟體支援大多數常見功能 · 產品會不斷依客戶需求來新增新功能
- ✤數以百萬RouterOS網路設備正在環遊 全世界
- ◆ 擁有23年的網路軟體和硬體開發經驗
- ◆ 全球超過13萬個RouterOS網路認證 工程師





產品比較	Cisco	MikroTik
支援	有SMARTnet 支援 ,但必須付費	■ 官方支援(回覆約1至3個工作日) ■ 討論區/社群支援 Free~
效能	支援更高階需求	網路吞吐量最快80Gbps
價格	較貴	●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●
功能	功能取決於型號及啟動的授權	所有型號共享相同的功能・ 只是硬體規格容量不同
管理	內建CLI,對初學者不易操作	CLI、GUI、內建網頁、 更多友善操作方式
測試	實體設備要做實驗(Lab)通常無法 負擔起費用	★86版的授權可免費試用24小時, 如需獲得實體設備上所有功能, 只需付便宜費用即可獲得。
市場	數據中心/網路服務供應商	家裡辦公、小型辦公(SOHO)及中小型企 業
證照	證照大家都知道	證照比較不知名





↔H縣教育網路中心 學校端L3 路由器、防火牆及L2 Switch、The Dude應用 ✤Y縣教育網路中心 中心端NAT Server 及學校端 L3 路由器應用 ✤C縣教育網路中心 學校端IPv4/IPv6防火牆、NAT、 無線網路存取閘道器應用 ✤ I縣教育網路中心 各校IPv4/IPv6防火牆、NAT、無 線網路存取閘道器應用







MikroTik主要產品分成二部份

- 1. 硬體:
- 由MikroTik 及合作夥伴設計製造
- 獨特功能: 雙電源輸入、內建RouterOS
- 2.軟體:
- RouterOS
- SwOS
- The Dude





一、電信等級路由器:具有先進的多核CPU和Smart Switch系列



產品介紹-硬體



電信等級路由器(Cloud Core Router)



CCR2004-1G-12S+2XS

The Connectivity Router - your best companion when it comes to SFP, SFP+ and SFP28 management! 1, 10 and 25 Gbps ports in a single device to make your life easier.



CCR1036-8G-2S+EM

1U rackmount, 8x Gigabit Ethernet, 2xSFP+ cages, LCD, 36 cores x 1.2GHz CPU, 8GB RAM, 41.5mpps fastpath, Up to 28Gbit/s throughput, RouterOS L6, Dual PSU

CCR1016-12S-1S+



1U rackmount, 12xSFP cage, 1xSFP+ cage, 16 cores x 1.2GHz CPU, 2GB RAM, LCD panel, Dual Power supplies, RouterOS L6

CCR1072-1G-8S+



1U rackmount, 1x Gigabit Ethernet, 8xSFP+ cages, LCD, 72 cores x 1GHz CPU, 16GB RAM, up to 120 million packets per second, <u>80Gbps throughput</u>, RouterOS L6



CCR1009-7G-1C-1S+

1U rackmount, 7x Gigabit Ethernet, 1x Combo port (SFP or Gigabit Ethernet), 1xSFP+ cage, 9 cores x 1.2GHz CPU, 2GB RAM, LCD panel, Dual Power supplies, SmartCard slot, RouterOS L6







二、RouterBOARD 系 列:可依需求搭配 模組及配件組裝成 一台路由器 RouterBOARD 硬體外觀



◆右圖片為 RB912 RB953 RouterBOARD

◆更多型號 <u>https://routerboard.com</u>









◆RouterBOARD型號命名方式有幾種,最常看到是使用
◆3位數字來做命名。

- 1. 數字第一碼: 系列代號
- 2. 數字第二碼: 有線埠數
- 3. 數字第三碼: 無線介面數(含內建mPCI和mPCIe插槽數)
- ◆直接用名稱命名:例如:OmniTIK, Groove, SXT, SEXTANT, Metal, LHG, DynaDish, cAP, wAP
- ◆特殊型號:像是MikroTik RouterBoard 600, 800, 1000, 1100, 1200, 2011



以3位數字命名後面的代號介紹

- **♦ U: USB**埠
- ◆ P: 電源Power簡稱P·多個以上的PoE Out埠 (有控制器)
- ◆ i:乙太網路電源供應連接器injector 簡稱 i, 單一PoE埠 (無控制器)
- ✤ A: 配置較多的記憶體或是License 等級比較高的機型
- ↔ H: 配置高效能的CPU
- ♦ G: 千兆乙太網路埠(通常會跟 "U", "A", "H"搭配)
- **↔ L:** 精簡版
- ◆ S: SFP光纖傳輸模組埠
- ◆ e: PCIe 擴充介面卡
- **◇ x <N>: "N"** 代表CPU核心數 (x2, x16, x36)
- ✤ R MiniPCI or MINIPCIe 插槽



例如: RB912UAG-5HPnD

- * **RB**: RouterBOARD
- *** 9:** 9 系列
- ◆1:1個有線網路埠
- ◆ 2: 1個WiFi 介面及1個內建 miniPCIe插槽
- **� U:** USB 埠
- * A: license level 4
- ◆G:千兆乙太網埠
- **◆5:**內建5GHz
- HP: High Power
- **◇n:** WiFi 802.11n **◇D**: 雙天線



產品介紹-硬體

三、無線產品:提供戶外室內用戶端設備(CPE)及AP 解決方案



產品介紹-軟體 RouterOS



RouterOS



© mikrotik

RouterOS v6.46.2

You have connected to a router. Administrative access only. If this device is not in your possession, please contact your local network administrator.

WebFig Login:

Login:	admin	Login
Password:		



Quick Set	Terminal		
CAPSMAN			•
Interfaces			
Wireless			
Bridge	ммм ммм	ккк тттттттттт ккк	
PPP	мммм мммм	ккк ттттттттт ккк	
Switch	MIMM MMMM MMM MMM MM MMM	III KKK KKK RRRRRR 000000 TTT III KKK III KKKKK RRR RRR 000 000 TTT III KKKK	
Mesh	MMM MMM	III KKK KKK RRRRRR 000 000 TTT III KKK	
IP D	MMM MMM	III KKK KKK RRR RRR 0000000 TIT III KKK	
MPLS 🕑	MikroTik Rout	er03 6.46.2 (c) 1999-2020 http://www.mikrotik.com/	
IPv6 D	[2]	Gives the list of available commands	
Routing 🗅	command [?]	Gives help on the command and list of arguments	
System 🗅	[Tab]	Completes the command/word. If the input is ambiguous,	
Queues		a second [Tab] gives possible options	
Files	1	Move up to base level	
Log	 /command	Move up one level	
RADIUS	Hello		
Tools 🗅	[admin@300MNAT]	>	•
New Terminal			
► Dot1×			
MetaROUTER			
Partition			
Make Supout.rif			
Manual			
New WinBox			
Exit			



RouterOS CHR (Cloud Hosted Router)

 ◇「虛擬機器」專用
 ◇支援x86 64bit 架構
 ◇支援多種版本虛擬伺服器,例如:VMWare、Hyper-V、 VirtualBox、KVM等
 ◇CHR 擁有完整的RouterOS預設功能



SwtichOS (SwOS)

MikroTik SwOS	
Link SFP Port Isolation LAG	Forwarding RSTP Stats Errors Hist VLAN VLANs Hosts IGMP SNMP ACL System Upgrade
General	
Address Acquisition	DHCP with fallback V
Static IP Address	192.168.88.1
Identity	MikroTik
Allow From	
Allow From Ports	
Allow From VLAN	
Watchdog	
Independent VLAN Lookup	
IGMP Snooping	
Mikrotik Discovery Protocol	
MAC Address	64:d1:54:c7:3a:58
Serial Number	763C076756AE
Board Name	
board Name	CRS326-24G-2S+

產品介紹-軟體 MikroTik the Dude





Client: rx 4.13 kbps / tx 353 bps Server: rx 0 bps / tx 0 bps

connected





❖埠數及介面種類

✤運用效能PPS、網路吞吐量Throghput

❖價格預算





目前提供160多種不同的產品 <u>https://mikrotik.com/products</u>



MikroTik	Home About Buy Jobs Hardware Software Support
Products	
Product categories All products Ethernet routers Switches	 CCR1009-7G-1C-PC 7x Gigabit Ethernet, 1x Combo port (SFP or Gigabit Ethernet), 9 cores x 1GHz CPU, 1GB RAM, passive cooling case, RouterOS L6
Wireless systems Wireless for home and office LTE products Data over Powerlines IoT products	CCR1009-7G-1C-1S+PC 7x Gigabit Ethernet, 1x Combo port (SFP or Gigabit Ethernet), 1xSFP+ cage, 9 cores x 1GHz CPU, 2GB RAM, LCD panel, passive cooling desktop enclosure, SmartCard slot, RouterOS L6, PSU
Enclosures Interfaces Accessories Antennas	CCR1009-7G-1C-1S+ 1U rackmount, 7x Gigabit Ethernet, 1x Combo port (SFP or Gigabit Ethernet), 1xSFP+ cage, 9 cores x 1.2GHz CPU, 2GB RAM, LCD panel, Dual Power supplies, SmartCard slot, RouterOS L6



一、RouterOS 基本功能與模擬器



MikroTik RouterOS™是一套軟體路由器系統, 可將一般PC或MikroTik RouterBOARD™硬體變成專用路由器

RouterOS 重要的功能如下:

- Firewall & NAT (封包控制).
- Routing (RIP, OSPF, BGP, RIPng, OSPF V3)
- VPN & Tunnel (EoIP, PPTP, L2TP, PPPoE, SSTP, OpenVPN)
- Wireless (802.11 a/b/g/n/ac, 2.4/5Ghz)
- DHCP、Hotspot、Radius (用戶端管理)
- QoS & Bandwidth limiter (頻寬管理)
- Proxy (Web Proxy)
- Tools (Torch, MAC-Ping, MRTG, Packet Sniffer)





✤RouterOS一般版的軟體授權等級分成 Level 0~6

等級	0 (試用模式)	1 (免費展示)	3 (WISP CPE)	4 (WISP)	5 (WISP)	6 (Controller)
價格	無金鑰	需要至官網註冊	大量授權	\$45美元	\$95 美元	\$250美元
初始設定支援	-	-	-	15 日	30 日	30 日
Wireless AP	試用24小時	-	-	支援	支援	支援
Wireless Client 及 Bridge	試用24小時	-	支援	支援	支援	支援
RIP, OSPF, BGP 協定	試用24小時	-	支援(*)	支援	支援	支援
EoIP tunnels	試用24小時	1	不限	不限	不限	不限
PPPoE tunnels	試用24小時	1	200	200	500	不限
PPTP tunnels	試用24小時	1	200	200	500	不限
L2TP tunnels	試用24小時	1	200	200	500	不限
OVPN tunnels	試用24小時	1	200	200	不限	不限
VLAN 介面	試用24小時	1	不限	不限	不限	不限
HotSpot 線上使用數限制	試用24小時	1	1	200	500	不限
RADIUS 客戶端	試用24小時	-	支援	支援	支援	支援
Queues 佇列	試用24小時	1	不限	不限	不限	不限
Web proxy網頁代理	試用24小時	-	支援	支援	支援	支援
User manager 活動session數	試用24小時	1	10	20	50	不限
KVM guests數量	無	1	不限	不限	不限	不限

(*) - BGP功能僅包含在等級3授權的RouterBOARD中,對於其他設備需要等級4或更高級別授權才能擁有BGP功能。



授權等級	網路速度限制	價格 (美元)
Free	1Mbit	免費
P1	1Gbit	\$45
P10	10Gbit	\$95
P-Unlimited	無限制	\$250



想了解RouterOS設定沒有實體機怎麼辦?





◆方法一、MikroTik 官方提供二個網址展示 <u>http://demo.mt.lv</u> <u>http://demo2.mt.lv</u>

❖方法二、直接在PC上裝模擬器



RouterOS搭配GNS3 模擬器介紹


GNS3[®]

GNS3 全名為「Graphical Network Simulator」是一款具有圖型化界面的網路 模擬器,可透過模擬的Router和Switch來 建立複雜網路測試環境。

GNS3 架構分成2種版本: *GNS3-all-in-one software (GUI) 安裝於本機PC(Windows, MAC, Linux) *The GNS3 virtual machine (VM) 用裝於VMServer



使用GNS3的優點: ◆免費工具 Free ◆開源軟體 (Open Source) ☆無需月費或年費授權(License) ❖模擬裝置數量無限制(需依硬體等級CPU及記體決定) ❖即時(Real-time)網路模擬 ✤跨平台系統及多種網路設備廠商裝置支援 ☆模擬各種網路架構及測試 ❖驗證網路概念 ✤GNS3模擬器可以連到外面真實的網路



Cisco Packet Tracer

- ✤非免費軟體(需要註冊於網路學院師生及註冊學校用戶才能使用)
- ✤專利程式碼非開源軟體Open source
- ❖只能模擬Cisco 裝置不支援其他設備商。
- ◆不支援部分設備的完整指令集。
- ◆只限軟體內部模擬無法整合實體網路裝置連出外網。

 ◆不支援MacOS



安裝檔下載位置:

https://github.com/GNS3/gns3-gui/releases

以下使用Windows 版為安裝範例,先找到 GNS3-x.x.x-all-in-one.exe

GNS3-2.2.12-all-in-one.exe	84.9 MB
GNS3-2.2.12-all-in-one.exe.sha256	93 Bytes
	73.6 MB
	82 Bytes
GNS3-2.2.12.source.zip	15.4 MB
GNS3-2.2.12.source.zip.sha256	89 Bytes
GNS3.VM.Hyper-V.2.2.12.zip	735 MB
GNS3.VM.Hyper-V.2.2.12.zip.sha256	93 Bytes
GNS3.VM.KVM.2.2.12.zip	655 MB
GNS3.VM.KVM.2.2.12.zip.sha256	89 Bytes
GNS3.VM.VirtualBox.2.2.12.zip	664 MB
GNS3.VM.VirtualBox.2.2.12.zip.sha256	96 Bytes
GNS3.VM.VMware.ESXI.2.2.12.zip	709 MB
GNS3.VM.VMware.ESXI.2.2.12.zip.sha256	97 Bytes
GNS3.VM.VMware.Workstation.2.2.12.zip	709 MB
GNS3.VM.VMware.Workstation.2.2.12.zip.sha256	104 Bytes
Source code (zip)	
Source code (tar.gz)	





下載 MikroTik CHR(Cloud Hosted Router) image

網址:<u>http://www.mikrotik.com/download</u> 找到 CHR-> Raw disk image->stable 下載

Cloud Hosted Router

	6.45.9 (Long-term)	6.47.1 (Stable)	6.48beta12 (Testing)
Images	vmdik, vhdx, vdi, ova, img		
Main package			
VHDX image			
VMDK image			
VDI image			
OVA template			
Raw disk image	B	Ē	
Extra packages			
The Dude server			
The Dude client			
Changelog			
Checksum	\checkmark	\checkmark	\checkmark





◆執行安裝			
GNS3 2.2.12 Setup Well Setup GNS3 Click N	- X Icome to GNS3 2.2.12 Setup will guide you through the installation of GNS3 2.2.12. ecommended that you close all other applications e starting Setup. This will make it possible to update ant system files without having to reboot your uter.	Copyright (C) 2007 Free Software Foundation, Inc. < <u>http://fsf.org/</u> > Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed. Preamble The GNU General Public License is a free, copyleft license for taffware and other linds of munice.	- • ×
	Next > Cancel	If you accept the terms of the agreement, click I Agree to continue. You agreement to install GNS3 2.2.12. GNS3 2.2.12 installer <back agree<="" i="" th=""><th>ee Cancel</th></back>	ee Cancel











❖ 執行安裝					
🚷 GNS3 2.2.12 Setup	-		×	😪 GNS3 2.2.12 Setup	- 🗆 🗙
Choose Install Location Choose the folder in which to install GNS3 2.2.12.			B	Installing Please wait while GNS3 2.2.12 is being installed.	e
Setup will install GNS3 2.2.12 in the following folder. To install in a diffe Browse and select another folder. Click Next to continue.	erent folde	r, click		Extract: user.svg	
Destination Folder C:\Program Files\GNS3	Brow	/se		Extract: scuit.svy Extract: server-cluster.svg Extract: server.svg Extract: square.svg Extract: statistics.svg Extract: statistics.svg Extract: storage.svg Extract: switch.svg Extract: switch.svg Extract: switch_multilayer.svg Extract: tablet.svg	
Space required: 307.8 MB Space available: 19.5 GB	1			Extract: tree.svg	*
GND3 2,2,12 Installer	ext >	Car	ncel	< Back Ne:	xt > Cancel









✤為了連結Internet 我們需要建立Loopback 網路介面

1. Windows鍵+R 呼叫「執行」輸入hdwwiz.exe



GNS3安装-建立Loopback 網路介面



✤建立Loopback 網路介面

新増硬體		新增硬體
	歡迎使用新增硬體精靈	這個精靈協助您安裝其他硬體
	此精靈協助安裝驅動程式軟體,以支援那些不支援隨插即用,且 Windows 無法自動辨識的較舊裝置。	精靈可以搜尋其他硬體,並自動為您安裝它。如果您知道要安裝的硬體型號,您也可以從清 單中選取。
	只有當您是進階使用者或經由技術支援人員引導至此處,才可以 使用此精靈。	您要精靈執行什麼工作? ○ 搜尋並自動安裝硬體 (建議選項)(S)
	▲ 如果您的硬體伴隨安裝 CD,建議您按 [取消] 關閉這個精 靈,然後使用製造商的 CD 來安裝這個硬體。	● 安裝我從清單中手動選取的硬體(進階選項)(M)
	請按 [下一步] 繼續。	
	<上一步(B) 下一步(N) > 取消	<上一步(B) 下一步(N) > 取消

GNS3安装-建立Loopback 網路介面







✤為了連上Internet 需建立Loopback 網路介面

注意:安裝後需重開機才生效





✤為了連上Internet 需建立Loopback 網路介面

注意:安裝後需重開機才生效



GNS3安装-建立Loopback 網路介面









◆啟動GNS3後,我們需要先製作RouterOS 映像檔 ◆GNS3->Edit->Preferences





8 Preferences						?	×
General	^ QE	MU pref	erences				
Server							
GNS3 VM	L	ocal settings					
Packet capture							
- Built-in	v	Enable hard	iware accelera	ion (KVM/HAXM)		
Ethernet hubs		Require har	dware acceler.	tion (KVM/HAXN	1)		
Ethernet switch							
Cloud nodes							
- VPCS							
VPCS nodes				4			
- Dynamins							
IOS routers							
	3						
OFMU							
- VirtualBox							
VirtualBox VMc							
							_
						Restore def	faults
viviware vivis				OV	Conset		1
* Docker	•			AU	Cancel	App	лу







🛞 New QEMU VM template	?	×	🛞 New QEMU VM template	? ×
QEMU VM name Please choose a descriptive name for your new QEMU virtual machine.			QEMU binary and memory Please check the Qemu binary is correctly set and the virtual machine has enough memory to work.	
6			Qemu binary: C:\Program Files\GNS3\qemu-3.1.0\qemu-system-x86_64w.exe	-
Name: CHR			RAM: 256 MB	\$
This is a legacy ASA VM				
	7			8
				0
< Back Next >	Cano	cel	< Back Next >	Cancel



🛞 New QEMU VM template	?	×	New QEMU VM template ? ×
Console type Please choose the console type. Telnet will connect to the serial console of the machine. VNC will connect to graphical output of the machine.			Disk image Please choose a base disk image for your virtual machine.
Vnc		•	○ Existing image ● New Image
Note: You don't need to install anything on the VM itself.			Disk image (hda): C:\Users\Kasper\GNS3\images\QEMU\chr-6.47.1.img Browse Create
	10		12
< <u>Back</u> Next >	Can	cel	< Back Finish Cancel

GENTRICE New Telecom Era 顯赫資訊

🛞 Preferences				Remute configurat	ion	? ×
General Server GNS3 VM	Qemu VM t	emplates ▼ General		CHR		
Packet capture - Built-in		Template name: Template ID: Default name format:	CHR none {name}-{0}	General settings HDD CD/ Adapters:	DVD Network Advanced Usage	\$
Ethernet hubs Ethernet switches		Server: Console type: Auto start console:	Kaspermac vnc False	First port name:	Ethemet{0}	
- VPCS VPCS nodes		CPUs: Memory: Linked base VM:	1 256 MB True	Segment size:	0	
Dynamips IOS routers IOS on UNIX		QEMU binary: Hard disks Disk image (hda):	qemu-system-x86_64w.exe C:\Users\Kasper\GNS3\images\QEMU\	Base MAC: Type:	::::: Intel Gigabit Ethernet (e1000)	•
IOU Devices - QEMU		Visk interface (hda): Vetwork Adapters:	lde 1	Custom adapters:	Configure custom adapters ates in Qemu	
Qemu VMs - VirtualBox		Type: • Optimizations	e1000	Use the legacy networking mode		
 VirtualBox VMs ✓ VMware VMware VMs 		 CPU throttling: Process priority: Additional options 	normal			
 Docker Docker containers 	4	New	<u>C</u> opy <u>E</u> dit	Delete		
			OK	Cancel Apply		

GENTRICE New Telecom Era 顯赫資訊

🛞 Preferences				Remute configurat	ion	? ×
General Server GNS3 VM	Qemu VM t	emplates ▼ General		CHR		
Packet capture - Built-in		Template name: Template ID: Default name format:	CHR none {name}-{0}	General settings HDD CD/ Adapters:	DVD Network Advanced Usage	\$
Ethernet hubs Ethernet switches		Server: Console type: Auto start console:	Kaspermac vnc False	First port name:	Ethemet{0}	
- VPCS VPCS nodes		CPUs: Memory: Linked base VM:	1 256 MB True	Segment size:	0	
Dynamips IOS routers IOS on UNIX		QEMU binary: Hard disks Disk image (hda):	qemu-system-x86_64w.exe C:\Users\Kasper\GNS3\images\QEMU\	Base MAC: Type:	::::: Intel Gigabit Ethernet (e1000)	•
IOU Devices - QEMU		Visk interface (hda): Vetwork Adapters:	lde 1	Custom adapters:	Configure custom adapters ates in Qemu	
Qemu VMs - VirtualBox		Type: • Optimizations	e1000	Use the legacy networking mode		
 VirtualBox VMs ✓ VMware VMware VMs 		 CPU throttling: Process priority: Additional options 	normal			
 Docker Docker containers 	4	New	<u>C</u> opy <u>E</u> dit	Delete		
			OK	Cancel Apply		

設定Cloud 網路









🔄 網路連線			>	X 7 大纲路 5 内网	~
$\leftrightarrow \rightarrow \vee$	↑ 🔄 > 控制台 > 所有控制台項	目 > 網路連線	◆ ひ		~
檔案(F) 編輯(E)) 檢視(V) 進階(N) 工具(T)			網路功能 驗證 共用	
組合管理 -	停用這個網路裝置 診斷這	固連線 重新命名這個連線 檢視這個連線的	1狀態 * 🔲 🕴 🔲	2 網際網路連線共用	
名稱	狀態	装置名稱	連線性	☑ 允許其他網路使用者透過這台電腦	的網際網路連線來連線(N)
in the first		 Antipation in the second state in 	and the second se		
1.00	1.00 M	100000-000		家用網路連線(H):	
		the second second second	-	選擇一個私人網路連線	~
。乙太網路:	5 網路	Parallels Ethernet Adapter	網際網路存取	────────────────────────────────────	
- 乙太網路	8 無法辨識的網路	Microsoft KM-TEST Loopback Adapte	er #2 無網路存取		
L	oopback inte	erface			設定(G)
۲.				>	確定 取消
6個項目 已	2選取1個項目		100	E	

RouterOS 模擬器測試









RouterOS 常用連線及管理方式: *Web **SSH ***Telnet **WinBox** MikroTik mobile app ***QuickSet**

RouterOS 使用Web連線



WebFig Login:

Login:	admin			Login	
assword:					
		1	= 9 0		



© mikrotik

RouterOS 使用SSH



*SSH

下載位置 <u>http://www.putty.org/</u>

🕵 PuTTY Configuration

10 M	
\sim	
~ ~	

E-Session	Basic options for your PuTTY session							
Logging	Specify the destination you want to c	onnect to						
- Teminal	Host Name (or IP address)	Port						
Bell	192.168.88.1	22						
Features	Connection type:							
Appearance Behaviour Translation Selection	Load, save or delete a stored session Saved Sessions	_						
Colours	Default Settings	Load						
Data		Save						
Telnet		Delete						
SsH	Close window on exit: Always Never Only	on clean exit						
About	Open	Cancel						

MMM MMM MMMM MMMM MMM MMMM MMM MMM MM MM	KKK KKK III KKK KKK RRRRRR III KKKKK RRR RR	TTTTTTTTTTT TTTTTTTTTTT OOOOOO TTT III R OOO OOO TTT III	ККК ККК ККК ККК ККККК
MMM MMM MMM MMM	III KKK KKK RRRRRR III KKK KKK RRR RR	000 000 TTT III R 000000 TTT III	ККК ККК ККК ККК
MikroTik Rout	erOS 6.47.1 (c) 1999-20	20 http://www.mikrotik	.com/
[?] command [?]	Gives the list of avai Gives help on the comm	lable commands and and list of arguments	
[Tab]	Completes the command/ a second [Tab] gives p	word. If the input is ambigu ossible options	ious,
/ /command	Move up to base level Move up one level Use command at the bas	e level	
[admin@MikroTik] > _		

RouterOS 使用SSH



◆Telnet 下載位置 <u>http://www.putty.org/</u>

Stration 28 PuTTY Configuration		? ×
Category:		
- Session	Basic options for your PuTTY se	ssion
- Logging - Terminal	Specify the destination you want to connect	t to
-Keyboard	Host Name (or IP address)	Port
Bell	192.168.88.1	23
-Features Window Appearance	Connection type:	I 🔿 Serial
-Behaviour -Translation • Selection	Load, save or delete a stored session Saved Sessions	
Colours Connection	Default Settings	Load
-Proxy -Telnet		Save
-Rlogin €SSH		Delete
-Serial	Close window on exit:	
	Always Never Only on cl	lean exit
About Help	Open	Cancel

MMM MMM MMMM MMMM MMM MMMM MMM MMM MM MM	KKK KKK III KKK KKK III KKKKK III KKK KKK	RRRRRR RRR RRR RRRRRR RRR RRR	000000 000 000 000 000 000000	TTTTTTTTTTT TTTTTTTTTTT TTT TTT TTT TT	I I I I I I I I I I I I I I I	ККК ККК ККК ККН ККККК ККК ККК ККК ККН
MikroTik Route	erOS 6.47.1 (c)	1999-2020	htt	p:∕∕www.mikr	rotik.	com/
[?] command [?]	Gives the list Gives help on	of availa the comman	ble commar d and list	ids ; of argument	ts	
[Tab]	Completes the a second [Tab]	commandzwo: gives pos:	rd. If the sible opti	input is an ons	nbiguc	ous,
/ /command	Move up to base Move up one le Use command at	e level vel the base	level			
[admin@MikroTik]	1 > _					

RouterOS 使用WinBox連線



↔WinBox管理工具

http://www.mikrotik.com/download

S WinBox v	3.24 (Addresses)	-	0		×
File Tools					
Connect To;	0C:5P:89:77:8A:00	-	Кеер Р	assword	
Login:	admin	-	Autosa	ve Sessio	m
Password;			Open Is	n New V	Vindow
Session:	<own> Browse</own>]			
Note:	MikroTik				
Group;		;			
RoMON Agent;		F			
	Add/Set Connect To RoMON Connect				
Managed Neigh	bors				
7 Refresh		Fin	d	all	Ŧ
MAC Address	/ IP Address Identity		Version		•
0C:5F:89:77:8A:0	0 0.0.0.0 MikroTik		6,47,1 (stable)	
•					•
1 item (1 selected)				

RouterOS 使用MikroTik 行動APP



✤可透過MikroTik 行動APP管理系統 ✤支援Android和iOS操作系統 Download on the App Store **☆iOS**下載位置 https://apps.apple.com/app/id1323064830 GET IT ON Google Play ◆Android 下載位置 https://play.google.com/store/apps/details? id=com.mikrotik.android.tikapp



RouterOS 使用MikroTik 行動APP





QuickSet 快速設定工具



只需單擊幾下即可幫助您設定路由器!

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RouterOS New Terminal介紹



		1										
	🔏 Quick Set	Terminal										
	🚊 CAPSMAN											
	🔚 Interfaces											
	🧝 Wireless											
	Sidge Bridge											
	📑 PPP											
	🛫 Switch											
	°t¦s Mesh											
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×	💥 Tools 🔹 🗅	[2]	Give	es the	list	of a	waila	ble c	omman	ds		
202	New Terminal	command [?]	Give	es helj	p on	the c	omman	d and	list	of argumer	nts	
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5	errition		a se	econd	[Tab]	give	s pos	sible	opti	ons		
л С	🗋 Make Supout.rif	1	Move	e up t	o bas	e lev	rel					
ð	🥶 Manual		Move	e up o	ne le	vel	haaa	lovol				
E	🍥 New WinBox	[admin@Mikroti	k]>	comma	nu at	une	Dase	revel				
2												

RouterOS 指令



✤具階層式架構,例如:/ip route

```
[admin@MikroTik] > ip route
[admin@MikroTik] ip route> print
Flags: X - disabled, A - active, D - dynamic,
C - connect, S - static, r - rip, b - bgp, o - ospf, m - mme,
B - blackhole, U - unreachable, P - prohibit
                         PREF-SRC
       DST-ADDRESS
                                       G GATEWAY
                                                        DIS INTE...
#
0 A S 0.0.0.0/0
                                        r 10.0.3.1
                                                        1
                                                            bridge1
1 ADC 1.0.1.0/24
                     1.0.1.1
                                                        0
                                                            bridge1
2 ADC 1.0.2.0/24 1.0.2.1
                                                        0 ether3
3 ADC 10.0.3.0/24 10.0.3.144
                                                        0
                                                            bridge1
4 ADC 10.10.10.0/24
                                                            wlan1
                       10.10.10.1
                                                         0
[admin@MikroTik] ip route>
```

◆回上一層:「…」

[admin@MikroTik] ip route> ..
[admin@MikroTik] ip>

◆回根目錄:「/」

[admin@MikroTik] ip route> /
[admin@MikroTik] >





✤<</p> <善用[TAB]提示</p>

```
[admin@MikroTik] > interface set e[Tab]_
[admin@MikroTik] > interface set ether[Tab]_
[admin@MikroTik] > interface set ether[Tab]_
ether1 ether5
[admin@MikroTik] > interface set ether_
```

✤縮寫指令功能

```
[admin@MikroTik] > pi 10.1 c 3 si 100
等同於
```

[admin@MikroTik] > ping 10.0.0.1 count 3 size 100
RouterOS 指令



◆常用指令:

add, edit, find, move, print, remove, set

[admin@MikroTik] > interface print Flags: X - disabled, D - dynamic, R - running NAME TYPE MTU # R ether1 ether 1500 0 R ether2 ether 1500 R ether3 2 ether 1500 3 R ether4 ether 1500 [admin@MikroTik] > interface set 0,1,2 mtu=1460 [admin@MikroTik] > interface print Flags: X - disabled, D - dynamic, R - running NAME TYPE # MTU R ether1 ether 1460 R ether2 ether 1460 R ether3 ether 1460 2 3 R ether4 ether 1500 [admin@MikroTik] >



✤/system backup save name=存檔檔名

[admin@MikroTik] > /system backup save name=20200825-CHR Saving system configuration Configuration backup saved

System 🗅	File List			
🗬 Queues	- 🍸 🖹 🖹 Backup Restore	Upload,		Find
Files Files	File Name	⊽Туре	Size	Creation Time 🔻
📃 Log	🔤 skins	directory		Aug/18/2020 03:25:57
RADIUS	Dup Dup	directory	100 G 1715	Aug/18/2020 09:43:00
Tools	autosupout.nf	.nt file	402.7 KiB	Aug/18/2020 09:43:31
Mew Terminal	Backup			
the Dest IV		Backup		
	Name: 20200825-CHR	Const		
Dide D	Password:	Cancel		
🛃 Make Supout.rif	Enormations loss sha?55			
🔁 Manual	Entryption, ars-snaz, o		1007	
🚫 New WinBox	Don't Encrypt	1239	40%	IICC



✤/system backup load name=存檔檔名

[admin@MikroTik] > /system backup load name=20200825-CHR.backup

password:

Restore and reboot? [y/N]:

y Restoring system configuration System configuration restored, rebooting now

🙀 System 🛛 🗋	File List						
╇ Queues	💻 🍸 🗈 🖹 Backup Restore	Upload				Find	
Files	File Name	∆ Type		Size	Creation Time	\bullet	
Log	20200825-CHR.backup	backup		14.6 KiB	Aug/18/2020	10:03:51	
	💷 autosupout,rif	rif file.		402,7 KiB	Aug/18/2020	09:43:31	
ADI03	📮 pub	directory	У		Aug/18/2020	09:43:00	
🗡 Tools 🛛 🗋	skins 🔤	director	y .		Aug/18/2020	03:25:57	
🔤 New Terminal	File <20200825-CHR.backup>			Restore			
💠 Dot1X	Bile Name: 20200825, CHR backup		OV				Postero
🚫 Dude 🛛 🗋	The Pathe, 2020025-CTIR, backup		0K	Backup File: 2020)825-CHR.backup	• •	Restore
Make Surout.rif	Type: backup		Remove			+	Cancel
Manual	Size: 14.6 KiB		Restore				
New WinBox	Creation Time: Aug/18/2020 10:03:51			Restore			
	L			-	. 84 .1		
				Do you want to res	tore configuration an	id reboot?	
					S	les No	



RouterOS 還原出廠預設值: /system reset-configuration

[admin@MikroTik] > /system reset-configuration
Dangerous! Reset anyway? [y/N]:

MPLS	Auto Upgrade Certificates	Reset Configuration
MPLS Routing Routing System Queues Files Log RADIUS Tools New Terminal Dot1X Dude Make Supout.rif Manual New WinBox Ruit	Certificates Clock Console Disks Health History Identity LEDs License Logging Note Packages Password Ports	Kesel Configuration Reset Configuration Keep User Configuration Reset Configuration CAPS Mode Cancel No Default Configuration Do Not Backup Run After Reset:
EAII	Resources RouterBOARD	

RouterOS 使用者密碼變更說明



使用者密碼變更指令: /password

[admin@MikroTik] > /password old-password: new-password: ***** confirm-new-password: *****

System	Auto Upgrade	User List				
P Queues	Certificates	Users Groups SSH Keys SSH Private	Keys Active I	Ísers		- terret
Files	Clock					Find
Log	Console	Name / Course Attended	dama	Test	I named Ta	1.104
ar RADIUS	Disks	system default user	uuuess	Last	rossen m	
🔀 Tools 🛛 🗈	Health	admin full			Aug/18/2020 1	0:17:19
🔤 New Terminal	History	User <admin></admin>			Change Password	
Dot1X	Identity	Name: admin		OK	New Password:	OK
🔇 Dude 🛛 🗋	LEDs	Group: full	-	Canoel	Confirm Password:	Canoel
🔊 Make Supout.rif	License	Allowed Address		Amla		A molar
🞴 Manual	Logging	Allowed Address:		Appry		Appry
SNew WinBox	Note	Last Logged In: Aug/18/2020 10:17:	19	Disable		
Exit	Packages			Comment		
	Password			Сору		
	Ports			Remove		
	Reboot			Password		
	Reset Configuration			1		
	Resources	enabled				
	RouterBOARD					
	SNTP Client					
	Scheduler					
	Scripts					
	Shutdown					
	Special Login					
	UPS					
	Users					
	Watchdog					





✤RouterOS 套件版本管理





RouterOS 基本設定: *IP Address *Default Gateway *DNS *DHCP Server *NTP Client





Q1:如何使用指令設定下列呢? ***IP -> Address ♦ IP -> Route ♦IP-> DNS *IP-> DHCP Server System -> SNTP Client** System -> Packages **System -> Routerboard**

Q2:如何設定非法的DHCP Server 呢?

Lab: Static Route









Lab1: Static Route



* R1

/ip address

add address=192.168.10.1/24 interface=ether3 add address=10.0.0.1/24 interface=ether1 add address=10.0.3.2/24 interface=ether2

/ip route

add distance=1 dst-address=192.168.20.0/24 gateway=10.0.0.2 add distance=1 dst-address=192.168.30.0/24 gateway=10.0.0.2 add distance=1 dst-address=192.168.40.0/24 gateway=10.0.3.1

* R2

/ip address

add address=192.168.20.1/24 interface=ether3 add address=10.0.1.1/24 interface=ether1 add address=10.0.0.2/24 interface=ether2 /ip route

add distance=1 dst-address=192.168.10.0/24 gateway=10.0.0.1 add distance=1 dst-address=192.168.30.0/24 gateway=10.0.1.2 add distance=1 dst-address=192.168.40.0/24 gateway=10.0.1.2

* R3

```
/ip address
add address=192.168.30.1/24 interface=ether3
add address=10.0.1.2/24 interface=ether2
add address=10.0.2.1/24 interface=ether1
/ip route
add distance=1 dst-address=192.168.10.0/24 gateway=10.0.1.1
add distance=1 dst-address=192.168.20.0/24 gateway=10.0.1.1
```

add distance=1 dst-address=192.168.20.0/24 gateway=10.0.1.1 add distance=1 dst-address=192.168.40.0/24 gateway=10.0.2.2

* R4

```
/ip address
add address=192.168.40.1/24 interface=ether3
add address=10.0.2.2/24 interface=ether2
add address=10.0.3.1/24 interface=ether1
/ip route
```

add distance=1 dst-address=192.168.10.0/24 gateway=10.0.3.2 add distance=1 dst-address=192.168.20.0/24 gateway=10.0.3.2 add distance=1 dst-address=192.168.30.0/24 gateway=10.0.2.1



_ MikroTik RouterOS 防火牆



 ◆嘗試將「受保護程度較低」的外部區域與「受保護程度較高」 的內部區域隔離開來。
 ◆安全是一個過程,「防火牆」只是其中的一部分

✤不太安全的因素存在鍵盤和椅子之間











RouterOS 防火牆到底是在那裡呢?





參與L2的防守,不僅只有MAC Address而已...

✤硬體:Switch晶片上的ACL

✤軟體:Bridge介面上的ACL



∻Layer2 防火牆

- Bridge \rightarrow Filter
- Switch → Rule 或 Access List 及其他

✤Layer3 (及以上)的 IPv4防火牆

- IP \rightarrow Firewall
- IP \rightarrow Web Proxy

◆Layer3 防火牆 IPv6

• IPv6 \rightarrow Firewall



◆L3 防火牆組成主要是由表(table)、鏈(chain)和規則 (rule)組成







防火牆 Filter 中常用 的三個鏈(chain):

* input

通過路由表後目的地為本 機封包

* forward

通過路由表後目的地不是 本機的封包 ✤ Output

來自本機的封包向外傳送



啟動防火牆過濾Filter Rules Chain: Input



Chain: Input

Firewall																	Ξ×
Filter Rules	NAT Mangle	Raw	Service Ports	Connections	Address Lists	Layer7 I	Protocols										
÷ - 🗸) 💥 🖻	T	🕒 Reset Cour	nters 🚺 🕓 R	eset All Counters]									Find	input	₹
# Action			Chain	Src. Addres	s Dst. Address	Proto	Src. Port	Dst. Port	In. Inter	Out. Int	In. Inter	Out. Int	Src. Address List	Dst. Ad	Bytes	Packets	•
;;; Establishe	d connections																
0 💙 acc	cept		input												4397.8 MiB	37 762 837	
;;; Related co	onnections																
1 💙 acc	cept		input												378.3 KiB	2 237	
;;; Drop invali	id connections																
2 🗱 dro	qu		input												1933.8 KiB	32 252	
;;; drop telnet	t brute forcers																
3 🗱 dro	φ		input			6 (tcp)		23					telnet_blacklist		0 B	0	
4 📑 add	d src to address	; list	input			6 (tcp)		23					teinet_stage3		0 B	0	
5 📑 add	d src to address	: list	input			6 (tcp)		23					teinet_stage2		0 B	0	
6 📑 add	d src to address	: list	input			6 (tcp)		23					teinet_stage1		0 B	0	
7 📑 add	d src to address	; list	input			6 (tcp)		23							0 B	0	
;;; !!! Check f	for well-known ι	/iruses !	!!!														
8 🔂 jum	q		input												236.1 MiB	3 988 451	
;;; ICMP																	
9 💙 acc	cept		input			1 (ic									18.6 MiB	269 059	
;;; Jump to de	emo chain																
10 🗖 jum	ib di		input												217.5 MiB	3 719 392	
;;; Drop ever;	ything else						-										
11 🗱 dro	ip		input												10.8 MiB	70 137	

啟動防火牆過濾Filter Rules Chain: Forward



Chain: Forward

Firewall									Ξ×
Filter Rules NAT Mangle Raw Ser	rvice Ports Connections /	Address Lists Layer7 Prot	ocols						
+- / × 2 7 (0	Reset Counters	et All Counters					F	ind	forward Ŧ
# Action	Chain Src. Address	Dst. Address Protocol	Src. Port Dst. F	Port In. Inter	Out. Int In. Inter	. Out. Int Src. Address List	Dst. Ad By	tes	Packets 🛛 🔻
;;; Established connections									
12 💙 accept	forward							0 B	0
;;; Related connections									
13 💙 accept	forward							0 B	0
;;; Drop invalid connections									
14 🗱 drop	forward							0 B	0
;;; !!! Check for well-known viruses !!!									
15 🗖 jump	forward							0 B	0
;;; UDP									
16 💙 accept	forward	17 (udp)						0 B	0
;;; ICMP									
17 💙 accept	forward	1 (icmp)						0 B	0

啟動防火牆過濾Filter Rules Chain: Output



Chain: Output

Firewall																	
Filter Rules	NAT	Mangle	Raw	Service Ports	Connections	Addres	s Lists	Layer7 Protoco	ls								
+ -		1	T	00 Reset Cour	iters 00 R	eset All C	ounters]							Find	output	₹
# Act	tion	0	Chain	Src. Address	Dst. Address	Proto	Src. Por	t Dst. Port	In. Inter	Out. Int	In. Inter	Out. Int	Src. Ad	Dst. Ad	Bytes	Packets	-
44 🖌	accept	c	output												2875.5 KiB	2 076	
1 item out of	45																





Interfaces	Route	rOS	v6.40 ((stable)							Quic	k Set	WebFig	Terr	ninal	•	
Bridge	Filter R	ules	NAT	Mangle Ra	w Service	Ports Connections	Address Lists	Layer7	Protocols							Fire	ewall
🛫 Switch																	
°සී Mesh	Add Ne	w] R	eset All	Counters											all		\$
255 IP v																	
ARP	8 items	;															
Accounting			#	Action	Chain	Suc Address	Dst.	Brot	Src Dort	Det Bort	Any Dort	In.	Out.	Putor	Dackata		
Addresses	-		#	Action	Chain	SIC. Address	Address	Prot	SIC. POIL	DSL. POR	Any. Port	Interf	Interf	bytes	Packets		
Cloud	;;; place	e hots	pot rule	es here						-					1		
DHCP Client	- <u>E</u>	X	0	🕒 passthi	ol unused-hs-	·C.								0 B	0		
DHCP Relay	;;; defc	onf: n	nasquer	ade						-	1				1		
DHCP Server	- E	X	1	≓ masque	era srcnat								ether1	0 B	0		
DNS	- D		2	≓∥ masque	era srcnat			_			-		ether2	2703.5 KiB	38 484		
Firewall	- D	_	3	≓∥ masque	era srcnat						-		ether3	2338.3 KiB	32 999		
Hotspot	- D		4	≓∥ masque	era srcnat								ether4	2330.4 KiB	32 856		
IPsec	- <u>E</u>	X	5	≓∥ masque	era srcnat	192.168.0.0/16						_	unknown	0 B	0		
Neighbors	- D		6	≓∥ masque	era srcnat	192.168.0.0/16								6.1 MiB	31 934		_
Packing	;;; mas	quera	de hots	pot network		- F					1						_
Pool	- <u>E</u>	X	7	≓ masque	ere srcnat	192.168.0.0/16								0 B	0		_
Routes																	

Address-List



Interfaces	Filter Rules	NAT Mangle	Service Ports	Connections	Address Lists	Laver7 Protocols			Firewall
FPP		north Fidingic		connections					Thewan
🕌 Bridge	Add New								all 🛟
🛫 Switch									
°ියී Mesh	4 items								
255 IP 🔻									
ARP	1	▲ Name	Address	Time	out				
Accounting	- D	server	1.1.1.2					 	
Addresses	- D	 server 	1.1.1.1						
Cloud	- D	server 2	2.1.1.2						
DHCP Client	- D	server 2	2.1.1.1						
DHCP Relay									
DHCP Server									
DNS									
Firewall									
Hotspot									
IPsec									
Neighbors									
Deskins									

防火牆連線狀態追蹤Connection tracking



-	Didas MAT Manda	Sanias Dada Corne	ctions Address Lists 1	nuez Destanala							-
race	r nues INAT Range	Service Forts Govern	Address Lists L	syer / Protocols							
-	Tracking									Fit	hd
	Src. Address /	Dst. Address	Reply Src. Address	Protocol	Connecti	Connecti	P2P	Timeout	TCP State	ICMP Type	
٩.	10.5.8.208.58337	66.228.113.24.8291	66.228.113.24.8291	6 (tcp)	No. Post State	10000000000	1000	00:04:2	3 established	a parte danse das	
J	10.10.0.3	224.0.0.5	224.0.0.5	(hqso) 68				00:09:1	7		
1	10.10.0.3 47445	66.228.113.24.161	66.228.113.24:161	17 (udp)				00:02:2	3		
1	10.10.0.3.51186	66.228.113.24:23	66.228.113.24:23	6 (tcp)				00:00:00	5 close		
A	10.10.0.3.51997	66.228.113.24.80	65.228.113.24:80	6 (tcp)				00:00:0	3 time wat		
٩.	10.10.0.3 55102	66.228.113.24.8291	66.228.113.24.8291	6 (tcp)				23:59:2	0 established		
A	10.10.0.3.56727	66.228.113.24.22	66.228.113.24.22	6 (tcp)				00:00:0	4 close		
A,	10.10.0.3.59423	66.228.113.24.21	65.228.113.24.21	6 (tcp)	ftp			00:00:00	6 time wat		
J	66.228.113.24	224.0.0.5	224.0.0.5	89 (ospf)				00:09:2	4		
J	66.228.113.24:22	159.148.172.205:1631	159.148.172.205:1631	6 (tcp)				07:41:2	7 established		
J	66.228.113.24:23	159.148.172.205:4566	159.148.172.205.4566	6 (tcp)				06:03:5	0 established		
U	66.228.113.24:80	61.247.26.243.1177	61.247.26.243:1177	6 (tcp)	N			21:59:3	2 established		
J	66.228.113.24:80	41.234.95.3:12701	41.234.95.3:12701	6 (tcp)				06:52:4	9 established		
J	66.228.113.24:80	58.96.34.68:4304	58.96.34.68:4304	6 (tcp)				01:43:5	1 established		
J	66.228.113.24:80	41.234.129.149.13058	41.234.129.149:13058	6 (tcp)				12:29:5	2 established		
U	66.228.113.24:80	125.160.169.179.51	125.160.169.179.51566	6 (top)				22:27:3	0 established		
J	66.228.113.24:80	77.48.235.215.8530	77.48.235.215.8530	6 (tcp)				05:49:4	2 established		
J	66.228.113.24:80	41.234.95.3:12700	41.234.95.3:12700	6 (tcp)				06:52:4	6 established		
J	66.228.113.24:80	217.52.99.170.3269	217.52.99.170.3269	6 (tcp)				06:17:5	1 established		
J.	66.228.113.24:80	65.5.222.47.50726	65.5.222.47:50726	6 (tcp)				10:42:1	2 established		
J	66.228.113.24:8291	41.233.48.14.50087	41.233.48.14:50087	6 (tcp)				19:54:0	0 established		
J.	66.228.113.24:8291	189.58.32.235 1484	189.58.32.235:1484	6 (tcp)				19:54:2	8 established		
J.	66.228.113.24:8291	41.236.252.35.52727	41.236.252.35.52727	6 (tcp)				15:57:3	6 established		
J	66.228.113.24:8291	189.58.32.236.1478	189.58.32.236:1478	6 (tcp)				19:53:3	2 established		
J	66.228.113.25	224.0.0.5	224.0.0.5	89 (cspf)				00:09:2	4		
Ą	80.93.248.214:2050	66.228.113.24.8291	66.228.113.24.8291	6 tcp)				06:54:2	0 established		
A	80.93.248.214:54899	66.228.113.24.8291	66.228.113.24.8291	6 (top)				23:57:5	5 established		
4	80.93.249.97:3687	66.228.113.24.8291	66.228.113.24:8291	6 (tcp)				02:08:3	0 established		
1	159.148.172.205:3160	66.228.113.24:161	66.228.113.24:161	17 (udp)				00:02:2	4		
4	159.148.172.205:4177	66.228.113.24.23	66.228.113.24.23	6 (tcp)				00:00:00	0 close		
4	159.148.172.205:4336	66.228.113.24.22	66.228.113.24:22	6 (tep)				00:00:0	2 close		
4	159 148 172 205:4403	66.228.113.24.21	65 228 113 24 21	6 tcp)	ftp			00:00:00	4 close		
A.	159.148.172.205:4512	66.228.113.24.80	66.228.113.24:80	6 (tcp)	16			00:00:00	4 time wat		
A	159.148.172.205:4939	66.228.113.24.8291	66.228.113.24.8291	6 (top)	10			23:55:2	3 established		
A	193.189.117.122.42	66.228.113.24:161	66.228.113.24:161	17 (udp)				00:01:4	0		
A	193.189.117.122:42	66.228.113.24.161	66 228 113 24:161	17 (udp)				00:01:4	0		

防火牆Layer7 Protocols



Filter Rules	NAT	Mangle	Raw	Service Ports	Connections	Address Lists	Layer7 Protocols
dd New							
ICC NEW							
items							
1		me	Reg	exp			
-	• D	NS_AAAA	\x10	C\x01			
-	e D	NS_AAAA	\x10	C\x01 (facebook.com). ³	*\$		
-	e D e fa	ONS_AAAA acebook qweb	\x10	C\x01 (facebook.com).* J.com	*\$		
	e D e fa e q	oNS_AAAA acebook qweb qweballow	\x10	C\x01 (facebook.com). .com v.qq.com	*\$		





Q1: 如何利用防火牆擋臉書 Facebook?

A1: MikroTik Facebook Block Script :

/ip firewall layer7-protocol add name=facebook regexp="^.+(facebook.com).*\$" /ip firewall filter add chain=forward protocol=tcp dst-port=80,443 layer7-protocol=facebook action=drop comment="Block Facebook"

*Q2: 如何利用防火牆擋住UDP 139,445 Port?

A2: MikroTik Block UDP 139,445 Script :

/ip firewall filter add chain=forward protocol=udp dst-port=139,445 action=drop

Q3: 如何利用防火牆做NAT位址轉換(118.163.8.254:53->192.168.10.20:514) 呢?

A3: MikroTik NAT mapping Script :

/ip firewall nat add chain=dstnat action=dst-nat to-addresses=192.168.10.20 to-ports=514 protocol=udp dst-address=118.163.8.254 dst-port=53



MikroTik RouterOS 認證網頁功能CWP











2020年7月25日一 艘日本貨輪「若潮號」 偏離航道最後在非洲 東南方的「模里西斯」 外海擱淺並造成原油 外洩。

發生原因: 船員為了 要連陸地上的WiFi









認證網頁功能CWP(Captive Web Portal)





MikroTik 內建的Hotspot 有那些功能呢? 1. 頻寬限制(網路速度限制或流量配額限制) **2. Hotspot Server**多種認證方法 3. 可排除不需要認證的裝置或IP 4. 自訂Hotspot網頁 5. 廣告系統 6. 與社群網站API整合





❖適用地方:旅館







❖ 適用地方:學生宿舍













☆適用地方:公車站牌














❖ 適用地方: 遊客中心



認證網頁功能CWP-Hotspot 快速設定







uter	OSv6.47版以前的Hotspot	領設登入頁面	RouterOSv6.47版以上Hotspot預設登入資
	Please log on to use the internet hotspot service		Mikrotik
			Please log in to use the internet hotspot service
		-	Lusername
	login		
	password		Password
	OK		
		1	Connect
	HOTSPOT GATEWAY		
	powered by MikroTik		Powered by MikroTik RouterOS
	Powered by MikroTik RouterOS		

認證網頁功能CWP-登入頁面自訂







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三、MikroTik RouterOS 8大網管工具介紹

RouterOS 工具 Traceroute



Interfaces	Start	Stop	Close									
🕌 Bridge		(
🛫 Switch	-				0000		1					
📑 PPP	Trac	eroute To			0.0.0		J					
ීයී Mesh	P	acket Size			56							
IP ►							1					
Ø MPLS		Timeout			1000		ms					
🐹 Routing 🔹 🕨		Protocol			icmp 🛊							
💮 System 🕨 🕨	· · · · · · · · · · · · · · · · · · ·											
룢 Queues		Port			33434]					
Files					0							
E Log		USE DNS										
🥵 Radius		Count	•									
💥 Tools 🛛 🔻												
BTest Server		Max Hops	•									
Bandwidth Test		Address	-									
Email	Sre	. Address	•									
Flood Ping		Interface	•									
Graphing												
IP Scan		DSCP	•									
MAC Server	Rou	ting Table	-									
Netwatch												
Packet Sniffer		#	Hon	Host		Loss	Sont	Lact	Ava	Bost	Wer	
Ping		#	пор	nusc		LUSS	Sent	Last	Avg.	Dest	wors	
Ping Speed												
Profile												
RoMON												
SMS												
Telnet												
Torch												
Traceroute												

RouterOS 工具 Ping



255 TP													
	•			Ping To	D	[]	168.95.1.1	\$					
😹 Routing	۲			Interfac	• •								
Bystem	•												
Queues				ARP Ping	9		2						
Files			Pac	ket Coun	+ -								
E Log			1 40		•								
🧟 Radius				Timeou	t	1	000		ms				
🔀 Tools	•												
BTest Server													
Bandwidth Test			Src	. Addres	s 🔻								
Email									-				
Flood Ping			Pa	acket Size	2	5	50						
Graphing				тт	•								
IP Scan					_								
MAC Server				DSC	•								
Netwatch			David	ine Tehl	_								
Packet Sniffer			Rout		• •								
Ping			Dont	Fragmen	t								
Ping Speed													
Profile				#	Seq #	Host		Time	Reply	TTL	Status		
RoMON		-			0	100 05 1 1		-	Size	240			
SMS				0	0	168.95.1.1		3	50	248			
Telnet				1	1	168.95.1.1		2	50	248			
Torch		_		2	2	168.95.1.1		2	50	248			
Traceroute													
Traffic Generator													
Traffic Monitor													
No. of Concession, Name													

RouterOS 工具 Ping、Flood Ping



🧘 Wireless								
🔚 Interfaces	Start Stop Close							
🧝 Bridge								
🙄 Switch								
📑 PPP	Flood Ping To	168.95.1.1						
ීය Mesh	Packet Count	1000						
IP I	•							
Ø MPLS	Packet Size	1500						
😹 Routing 🔹 🕨	Timeout	1000						
💮 System 🛛	•							
룢 Queues	Packets Sent	507						
Files								
Log	Packets Received	000						
🥵 Radius	Minimum RTT	3						
💥 Tools 🔹 🦄	· · · · · · · · · · · · · · · · · · ·							
BTest Server	Average RTT	3						
Bandwidth Test	Maximum RTT	8						
Email	_							
Flood Ping								
Graphing								
IP Scan								
MAC Server								
Netwatch								
Packet Sniffer								
Ping								

RouterOS 工具 IPScan



0	-								
Interfaces	Start	Stop	Close						
Bridge									
🙄 Switch		T-1-1-1-1-1		Called and					
ei PPP		Interrac	e 🔺	ether1-gatew	ay Ŧ				
°18 Mesh	Add	ress Rang	je 🔺	192.168.3.1-19	2.168.3.254				
호 IP 🕨									
🖉 MPLS 🔹 🕨		#	Address	MAC Address	Time (ms)	DNS	SNMP	Netbios	
🝂 Routing 🛛 🕨 🕨		0	192.168.3.6	5C:FF:35:	41				
💮 System 🕨		1	192.168.3.12		0				
룢 Queues		2	192.168.3.20	00:21:5E	74				
Files		3	192.168.3.15	70:F1:A1	0				
📄 Log		4	192.168.3.17	A4:DB:30	0				
🥵 Radius		5	192.168.3.16	40:B8:37	126				
💥 Tools 🔹 🔻		6	192.168.3.11	80:EA:96	98				
BTest Server		7	192.168.3.14	B4:CE:F6	0				
Bandwidth Test		8	192.168.3.251	8C:73:6E	1				
Email		9	192.168.3.19	5C:3C:27	0				
Flood Ping		10	192.168.3.32	00:13:02	0			I	
Graphing		11	192.168.3.26	34:51:C9	0				
IP Scan	1	12	192.168.3.33	F4:09:D8	0				
MAC Server		13	192.168.3.36	6C:40:08	0				
Netwatch		14	192.168.3.34	30:10:B3	0				
Packet Sniffer		15	192.168.3.44	08:00:27	0				
Ping		16	192.168.3.48	AC:F7:F3	0				
Ping Speed		17	192.168.3.37	00:F7:6F:	0				
Profile		10	102 169 2 50	00.26.88	0				

RouterOS 工具 Graphing



🔚 Interfaces		Interface R	Rules	Oueue Rules	Resource Rules	Interface Graphs	Oueue Graphs	Resource Graphs	
Interface									
🕌 Bridge		Add New	Grant	hing Settings					
🙄 Switch			Ciupi	Joernings					
°t¦8 Mesh		1 item							
IP	•								
MPLS	•			Interface	Allow Addre	ss Store on Disk			
🖉 OpenFlow		-	al	I	192.168.0.0/2	16 yes			
🧟 Routing	•					·			
System	•								
쪶 Queues									
📄 Files									
📄 Log									
🥵 Radius									
🄀 Tools									
BTest Server									
Bandwidth Test									
Email									
Flood Ping									
Graphing									
IP Scan									
MAC Server									
Netwatch									
Packet Sniffer									
Ping									

RouterOS 工具 Profiler



Bridge	Start Stop	Close		
2 Switch				
t <mark>8</mark> Mesh				
IP 🕨	#	Name	▼ Usage	
🖉 MPLS 🔹 🕨	4	idle	94.0	
OpenFlow	5	profiling	5.0	
🧟 Routing 🛛 🕨	0	www	0.5	
🕃 System 🕨 🕨	3	management	0.5	
P Queues	1	firewall	0.0	
Files	2	networking	0.0	
E Log				
🥵 Radius				
🗶 Tools 🛛 🔻				
BTest Server				
Bandwidth Test				
Email				
Flood Ping				
Graphing				
IP Scan				
MAC Server				
Netwatch				
Packet Sniffer				
Ping				
Ping Speed				
Profile				
RoMON				

RouterOS 工具 Torch



C Mesh								Bas	ic							Filters
IP	•			C									/-			
MPLS	•		Interface		ether1	ŧ				Src. /	ddress	0.0	.0.0/0			
😹 Routing	•	Entry	Timeou	t 0	0:00:03		s			Dst. /	ddress	0.0	.0.0/0		1	
G System	•														-	
👰 Queues								Colle	ct	Src. Ad	ldress6	::/0)			
Files				_	Cro Ad	draga		Dat Address		Det A	Idrocce)		1	
E Log					SIC. Au	uless				101 2330						
🥵 Radius					Src. Ad	dress6		Solution Dst. Address 6 MAC Protocol		rotocol	all 🗘					
ECD																
💥 Tools	Ŧ				MAC Pr	otocol	C	Protocol		P	rotocol	lan	/	\$		
BTest Server				_	Port			VLAN Id			Port	an	<i>j</i>	\$		
Bandwidth Test								,								
Email					DSCP					\ \	LAN Id	an	(\$		
Flood Ping											DSCP	[an	,			
Graphing											boor	Call	(
IP Scan													Tv	By		
MAC Server			#	Eth. Protocol	Pro	Src.		Dst.	VLAN Id	DSCP	Tx Rate	Rx Rate	Packet	Packet		
Netwatch													Rate	Rate		
Packet Sniffer																
Ping																
Ping Speed																
Profile																
RoMON																
SMS																
Telnet																
Torch																
Traceroute																
Traffic Generator																
Traffic Monitor																

RouterOS 工具Packet Sniffer



Interfaces		Apply Start St	ton Backets Connections Hosts Brotocols
PPP			
🕌 Bridge		stopped	
🛫 Switch			
°ය Mesh			Gener
IP	•		
Ø MPLS	•	Memory Limit	100000 kb
😹 Routing	•	Only Headers	
System	•		
Queues		File Name	▲ raidus.pcap
Files		File Limit	100000 kb
E Log			
🥵 Radius			Streami
LCD			
🔀 Tools		Streaming Enabled	
BTest Server		Server	0.0.0.0
Bandwidth Test			
Email		Filter Stream	
Flood Ping			
Graphing			Filt
IP Scan		Interfaces	▼ all 🗘 ▲
MAC Server			_
Netwatch	_	MAC Address	•
Packet Sniffer		MAC Protocol	▼
Ping			
Ping Speed		IP Address	▼
Profile		IP Protocol	▼
RoMON		2	
SMS		Port	▼
Telnet		Direction	
Torch		Direction	



簡報完畢 敬請指教

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