i-BEAM
steering ahead

MikroTik RouterOS

Online Training Class – Special Series 3

Burmese Version

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CCNA R&S, CCNP R&S, CCIP, JNCIA-Junos, JNCDA

EOIP VPN in Hub and Spoke Topology

Presented by Phyo Phyo Hein

14-05-2017

Information Beam Co.,Ltd

About Me

- **Phyo Phyo Hein**
  - B. C. Tech (hons)
  - MikroTik Consultant
  - Director of Information Beam Co.,Ltd.
  - Experiences:
    - Cisco instructor since 2005 at i-BEAM Co., Ltd
    - SingTel Mobile Support Network Engineer at NCS Co., Ltd (2008-2010)
    - Nera Telecommunications (Singapore) (2011-2012)
    - System Integration Manager at Yatanarpon Teleport (2012-2014)
    - Enterprise/ISP Manager at Kinetic Myanmar Technology (2014-2016)
  - Certifications:
    - **Cisco** CCNA R&S, CCNP R&S, CCIP, CCIE R&S Written
    - **Juniper** JNCIA-Junos, JNCDA
    - MikroTik MTCNA, MikroTik MTCRE, MikroTik MTCWE, MikroTik MTCTCE, MikroTik MTCUME, MikroTik MTCINE

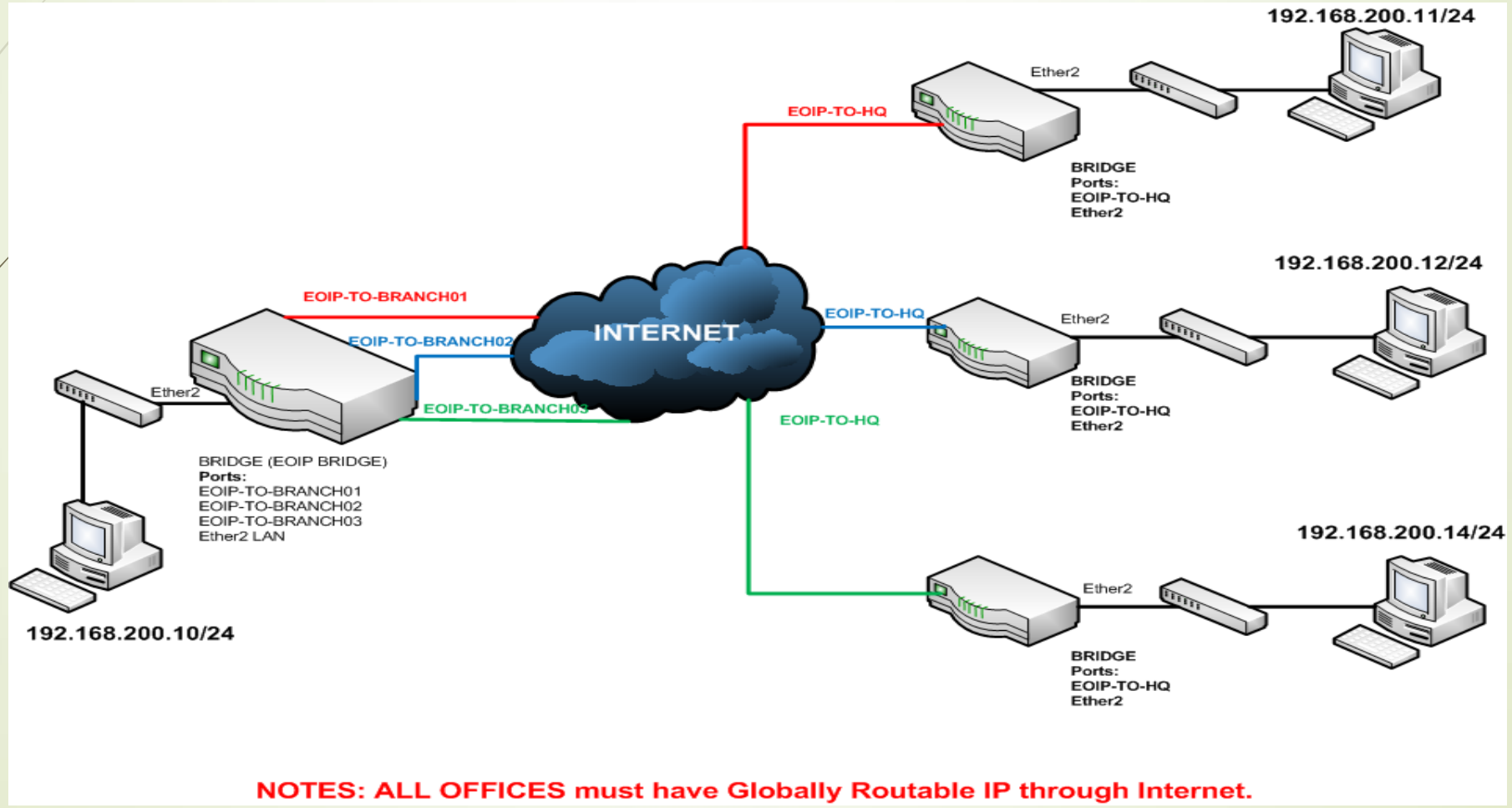
What is EOIP?

- Stands for Ethernet Over IP.
- A MikroTik Proprietary Protocol.
- Use GRE Protocol (Protocol ID 47).
- Configurable as Layer 2 VPN or Layer 3 VPN
  - L2VPN: All sites in same subnet
  - L3VPN: Each Site is in separate subnet.
- No Encryption by default.
- Tunnel MAC address Range : 00:00:5E:80:00:00 - 00:00:5E:FF:FF:FF
- IPsec for encryption as optional.
- Can be run over PPTP or IPIP Tunnel or any connections which is able to transport IP.

Why do we use EOIP?

- Case Scenario
  - Bridging the LANs of the Offices where are located in different Countries.
- Head Quarter's Requirement
  - Internet Line
  - Public IP
- Branch Office's Requirement
  - Internet Line
  - Public IP
- EOIP Solution which can bridge office LANs across internet ☺.

Case Scenario of Bridging Multiple Office LANs



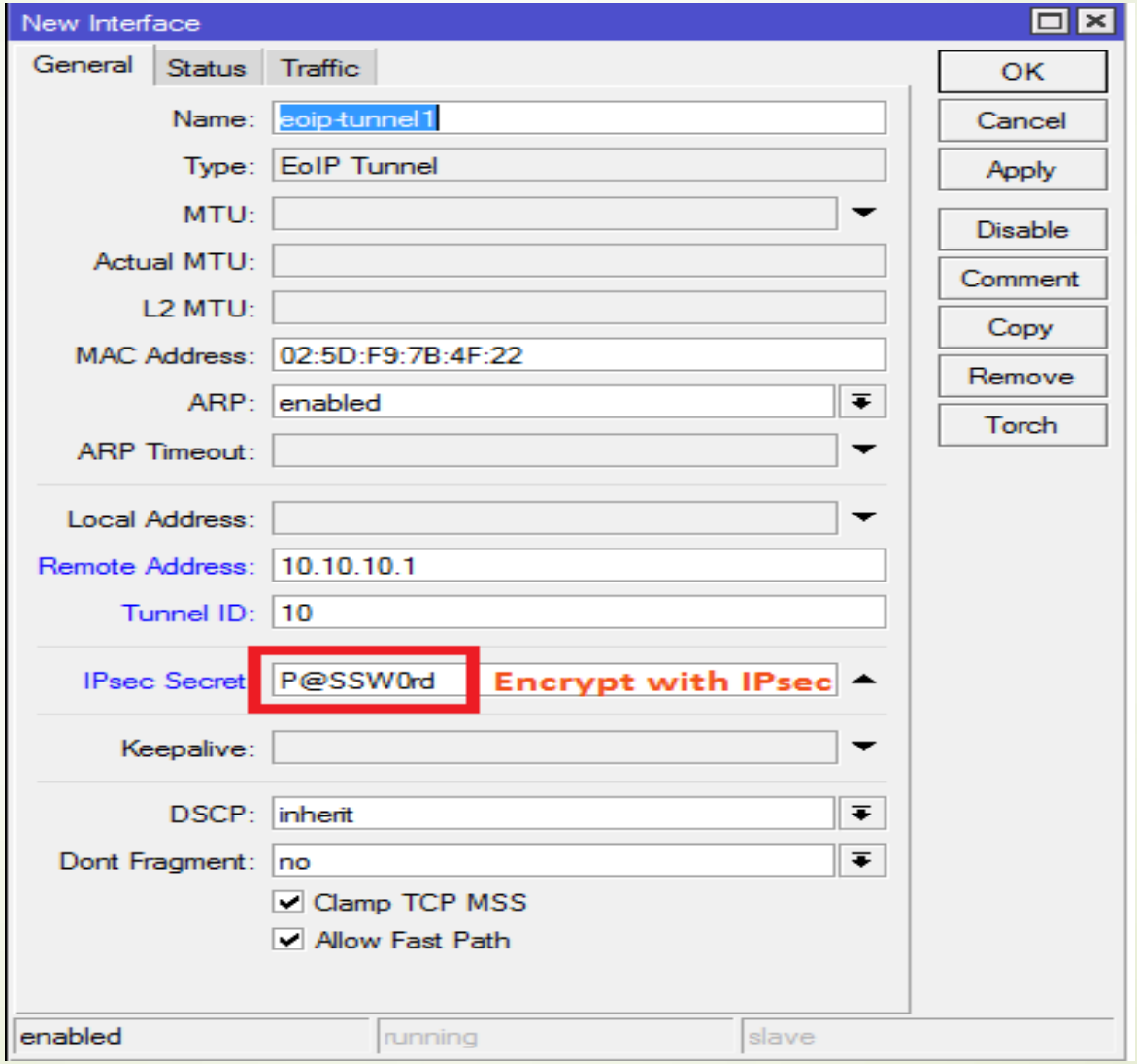
Pros and Cons

- Pros
  - Office LANs can be in same subnet by bridging EOIP and LAN .
- Cons
  - No Encryption by default.
  - Can cause Layer 2 Loop
    - Broadcast Domain, Unicast Flooding, MAC Table Instability..etc.
- Solutions for L2 Loop
  - STP(Spanning Tree Protocol)
  - RSTP (Rapid Spanning Tree Protocol)

How To Secure EOIP Tunnel

- By default, there is no Encryption.
- Optionally, IPsec Secret can be added for encrypting EOIP Traffic.
- Need to specify both local address and remote address of Tunnel.
- Automatically adds IPsec Peer with Pre-shared key and Policy with default-values (by default phase2 uses sha1/aes128cbc)

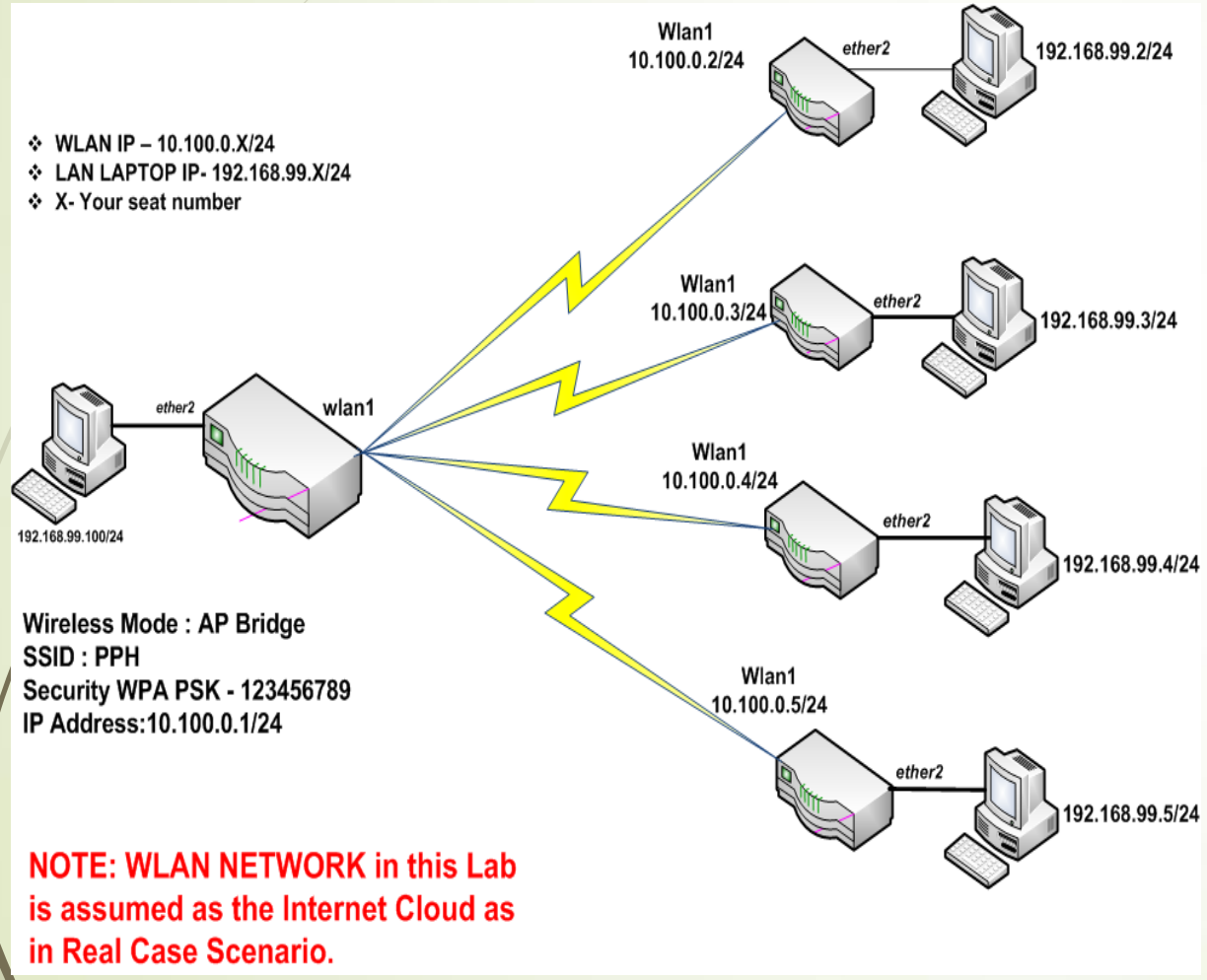
IPsec Secret For Encryted EOIP Traffic



MTU Factor Consideration

- Total MTU of EOIP – 1542 bytes
- MTU 1500+42 bytes EOIP Header ((8byte GRE + 14 byte Ethernet + 20 byte IP).
- Use Case : Bridging
  - L3MTU 1500, no change to underlying link MTU, fragmentation happens
  - L3MTU 1500, change underlying link MTU, no fragmentation
- Use Case : Routing
  - can set lower MTU to avoid EoIP GRE packets fragmentation
  - 1500-IP-Ethernet-GRE=1458

LAB SETUP



- **HUB Router**
  - Configure WLAN as AP Mode, SSID, Security Profiles.
  - Configure WLAN IP Address.
  - Configure LAPTOP IP as 192.168.99.1/24.
  - Configure EOIP Tunnels to each Branch Routers.
  - Create Bridge and Add EOIP Tunnel and LAN Port to the Bridge.
- **BRANCH Routers**
  - Configure WLAN as Station and Connect to HUB Router SSID.
  - Configure WLAN IP Address (10.100.0.X/24)
  - Configure LAPTOP IP to be the same subnet IP as Hub Routers. (192.168.99.X/24)
  - Create EOIP Tunnel to Hub Router.
  - Create Bridge and Add EOIP Tunnel and LAN Port to the Bridge.

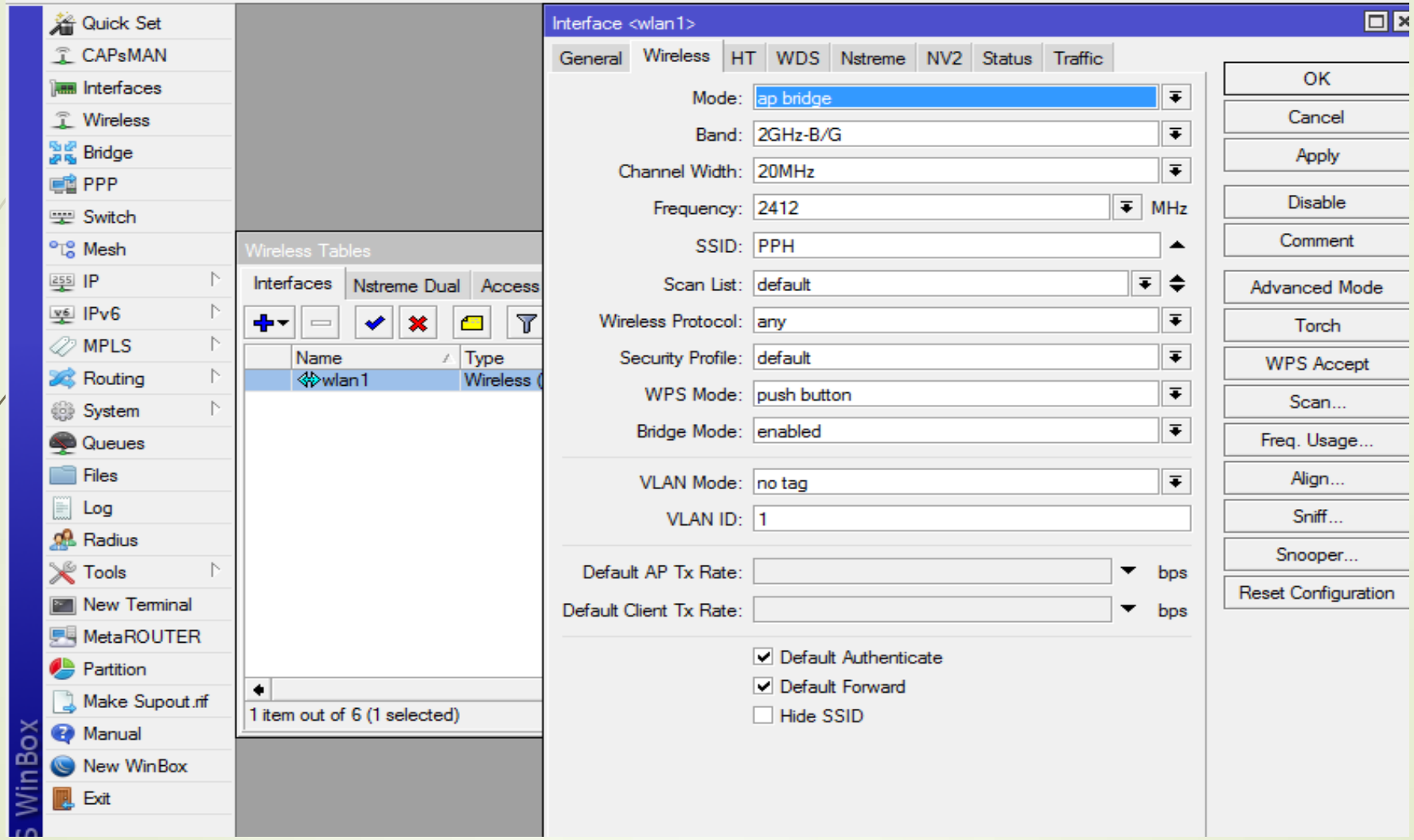
HUB ROUTER CONFIG

Basic Setup

Tunnel Configuration

Bridge Configuration and add ports to Bridge

Wireless AP Configuration



Wireless AP Security Profile

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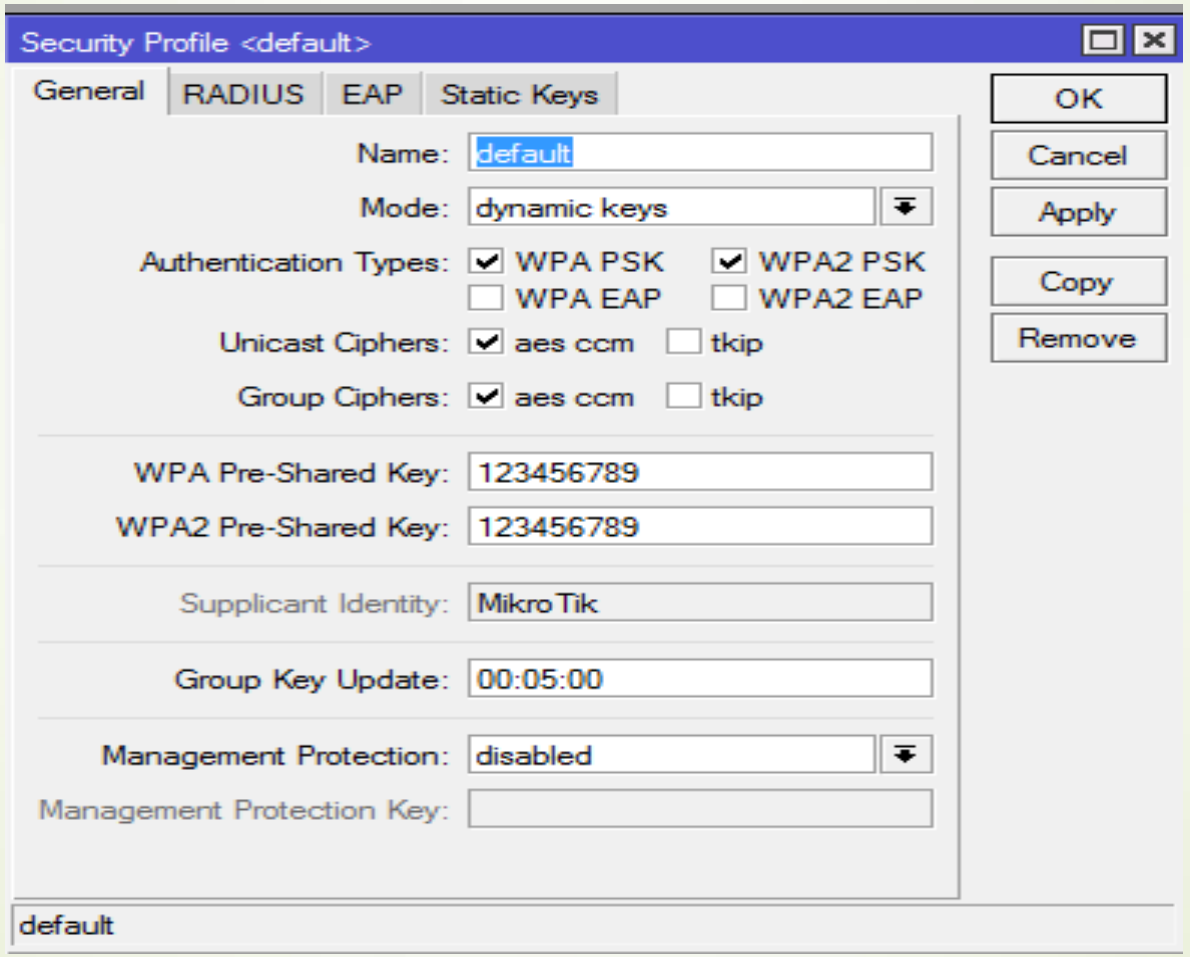
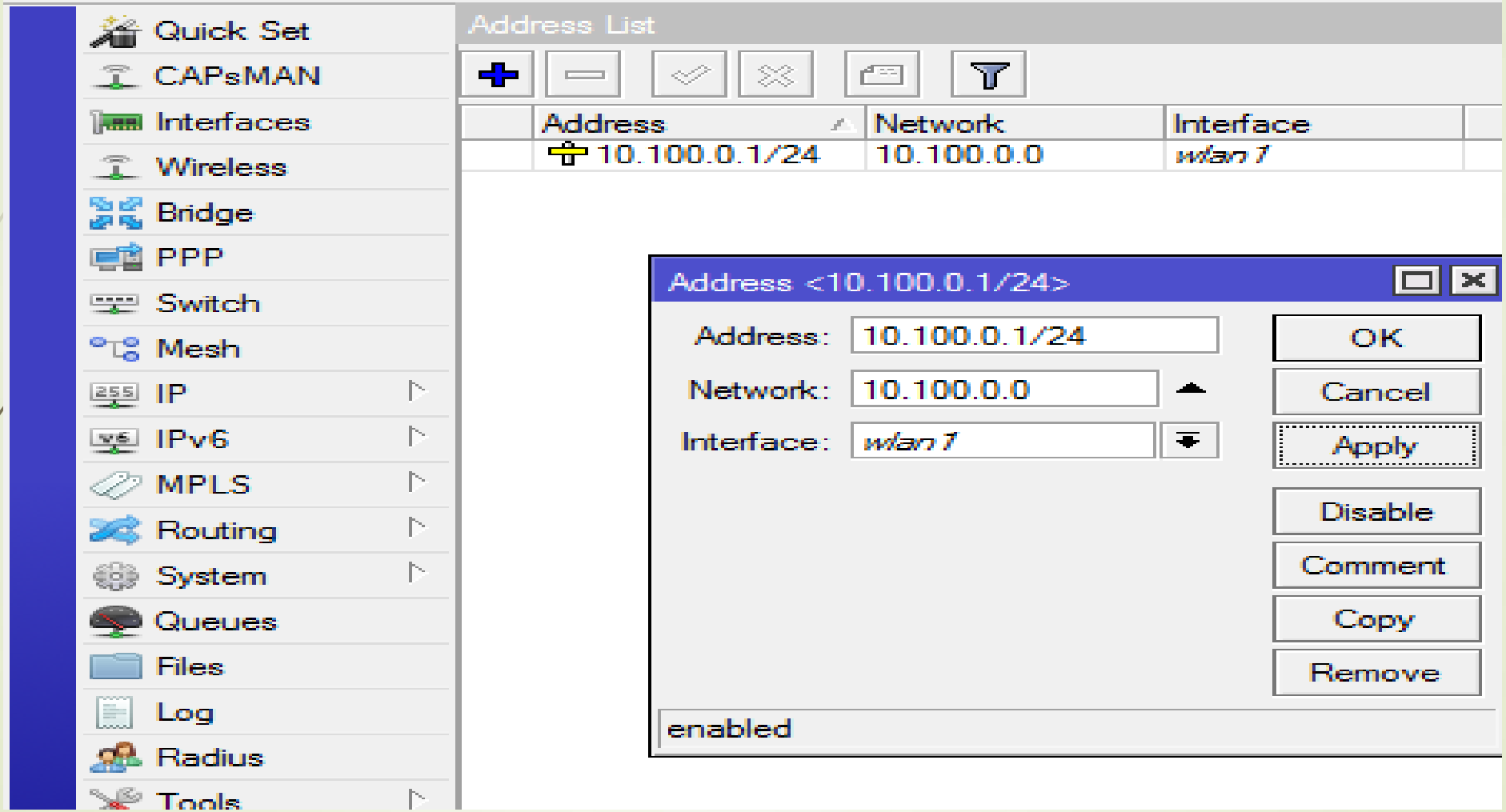
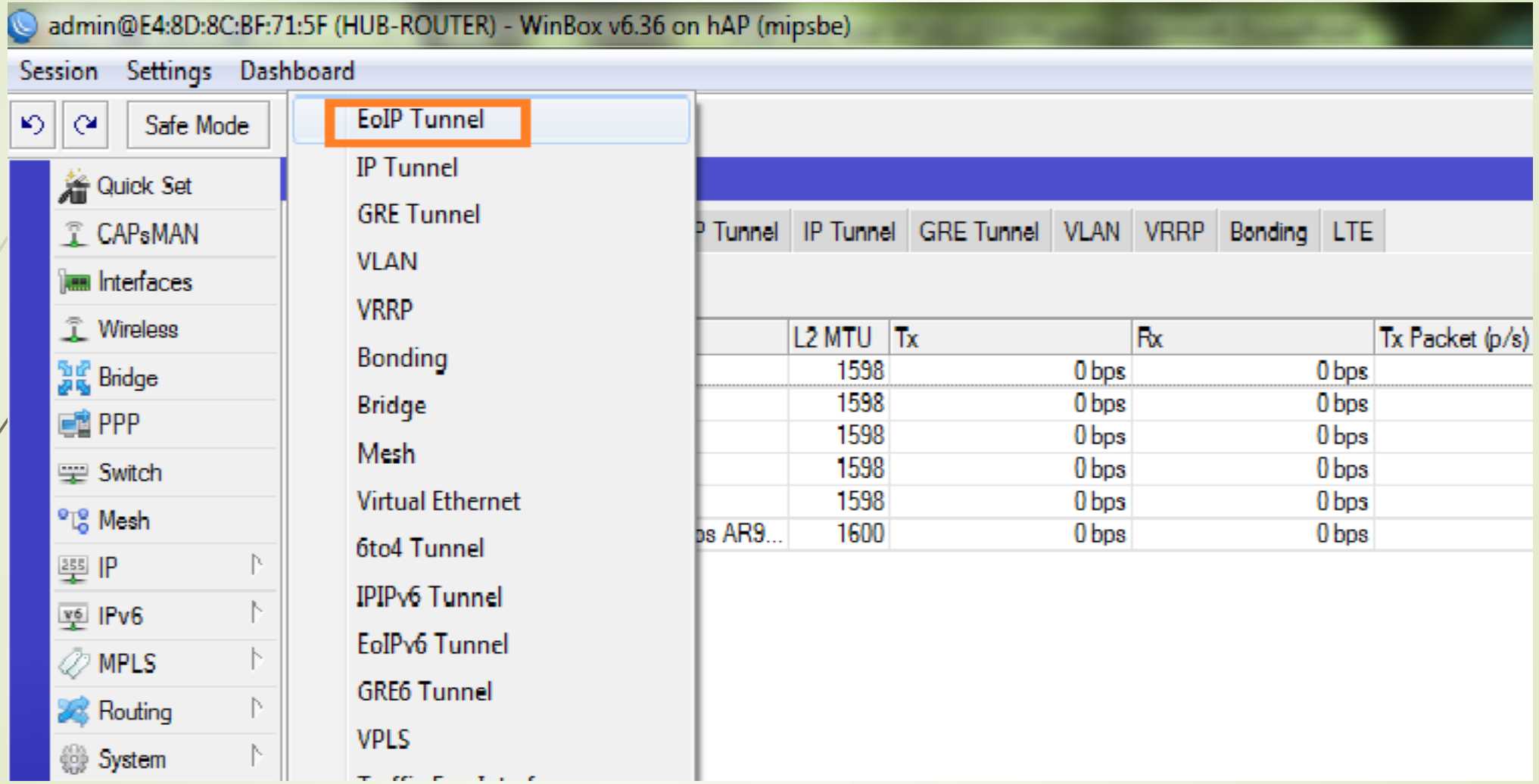
Wireless => Security Profile



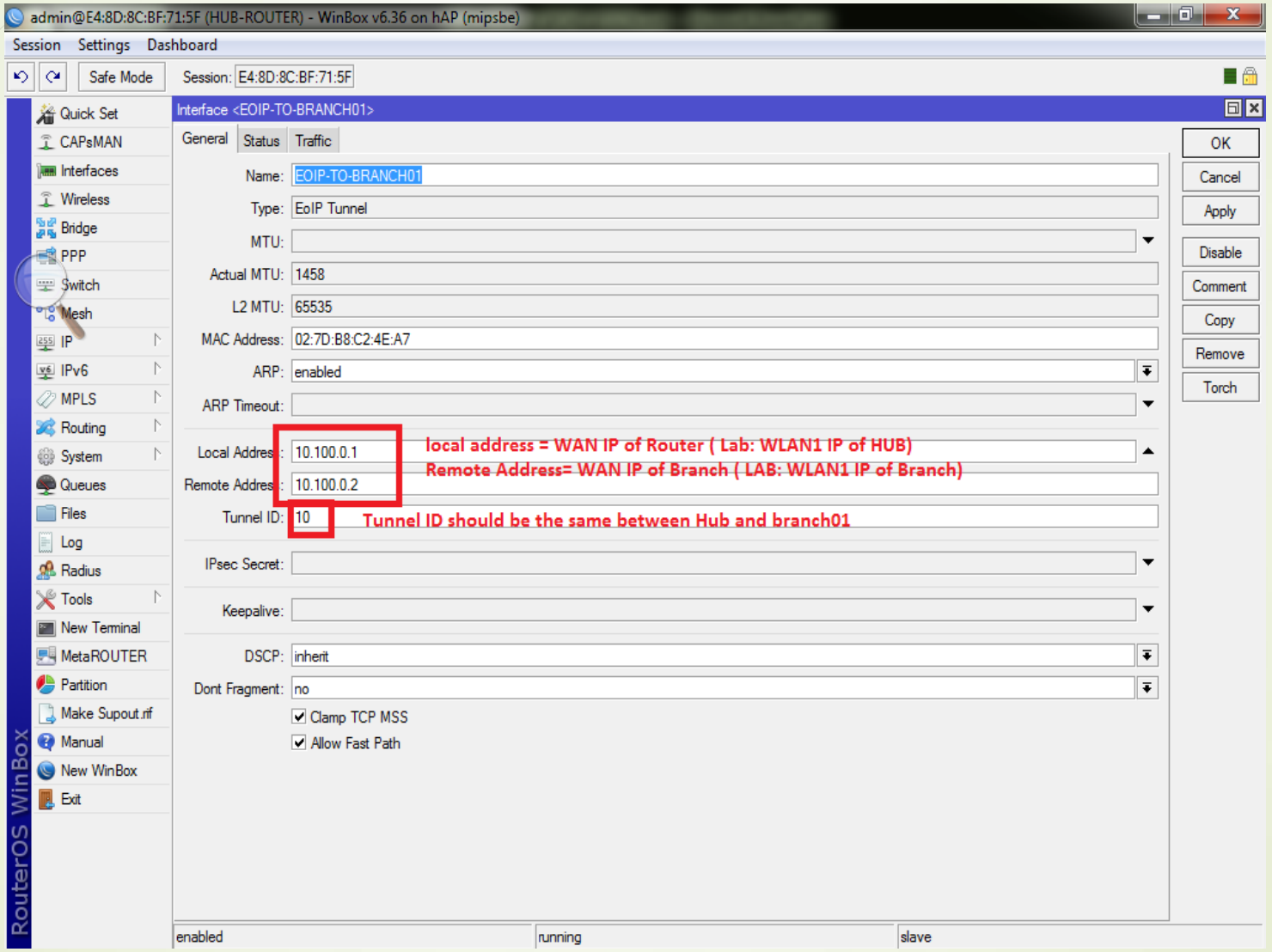
WLAN IP CONFIGURATION



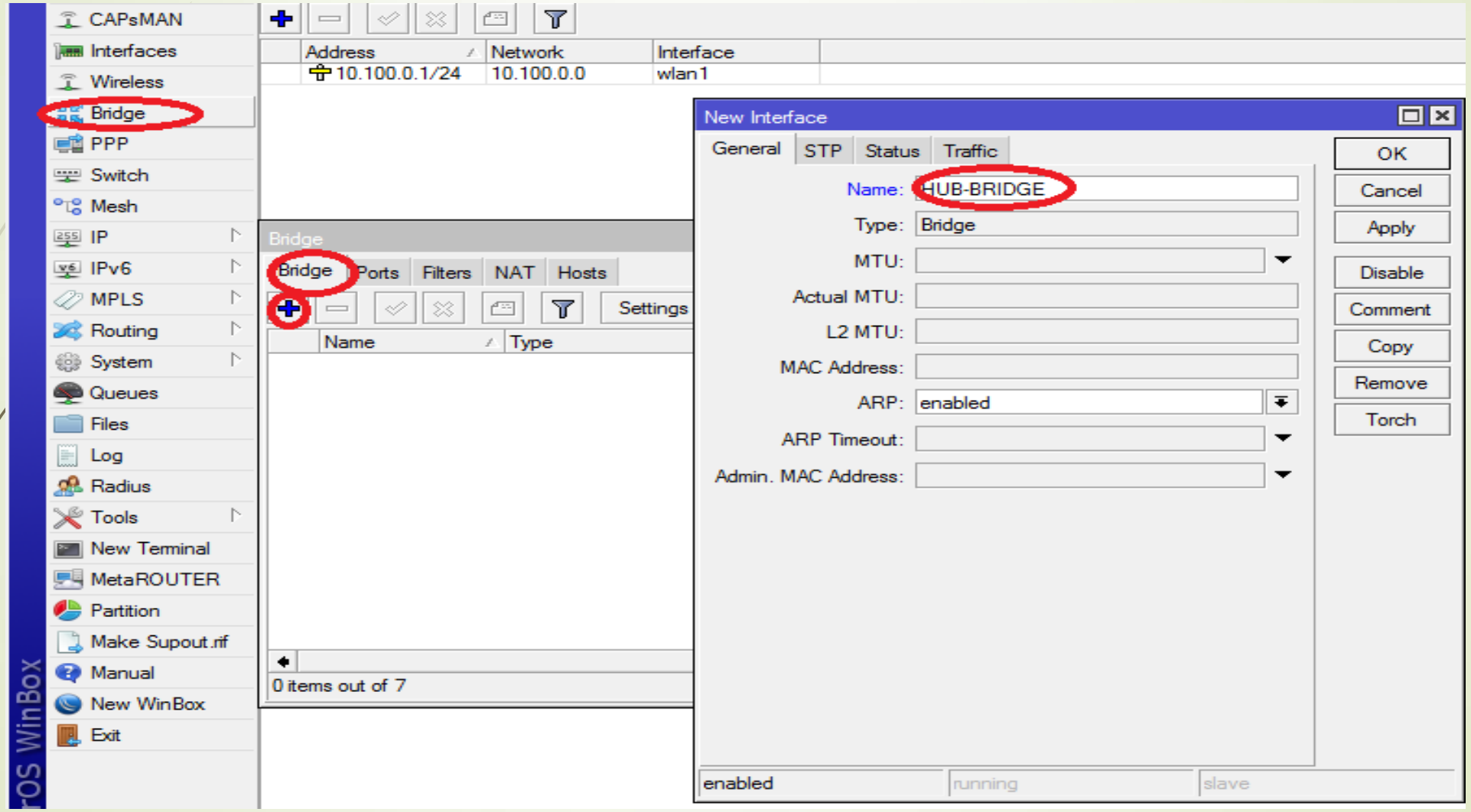
EOIP TUNNEL SET UP with BRANCH01



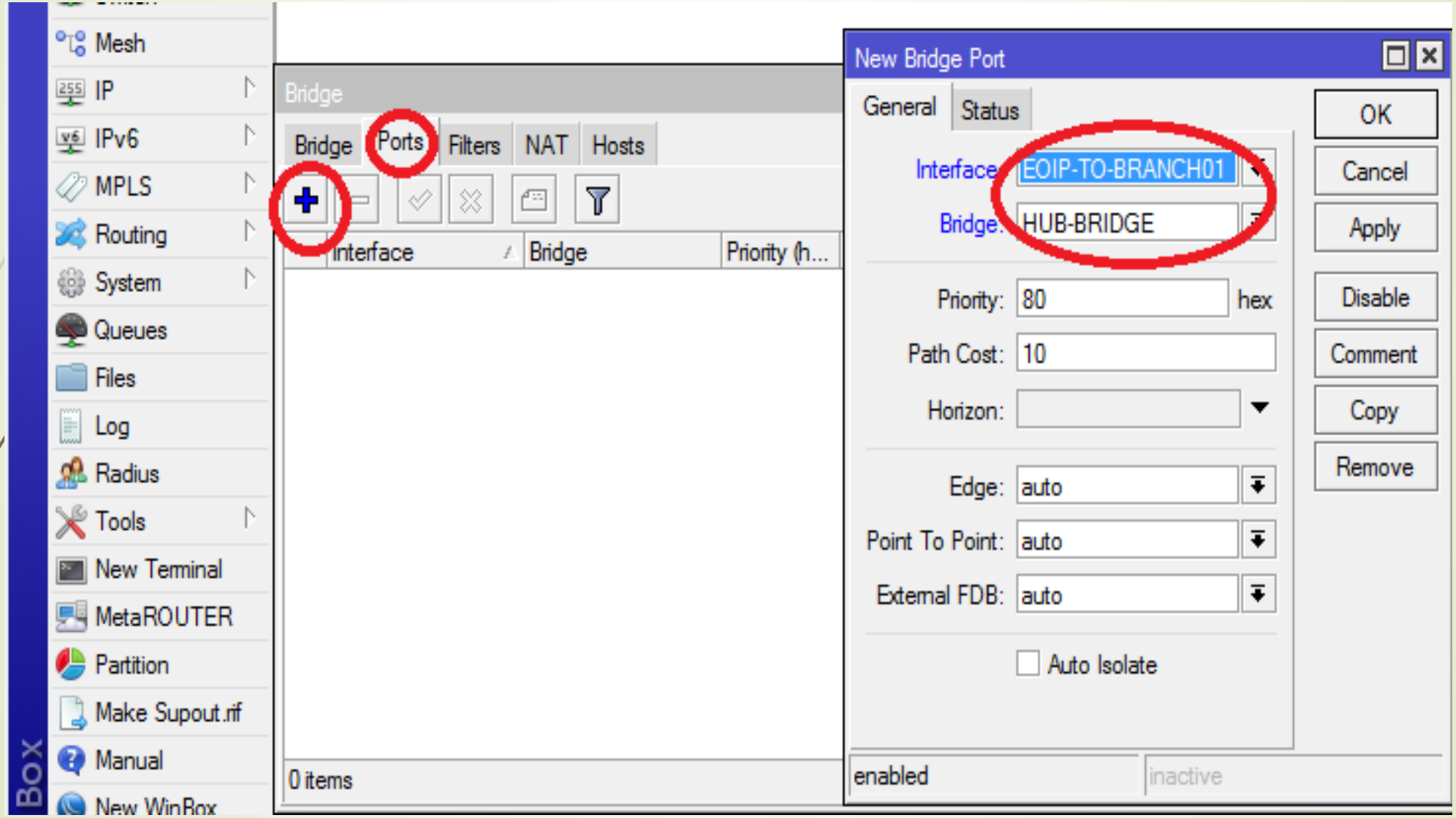
EOIP TUNNEL SETUP with BRANCH01



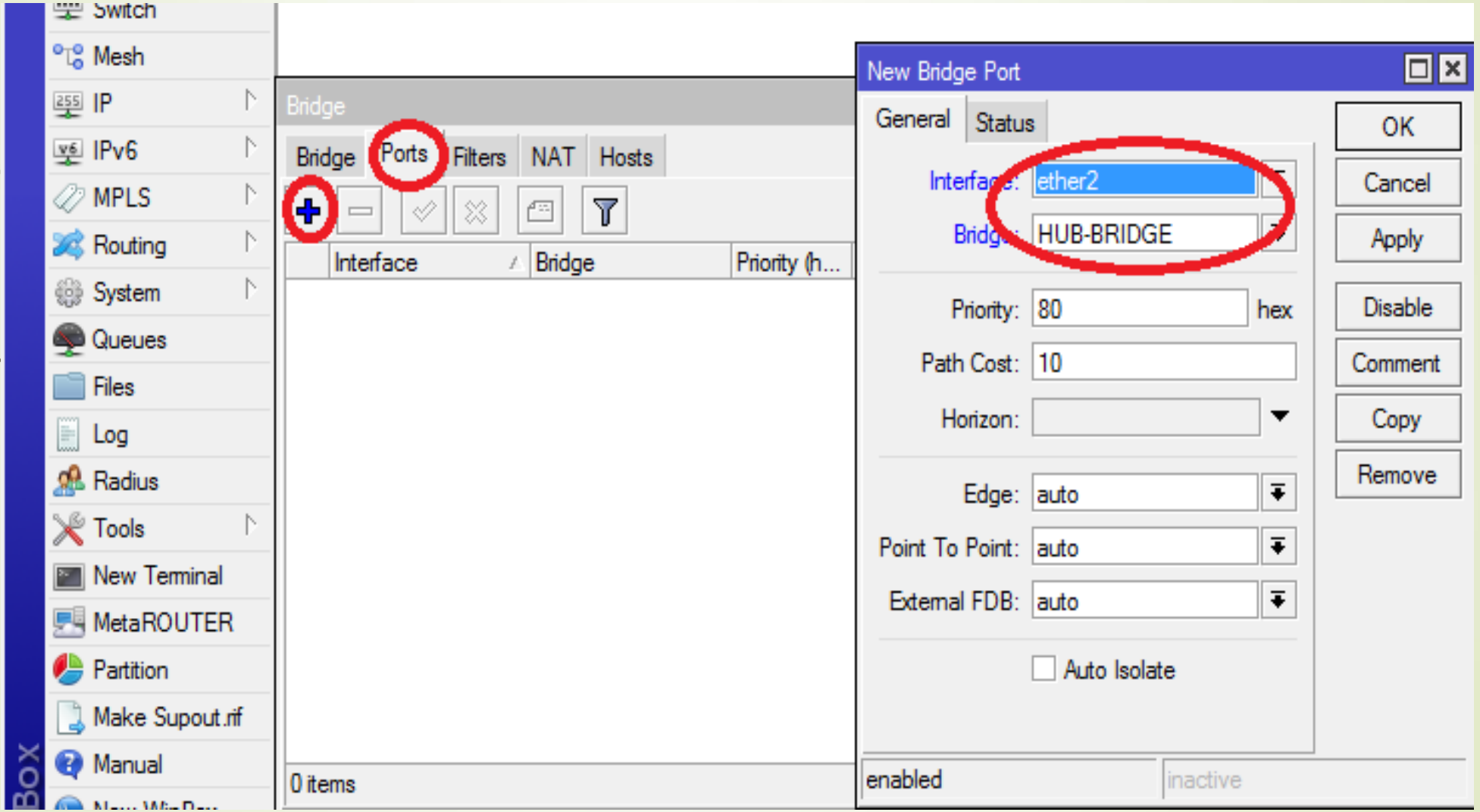
BRIDGE SET UP



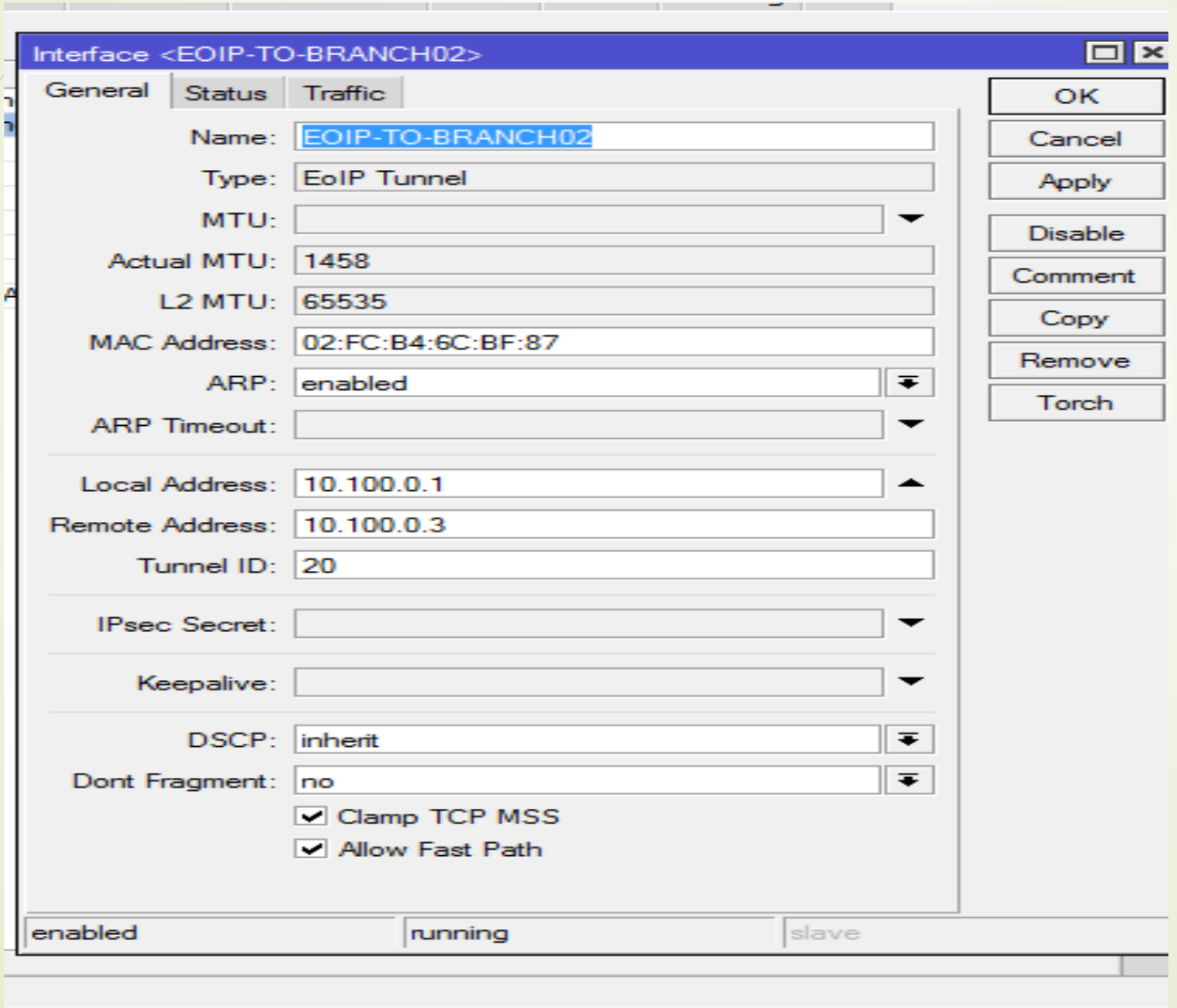
ADD EOIP TUNNEL TO BRIDGE PORTS



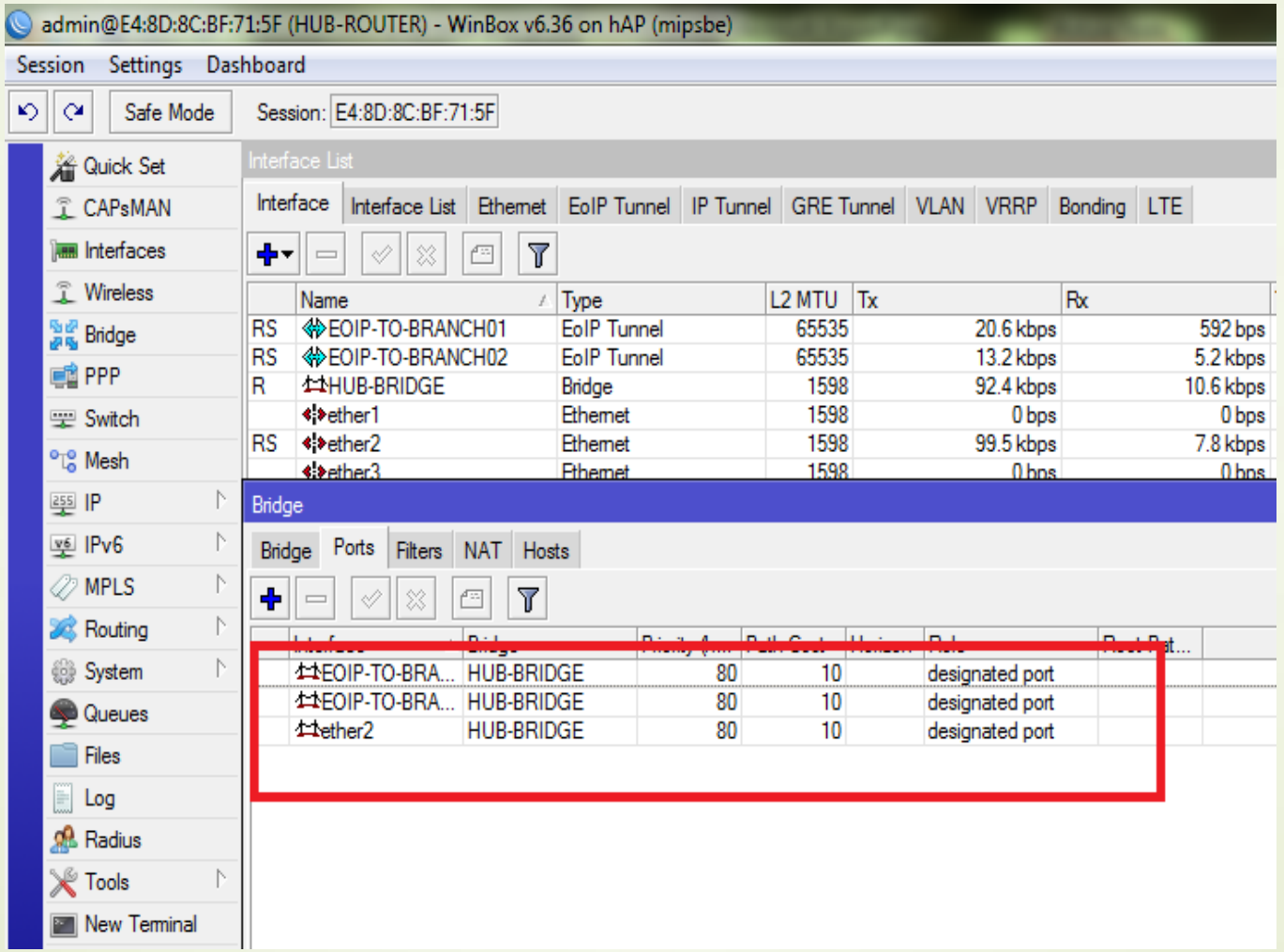
ADD LAN PORT TO BRIDGE PORTS



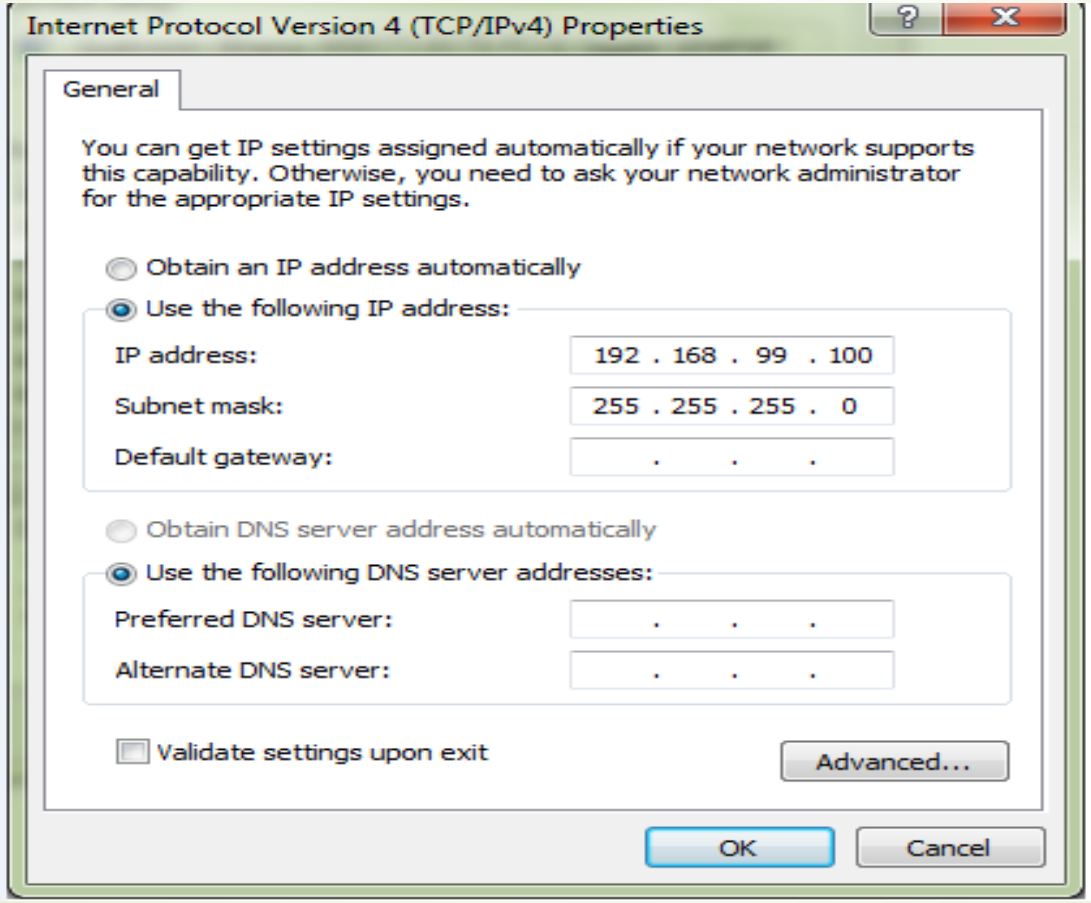
EOIP SETUP WITH BRANCH02



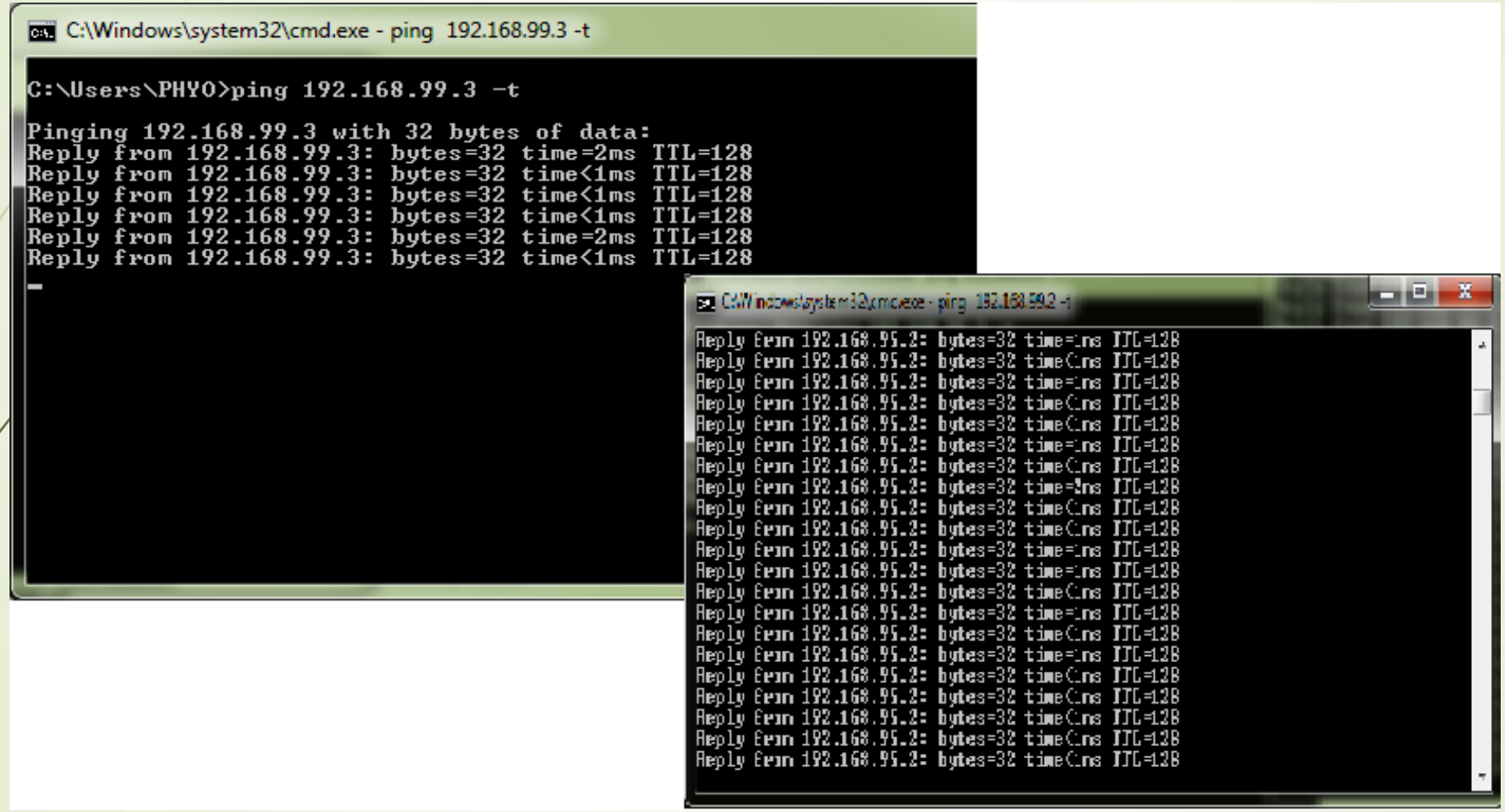
ADDING TUNNEL PORTS TO BRIDGE PORTS



ASSIGN IP TO LAPTOP'S LAN IP



PING TO BRANCH LAN IPs



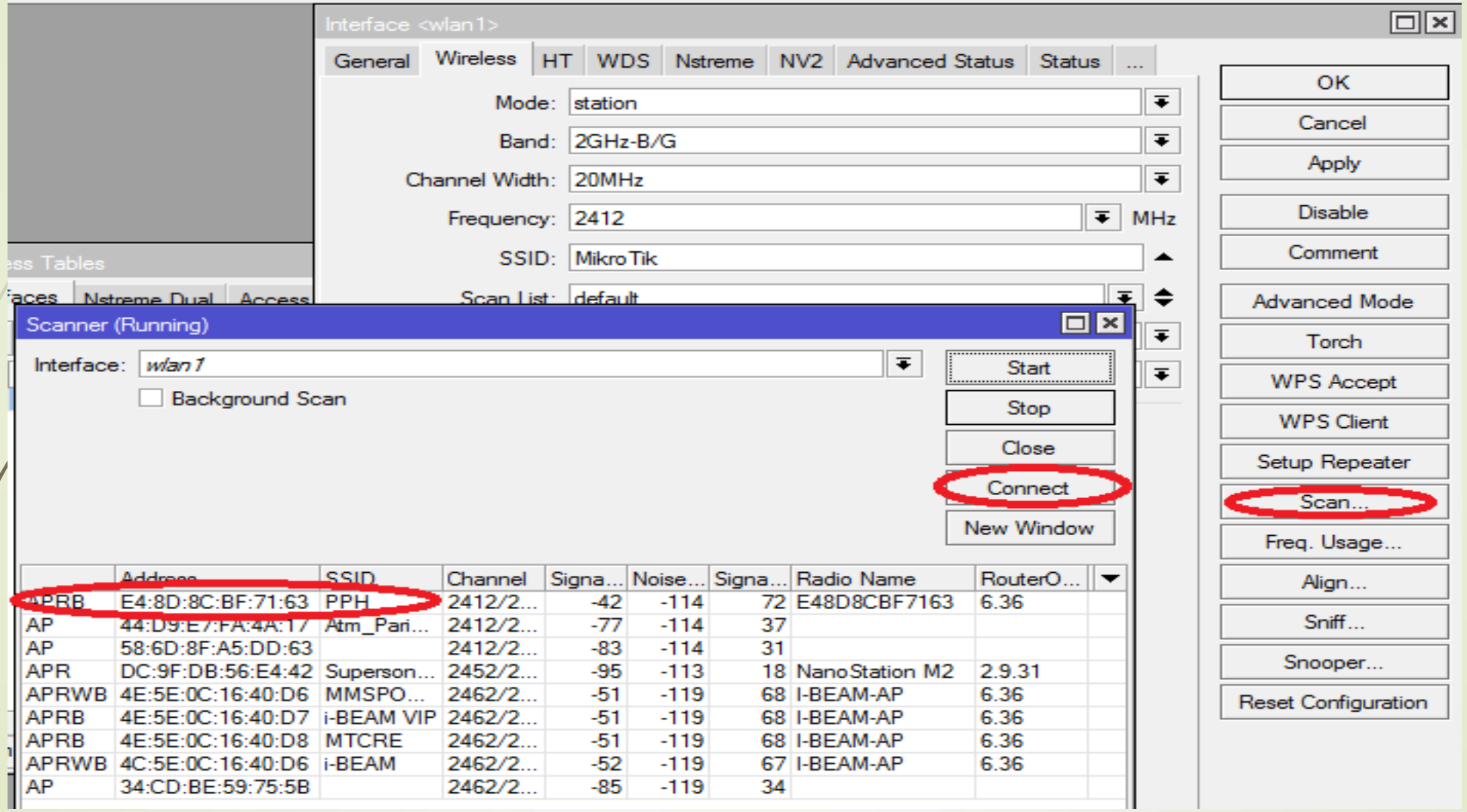
BRANCH ROUTER CONFIG

Connect to WLAN AP

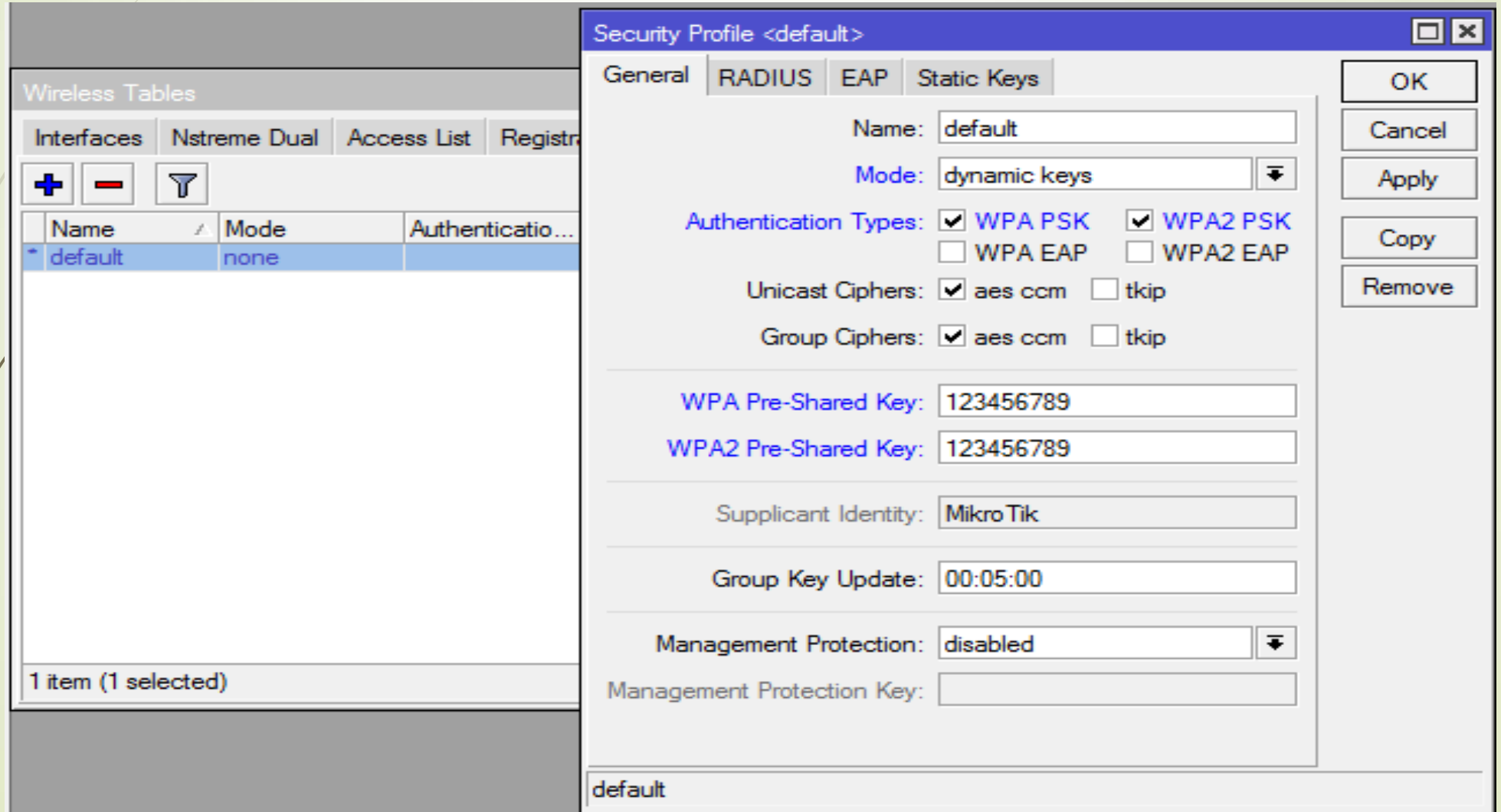
Tunnel Configuration

Bridge Configuration/Adding ports to Bridge

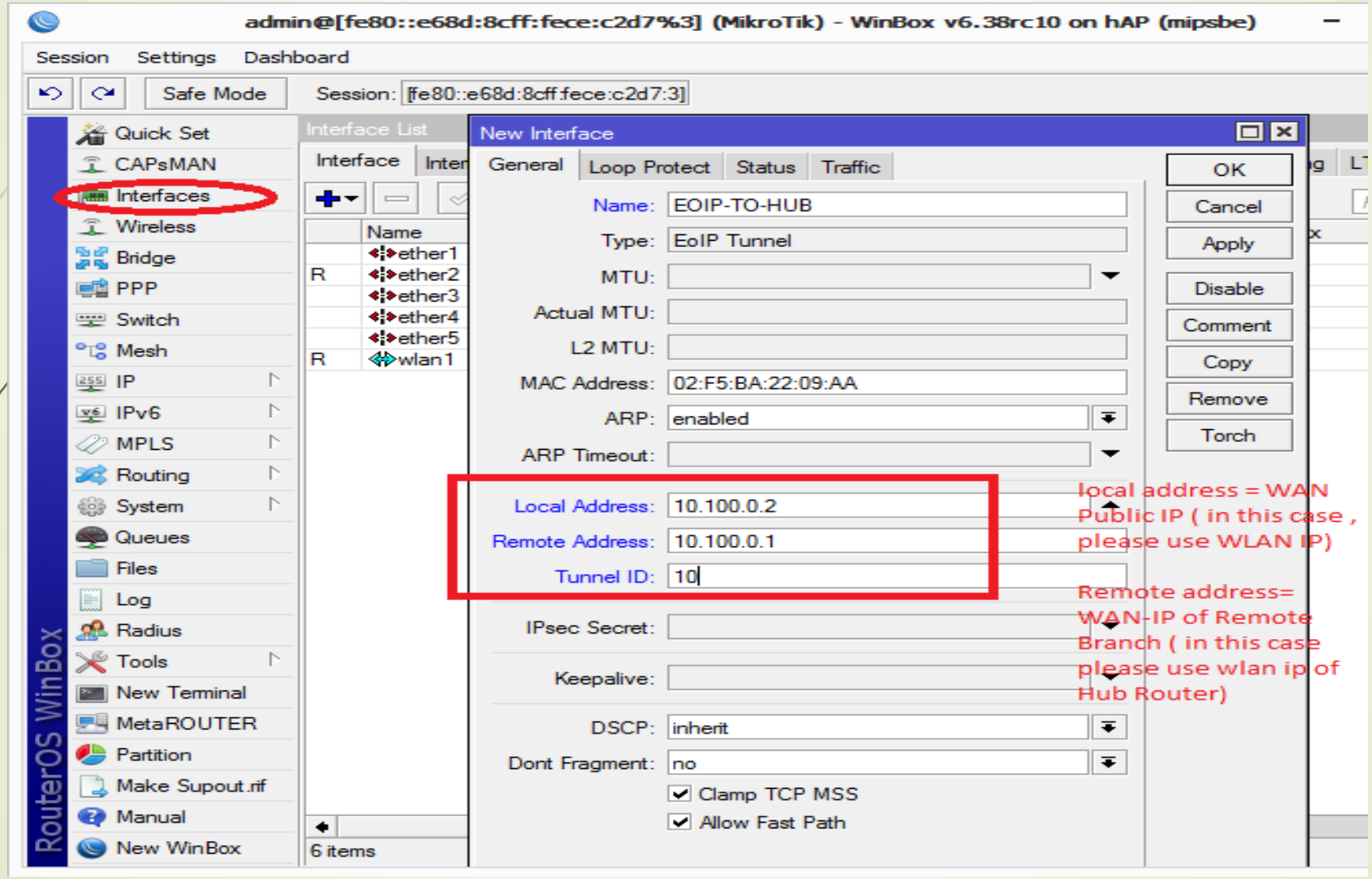
WIRELESS CONFIGURATION



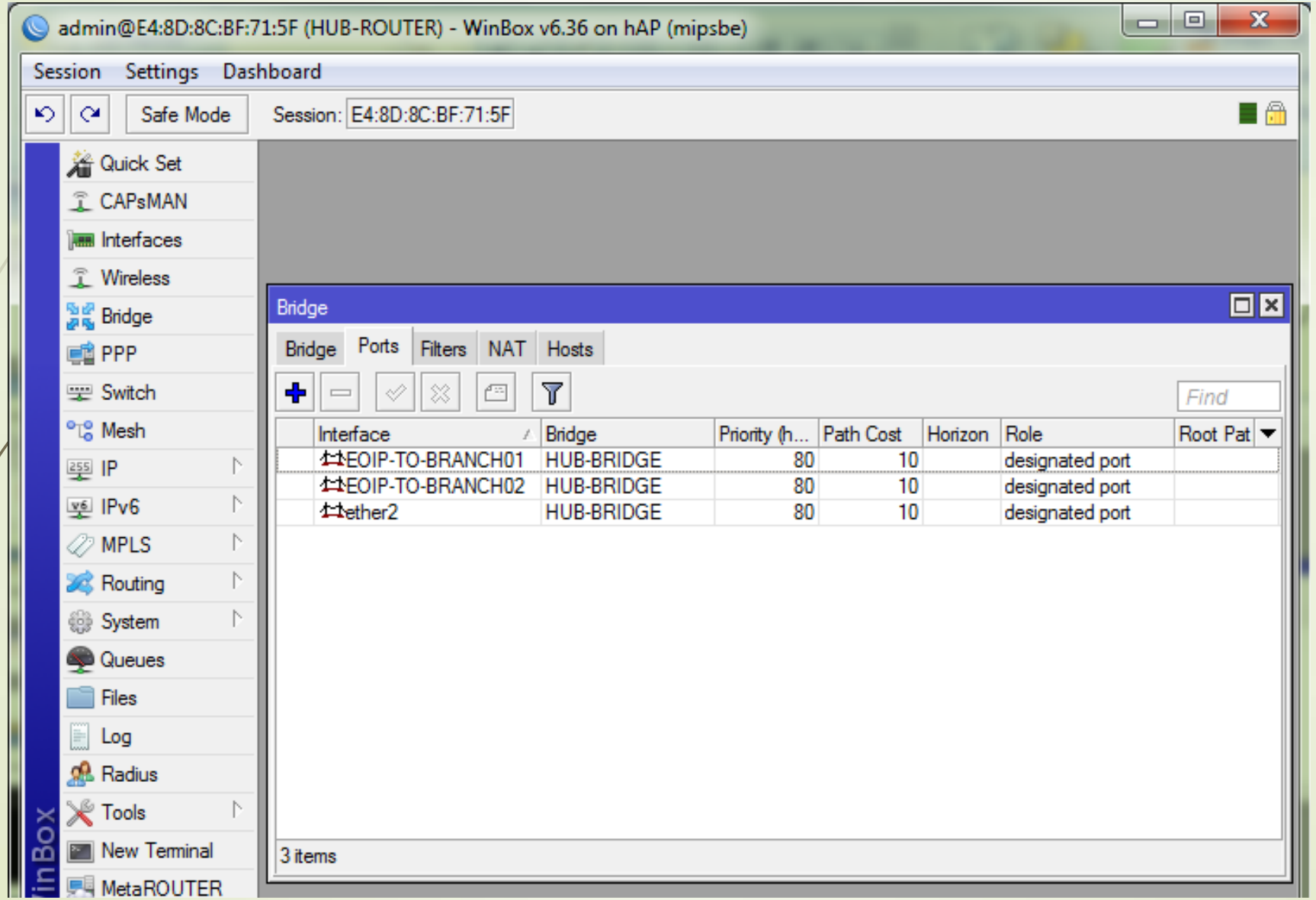
WIRELESS SECURITY PROFILE CONFIGURATION



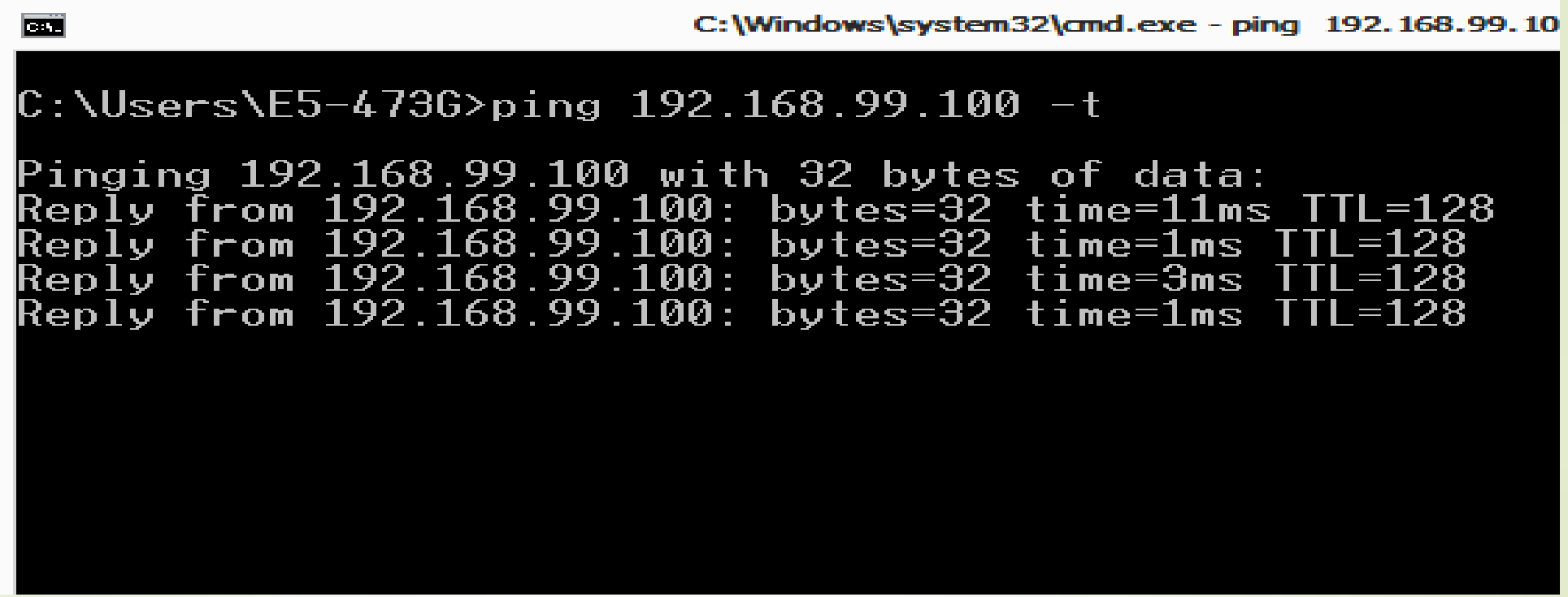
BRANCH ROUTER EOIP TUNNEL CONFIG



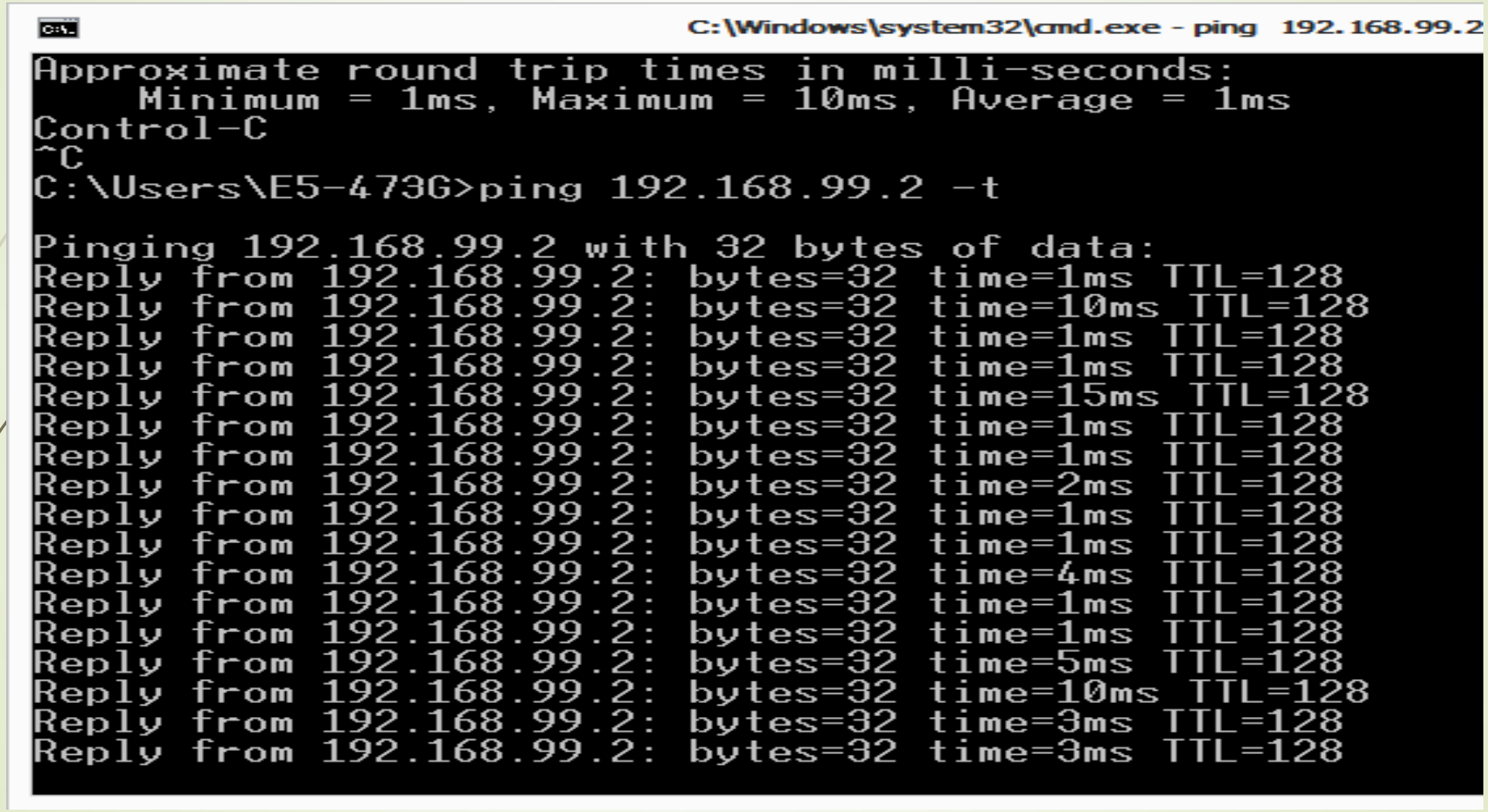
BRANCH ROUTER BRIDGE CONFIG



PING TO HUB LAN



PING FROM BRANCH TO BRANCH



SPANNING TREE PROTOCOL

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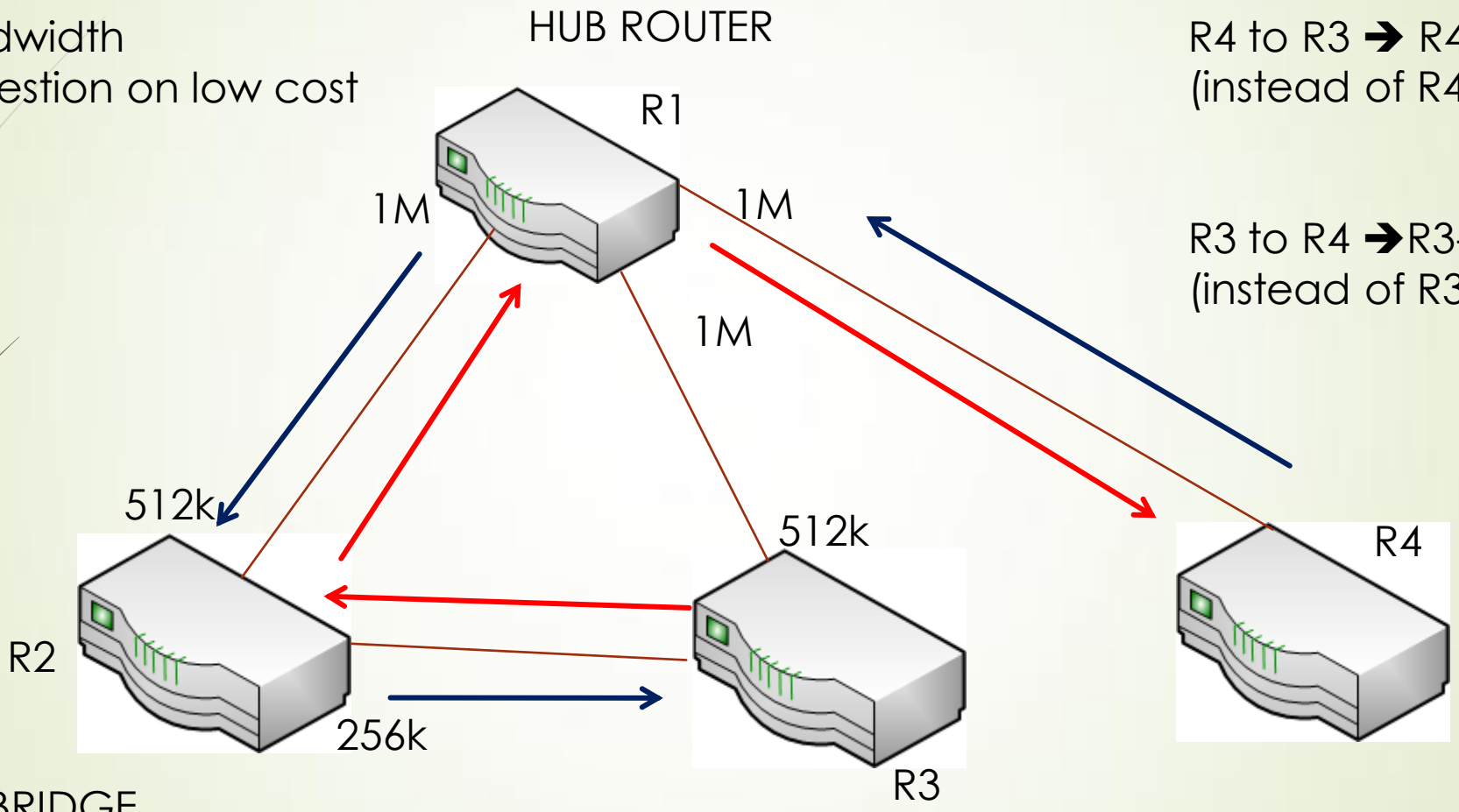
- Builds loop-free network for Ethernet Networks.
- Prevents L2 Bridging Loops
  - Broadcast Loop and Unicast Flooding Issues.
- Makes it easier for Redundancy Network Links without loop issue
  - When Primary Link is down, auto-failover to secondary link
  - Non-Designated (BLK) port changed to Forwarding State
- Selection of Root Bridge per Network
  - Lowest Priority
  - Priority Ties: Lowest MAC

Potential Issue In Hub and Spoke

- Wastes bandwidth
- Traffic Congestion on low cost bandwidth



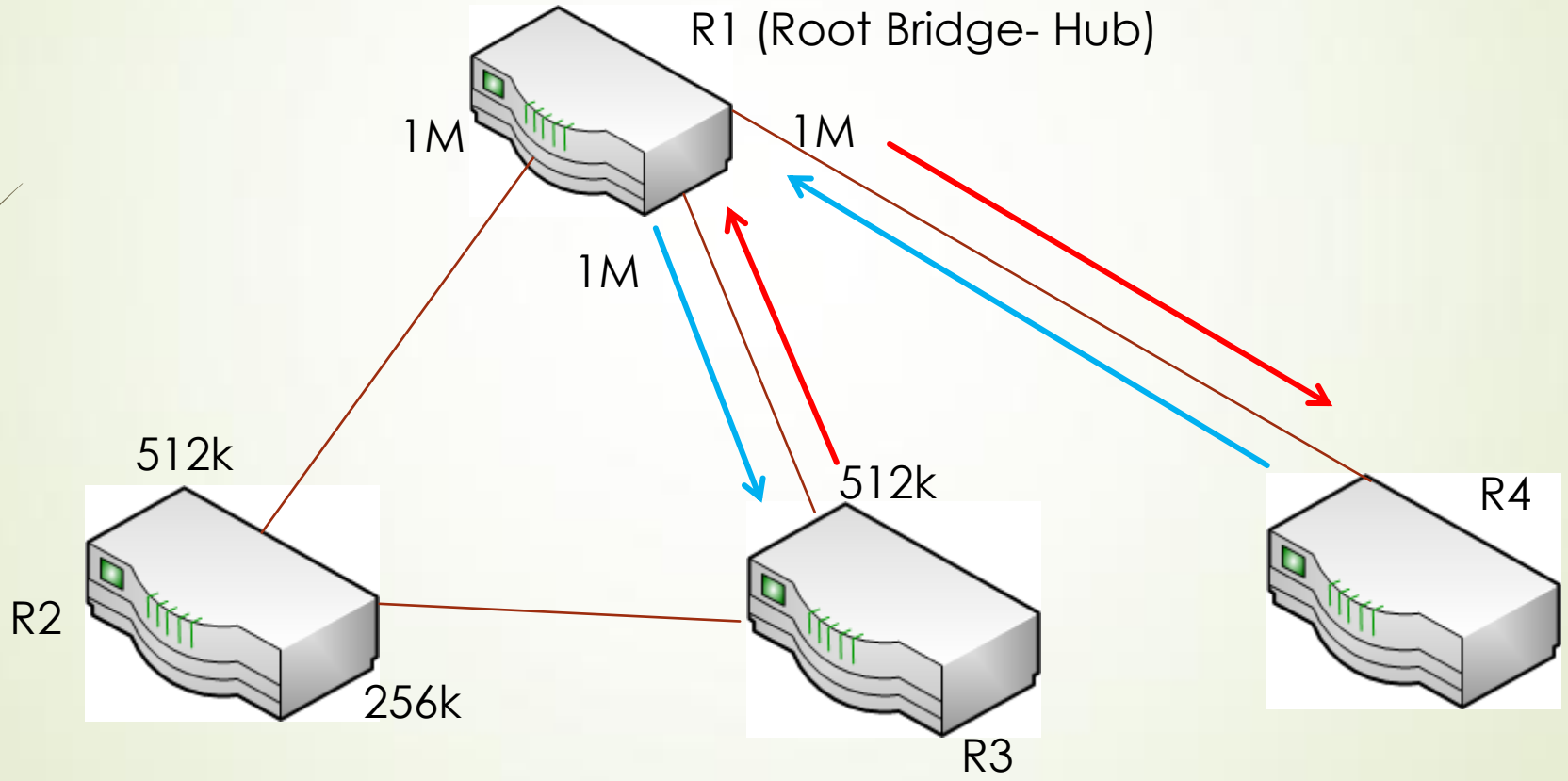
R4 to R3 ➔ R4-R1-R2-R3
(instead of R4-R1-R3)

R3 to R4 ➔R3-R2-R1-R4
(instead of R3-R1-R4)

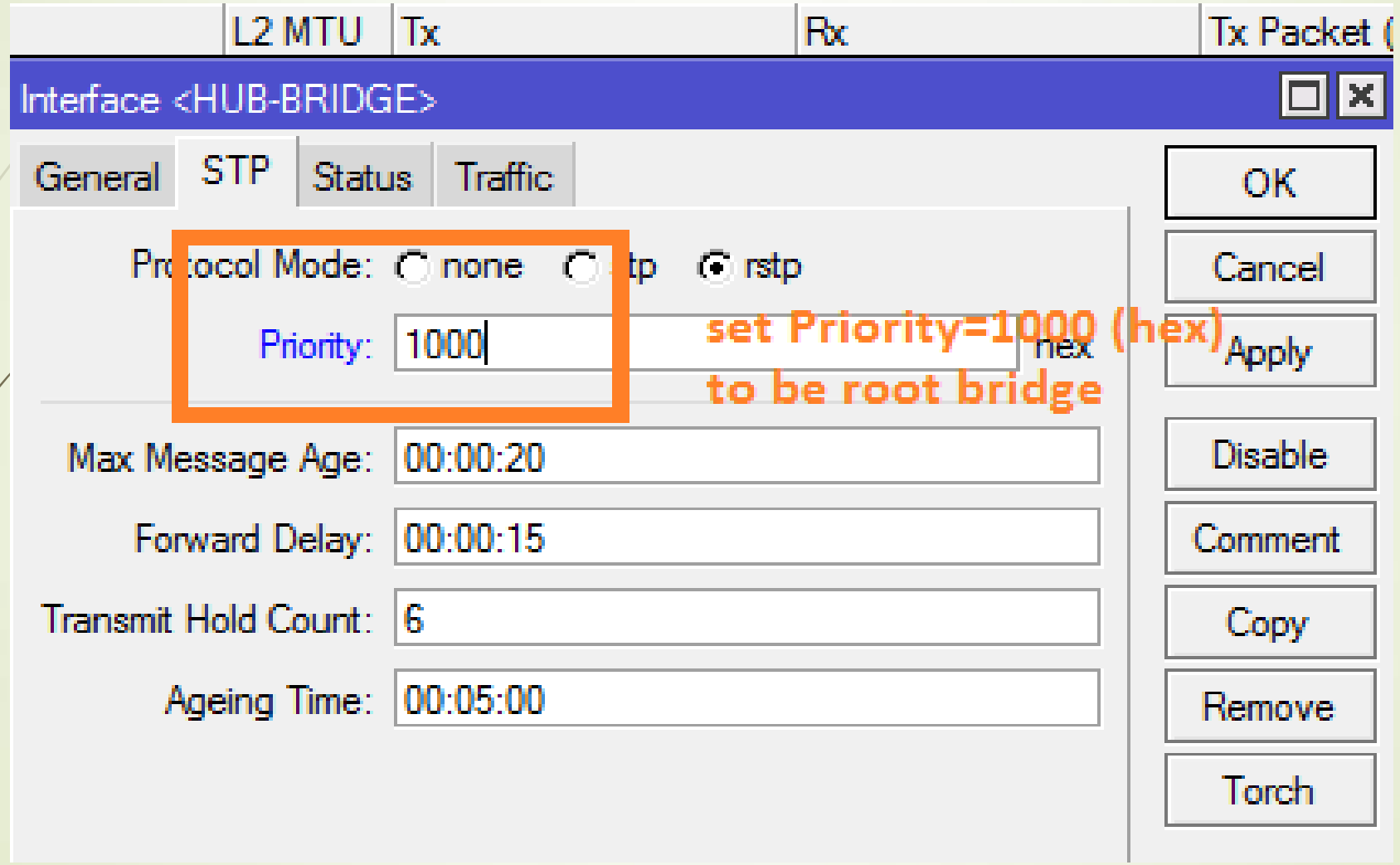
ROOT BRIDGE
(Lowest Bridge ID (Lowest Priority/Lowest MAC)

Solution !!!

R1 (Hub Router) should be set as root bridge in RSTP



ROOT BRIDGE SETTING



VERIFICATION OF ROOT BRIDGE

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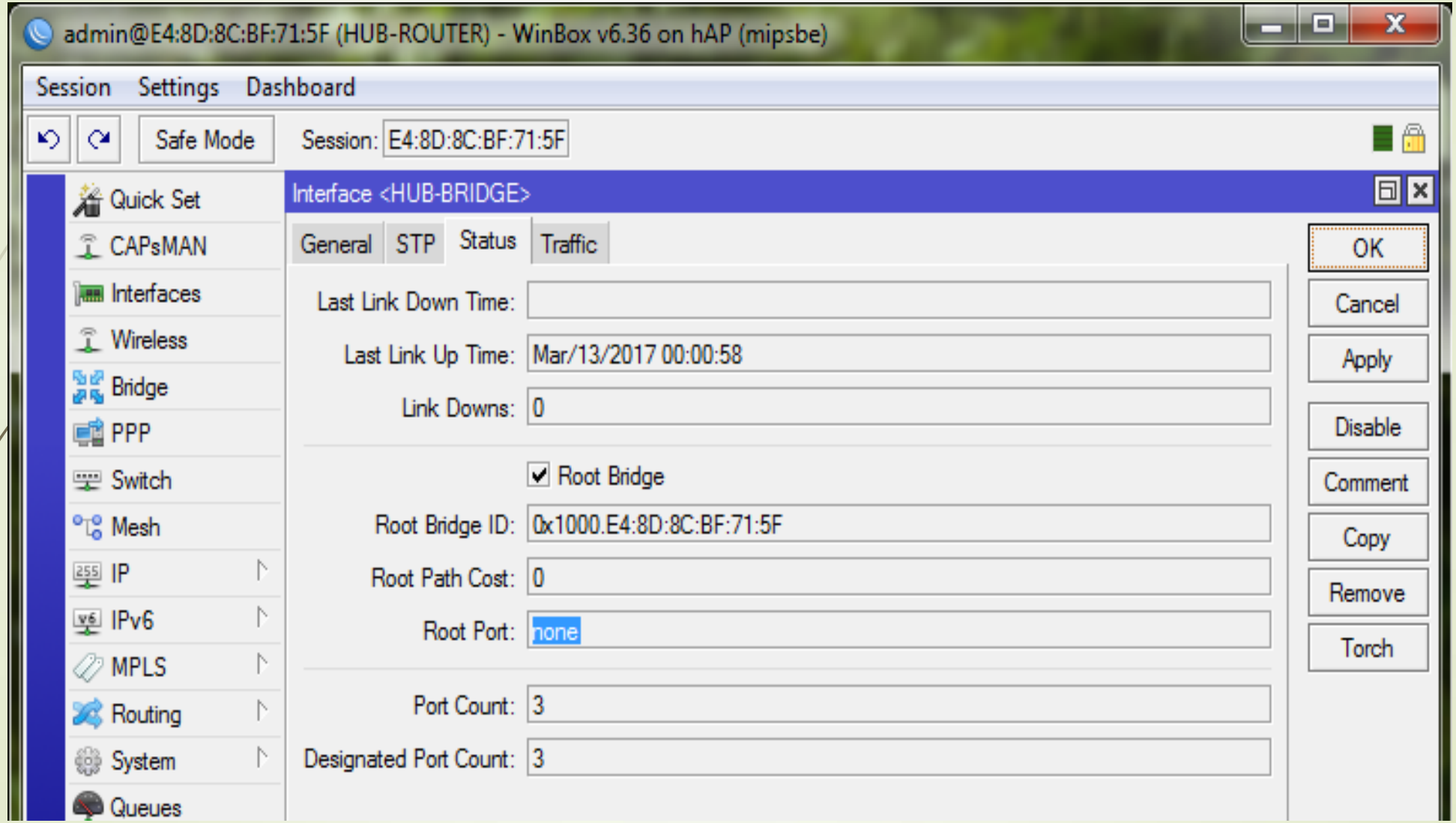

Q & A Section!!!

Please feel free to ask me if you have any question.

THANKS FOR YOUR ATTENTION!!!!