

MikroTik RouterOS

Online Training Class – Special Series 3

Burmese Version

1

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EOIP VPN in Hub and Spoke Topology

Presented by Phyo Phyo Hein

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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
 -      

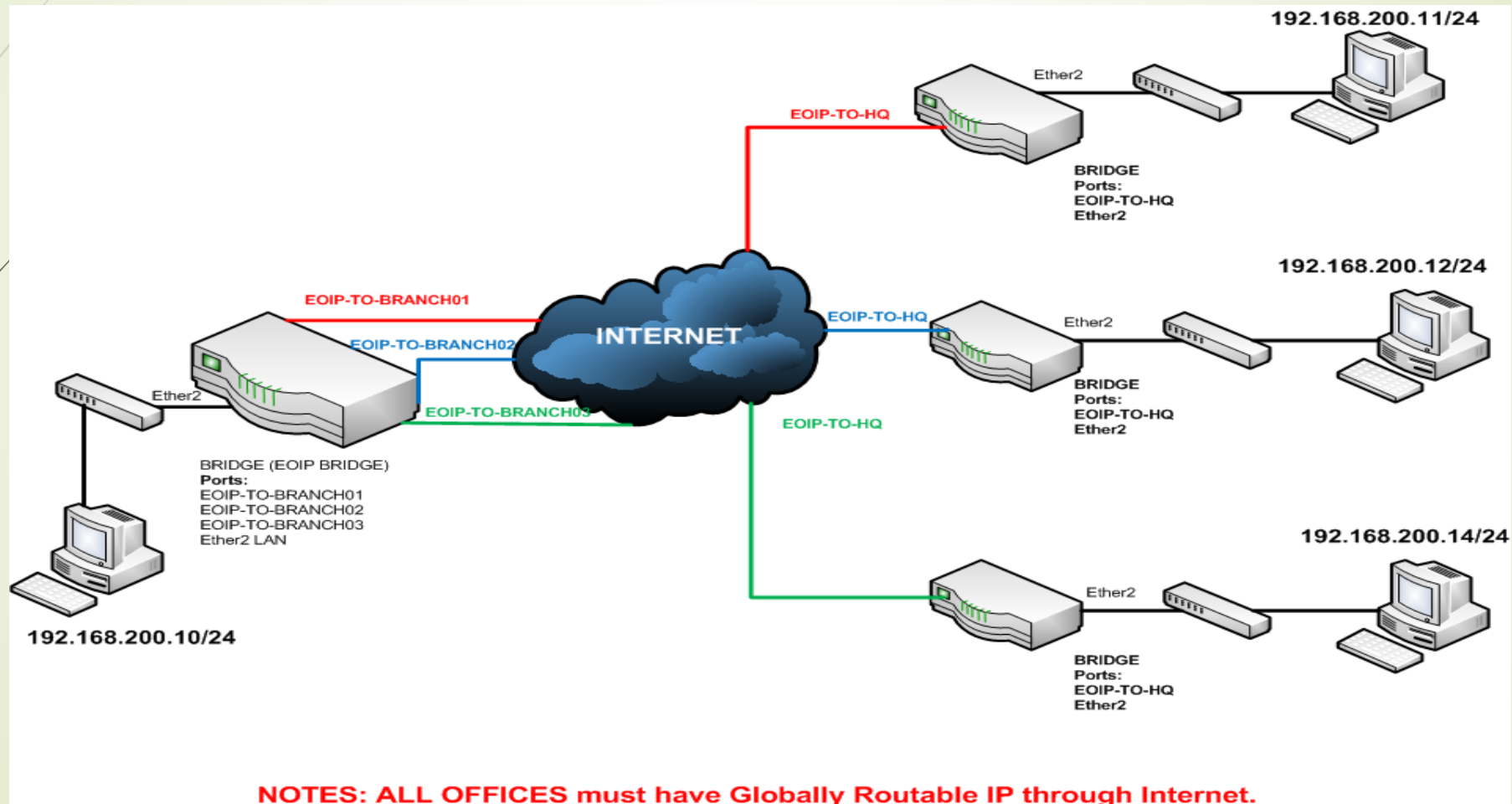
What is EOIP?

- 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



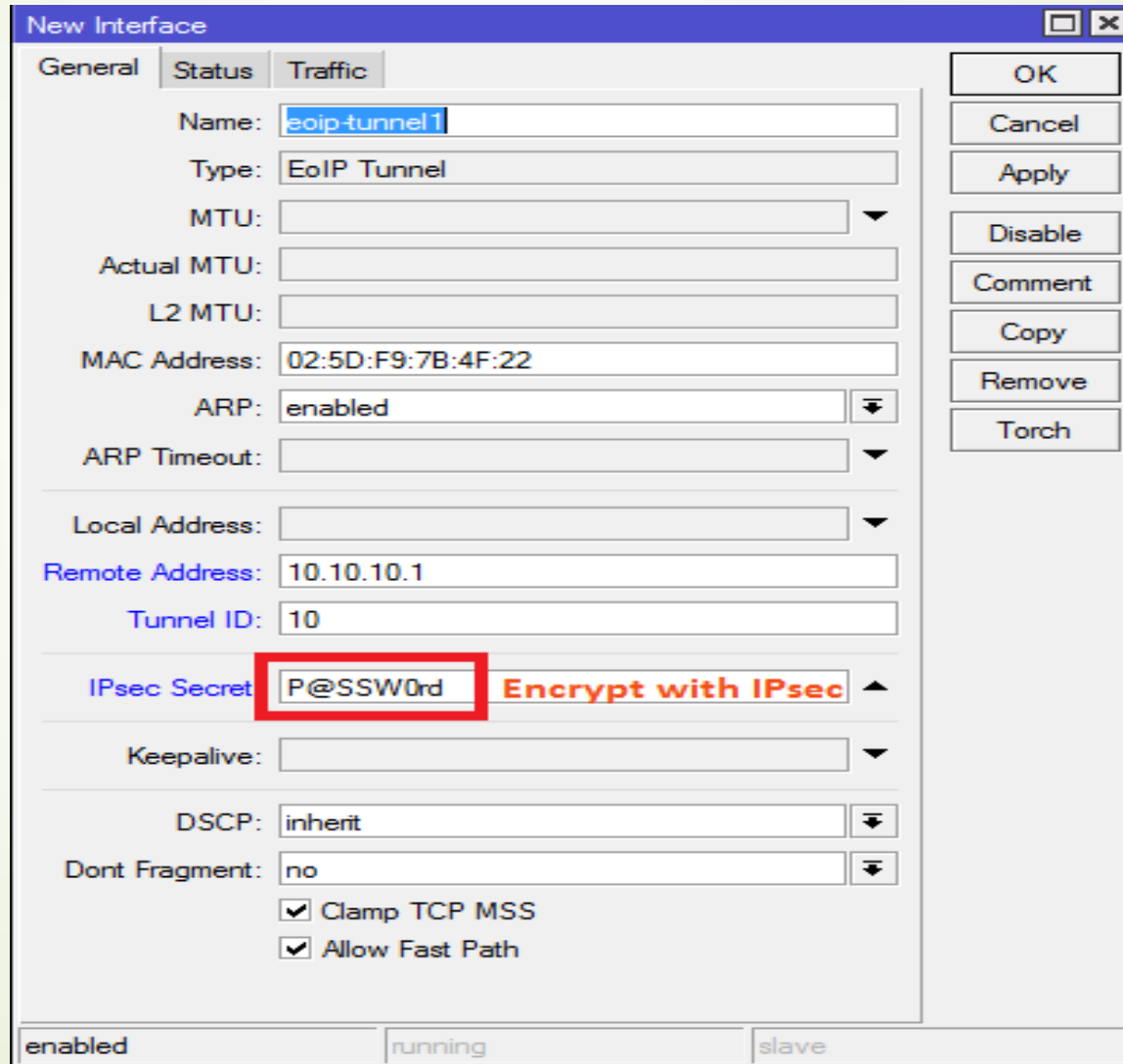
Pros and Cons

- 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 Encrypted EOIP Traffic



The image shows a 'New Interface' dialog box with the 'General' tab selected. The interface is for configuring an 'EoIP Tunnel'. The 'Name' field is 'eoiptunnel1'. The 'Type' is 'EoIP Tunnel'. The 'MTU' is empty. The 'Actual MTU' and 'L2 MTU' are empty. The 'MAC Address' is '02:5D:F9:7B:4F:22'. The 'ARP' is 'enabled'. The 'ARP Timeout' is empty. The 'Local Address' is empty. The 'Remote Address' is '10.10.10.1'. The 'Tunnel ID' is '10'. The 'IPsec Secret' is 'P@SSW0rd', which is highlighted with a red box. To the right of the secret field is a red label 'Encrypt with IPsec'. The 'Keepalive' is empty. The 'DSCP' is 'inherit'. The 'Dont Fragment' is 'no'. There are two checked checkboxes: 'Clamp TCP MSS' and 'Allow Fast Path'. On the right side of the dialog, there are buttons: 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', 'Remove', and 'Torch'. At the bottom, there are three status indicators: 'enabled', 'running', and 'slave'.

New Interface

General | Status | Traffic

Name:

Type:

MTU:

Actual MTU:

L2 MTU:

MAC Address:

ARP:

ARP Timeout:

Local Address:

Remote Address:

Tunnel ID:

IPsec Secret: **Encrypt with IPsec**

Keepalive:

DSCP:

Dont Fragment:

☒ Clamp TCP MSS

☒ Allow Fast Path

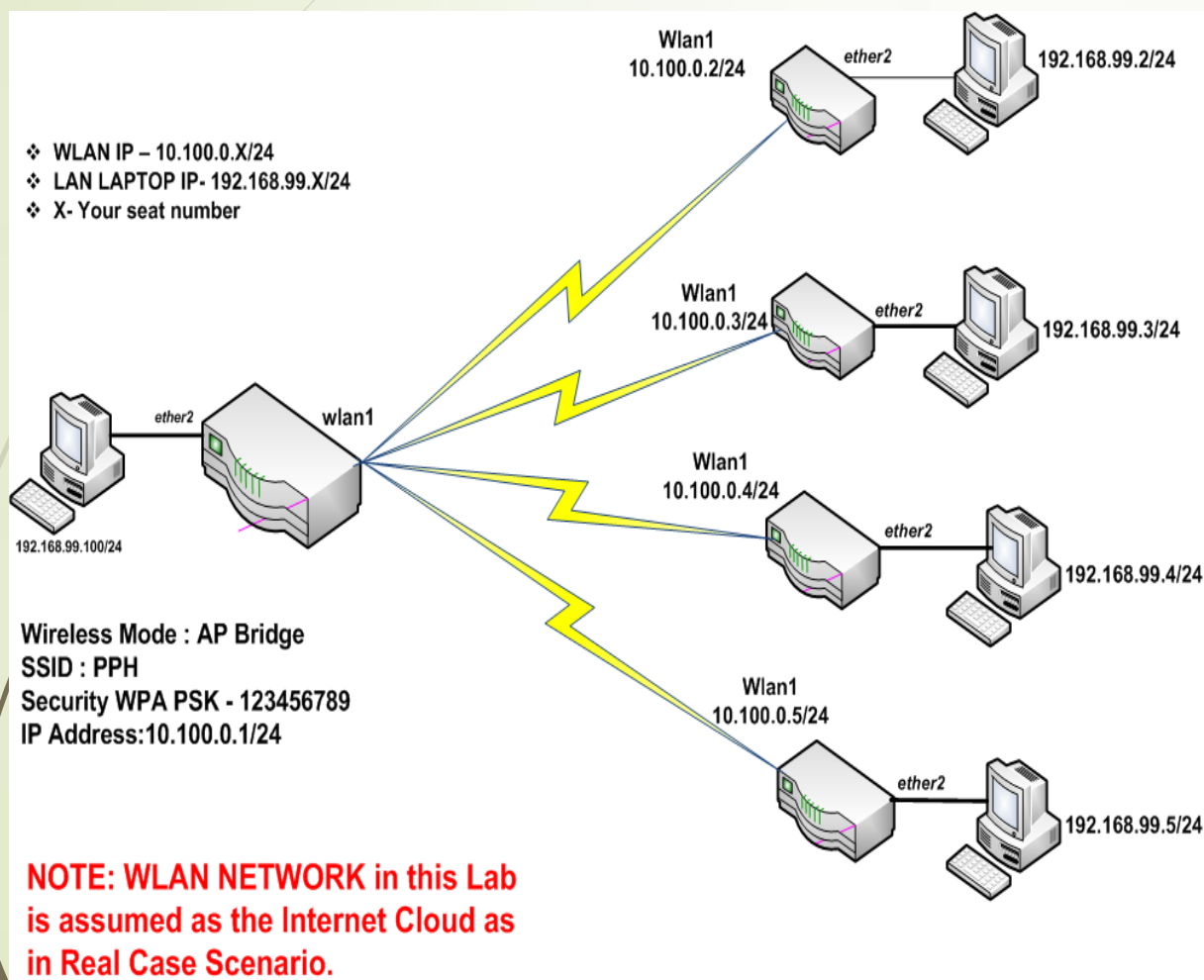
OK Cancel Apply Disable Comment Copy Remove Torch

enabled running slave

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
 - $1500 - \text{IP} - \text{Ethernet} - \text{GRE} = 1458$

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

The screenshot displays the WinBox configuration utility for a wireless access point. The left sidebar contains a navigation menu with categories like Quick Set, CAPsMAN, Interfaces, Wireless, Bridge, PPP, Switch, Mesh, IP, IPv6, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, MetaROUTER, Partition, Make Supout.rif, Manual, New WinBox, and Exit. The main window is titled 'Interface <wlan1>' and features several tabs: General, Wireless, HT, WDS, Nstreme, NV2, Status, and Traffic. The 'Wireless' tab is active, showing configuration parameters for the 'wlan1' interface. These parameters include Mode (set to 'ap bridge'), Band (2GHz-B/G), Channel Width (20MHz), Frequency (2412 MHz), SSID (PPH), Scan List (default), Wireless Protocol (any), Security Profile (default), WPS Mode (push button), Bridge Mode (enabled), VLAN Mode (no tag), and VLAN ID (1). At the bottom, there are checkboxes for 'Default Authenticate' (checked), 'Default Forward' (checked), and 'Hide SSID' (unchecked). On the right side of the window, a vertical stack of buttons includes OK, Cancel, Apply, Disable, Comment, Advanced Mode, Torch, WPS Accept, Scan..., Freq. Usage..., Align..., Sniff..., Snooper..., and Reset Configuration. A table titled 'Wireless Tables' is visible in the background, showing a list of interfaces with columns for Name and Type.

| Name | Type |
|-------|----------|
| wlan1 | Wireless |

Wireless AP Security Profile

Wireless => Security Profile

Security Profile <default>

General | **RADIUS** | EAP | Static Keys

Name: default

Mode: dynamic keys

Authentication Types: ☒ WPA PSK ☒ WPA2 PSK
☐ WPA EAP ☐ WPA2 EAP

Unicast Ciphers: ☒ aes ccm ☐ tkip

Group Ciphers: ☒ aes ccm ☐ tkip

WPA Pre-Shared Key: 123456789

WPA2 Pre-Shared Key: 123456789

Supplicant Identity: MikroTik

Group Key Update: 00:05:00

Management Protection: disabled

Management Protection Key:

OK
Cancel
Apply
Copy
Remove

default

WLAN IP CONFIGURATION

Quick Set

CAPsMAN

Interfaces

Wireless

Bridge

PPP

Switch

Mesh

IP

IPv6

MPLS

Routing

System

Queues

Files

Log

Radius

Tools

Address List

+

-

✓

✗

⌵

| Address | Network | Interface |
|---------------|------------|-----------|
| 10.100.0.1/24 | 10.100.0.0 | wlan1 |

Address <10.100.0.1/24>

Address: 10.100.0.1/24

Network: 10.100.0.0

Interface: wlan1

OK

Cancel

Apply

Disable

Comment

Copy

Remove

enabled

EOIP TUNNEL SET UP with BRANCH01

admin@E4:8D:8C:BF:71:5F (HUB-ROUTER) - WinBox v6.36 on hAP (mipsbe)

Session Settings Dashboard

Safe Mode

EoIP Tunnel

- IP Tunnel
- GRE Tunnel
- VLAN
- VRRP
- Bonding
- Bridge
- Mesh
- Virtual Ethernet
- 6to4 Tunnel
- IPv6 Tunnel
- EoIPv6 Tunnel
- GRE6 Tunnel
- VPLS

Quick Set

CAPsMAN

Interfaces

Wireless

Bridge

PPP

Switch

Mesh

IP

IPv6

MPLS

Routing

System

IP Tunnel GRE Tunnel VLAN VRRP Bonding LTE

| | L2 MTU | Tx | Rx | Tx Packet (p/s) |
|-----------|--------|-------|-------|-----------------|
| | 1598 | 0 bps | 0 bps | |
| | 1598 | 0 bps | 0 bps | |
| | 1598 | 0 bps | 0 bps | |
| | 1598 | 0 bps | 0 bps | |
| | 1598 | 0 bps | 0 bps | |
| ps AR9... | 1600 | 0 bps | 0 bps | |

EOIP TUNNEL SETUP with BRANCH01

admin@E4:8D:8C:BF:71:5F (HUB-ROUTER) - WinBox v6.36 on hAP (mipsbe)

Session Settings Dashboard

Safe Mode Session: E4:8D:8C:BF:71:5F

Interface <EOIP-TO-BRANCH01>

General Status Traffic

Name: EOIP-TO-BRANCH01

Type: EoIP Tunnel

MTU:

Actual MTU: 1458

L2 MTU: 65535

MAC Address: 02:7D:B8:C2:4E:A7

ARP: enabled

ARP Timeout:

Local Address: 10.100.0.1

Remote Address: 10.100.0.2

Tunnel ID: 10

IPsec Secret:

Keepalive:

DSCP: inherit

Dont Fragment: no

☒ Clamp TCP MSS

☒ Allow Fast Path

OK Cancel Apply Disable Comment Copy Remove Torch

enabled running slave

RouterOS WinBox

Quick Set
CAPsMAN
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
MetaROUTER
Partition
Make Supout.rif
Manual
New WinBox
Exit

local address = WAN IP of Router (Lab: WLAN1 IP of HUB)

Remote Address= WAN IP of Branch (LAB: WLAN1 IP of Branch)

Tunnel ID should be the same between Hub and branch01

BRIDGE SET UP

The screenshot displays the MikroTik WinBox interface. On the left sidebar, the 'Bridge' option is highlighted with a red circle. The main window shows a table with columns 'Address', 'Network', and 'Interface'. The first row contains the address '10.100.0.1/24', network '10.100.0.0', and interface 'wlan1'. Below this, the 'Bridge' tab is selected, and a red circle highlights the '+' icon for adding a new bridge. A 'New Interface' dialog box is open, showing the 'General' tab. The 'Name' field is set to 'HUB-BRIDGE' and is circled in red. The 'Type' is set to 'Bridge'. Other fields include 'MTU', 'Actual MTU', 'L2 MTU', 'MAC Address', 'ARP' (set to 'enabled'), 'ARP Timeout', and 'Admin. MAC Address'. On the right side of the dialog, there are buttons for 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', 'Remove', and 'Torch'. At the bottom of the dialog, the status is shown as 'enabled', 'running', and 'slave'.

| Address | Network | Interface |
|---------------|------------|-----------|
| 10.100.0.1/24 | 10.100.0.0 | wlan1 |

Bridge

Bridge Ports Filters NAT Hosts

Settings

Name Type

0 items out of 7

New Interface

General STP Status Traffic

Name: HUB-BRIDGE

Type: Bridge

MTU:

Actual MTU:

L2 MTU:

MAC Address:

ARP: enabled

ARP Timeout:

Admin. MAC Address:

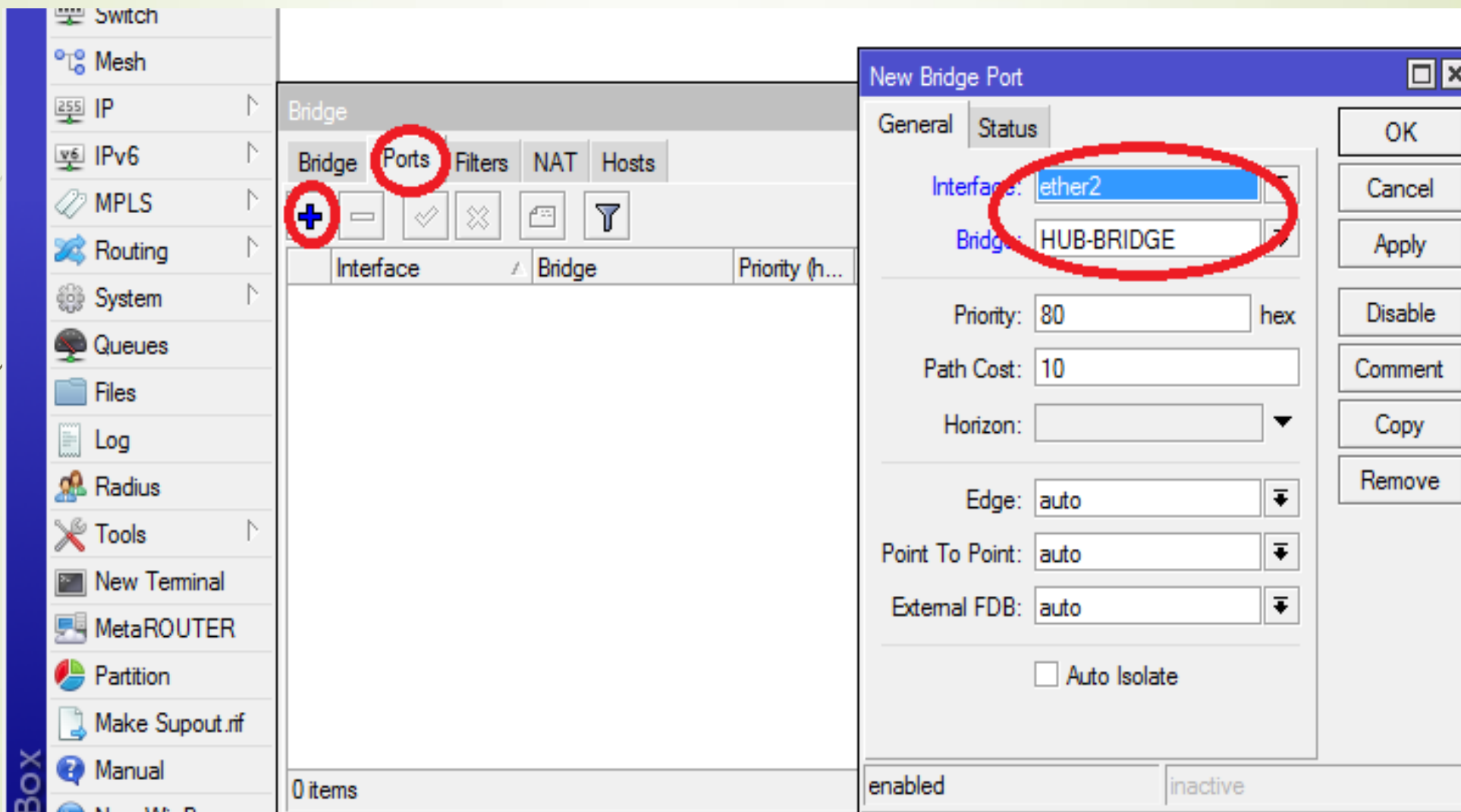
OK Cancel Apply Disable Comment Copy Remove Torch

enabled running slave

ADD EOIP TUNNEL TO BRIDGE PORTS

The screenshot shows the i-BEAM software interface. On the left is a sidebar with various icons and labels: Mesh, IP, IPv6, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, MetaROUTER, Partition, Make Supout.tif, Manual, and New WinBox. The main window has a 'Bridge' tab selected, with sub-tabs for Bridge, Ports, Filters, NAT, and Hosts. The 'Ports' sub-tab is active, showing a table with columns 'Interface', 'Bridge', and 'Priority (h...'. A red circle highlights the '+' icon in the toolbar. Another red circle highlights the 'Ports' sub-tab. A third red circle highlights the 'Interface' dropdown in the 'New Bridge Port' dialog, which is set to 'EOIP-TO-BRANCH01'. The 'Bridge' dropdown in the same dialog is set to 'HUB-BRIDGE'. The 'New Bridge Port' dialog has a 'General' tab and a 'Status' tab. The 'General' tab is active, showing fields for 'Priority' (80), 'Path Cost' (10), 'Horizon' (dropdown), 'Edge' (auto), 'Point To Point' (auto), and 'External FDB' (auto). There is an 'Auto Isolate' checkbox which is unchecked. At the bottom of the dialog, there are two radio buttons: 'enabled' (selected) and 'inactive'. On the right side of the dialog are buttons for 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', and 'Remove'.

ADD LAN PORT TO BRIDGE PORTS



EOIP SETUP WITH BRANCH02

Interface <EOIP-TO-BRANCH02>

General Status Traffic

Name: EOIP-TO-BRANCH02

Type: EoIP Tunnel

MTU:

Actual MTU: 1458

L2 MTU: 65535

MAC Address: 02:FC:B4:6C:BF:87

ARP: enabled

ARP Timeout:

Local Address: 10.100.0.1

Remote Address: 10.100.0.3

Tunnel ID: 20

IPsec Secret:

Keepalive:

DSCP: inherit

Dont Fragment: no

☒ Clamp TCP MSS

☒ Allow Fast Path

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Torch

enabled running slave

ADDING TUNNEL PORTS TO BRIDGE

admin@E4:8D:8C:BF:71:5F (HUB-ROUTER) - WinBox v6.36 on hAP (mipsbe)

Session Settings Dashboard

Safe Mode Session: E4:8D:8C:BF:71:5F

Quick Set
CAPsMAN
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal

Interface List

Interface Interface List Ethernet EoIP Tunnel IP Tunnel GRE Tunnel VLAN VRRP Bonding LTE

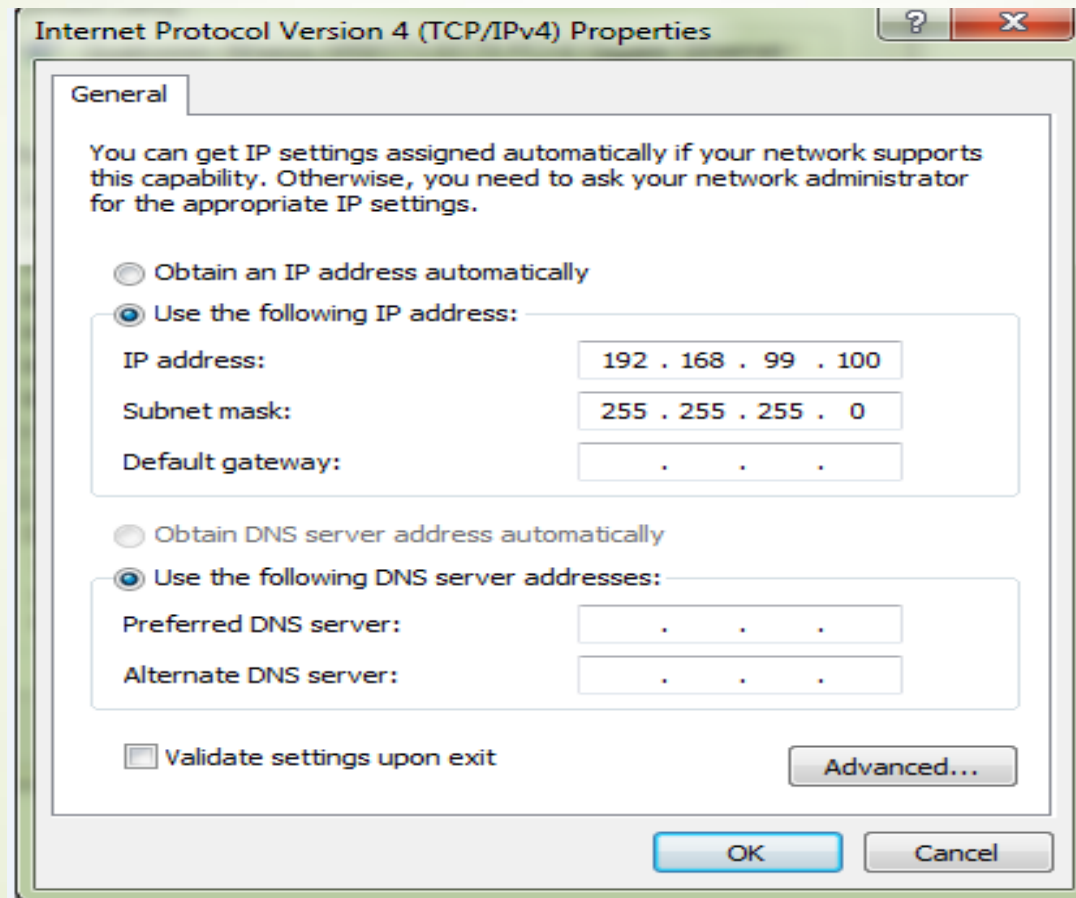
| | Name | Type | L2 MTU | Tx | Rx |
|----|------------------|-------------|--------|-----------|-----------|
| RS | EoIP-TO-BRANCH01 | EoIP Tunnel | 65535 | 20.6 kbps | 592 bps |
| RS | EoIP-TO-BRANCH02 | EoIP Tunnel | 65535 | 13.2 kbps | 5.2 kbps |
| R | HUB-BRIDGE | Bridge | 1598 | 92.4 kbps | 10.6 kbps |
| | ether1 | Ethernet | 1598 | 0 bps | 0 bps |
| RS | ether2 | Ethernet | 1598 | 99.5 kbps | 7.8 kbps |
| | ether3 | Ethernet | 1598 | 0 bps | 0 bps |

Bridge

Bridge Ports Filters NAT Hosts

| Interface | Bridge | Priority | Cost | Role | Port Pst... |
|----------------|------------|----------|------|-----------------|-------------|
| EoIP-TO-BRA... | HUB-BRIDGE | 80 | 10 | designated port | |
| EoIP-TO-BRA... | HUB-BRIDGE | 80 | 10 | designated port | |
| ether2 | HUB-BRIDGE | 80 | 10 | designated port | |

ASSIGN IP TO LAPTOP'S LAN IP



PING TO BRANCH LAN IPs

[illegible]

BRANCH ROUTER CONFIG

Connect to WLAN AP

Tunnel Configuration

Bridge Configuration/Adding ports to Bridge

WIRELESS CONFIGURATION

The screenshot displays the i-BEAM wireless configuration interface. The main window is titled 'Interface <wlan1>' and has tabs for General, Wireless, HT, WDS, Nstreme, NV2, Advanced Status, and Status. The 'Wireless' tab is active, showing settings for Mode (station), Band (2GHz-B/G), Channel Width (20MHz), Frequency (2412 MHz), SSID (MikroTik), and Scan List (default). A 'Scanner (Running)' dialog box is overlaid on the main window. This dialog has a dropdown for 'Interface' set to 'wlan1' and a 'Background Scan' checkbox. It contains buttons for Start, Stop, Close, Connect (circled in red), and New Window. Below these buttons is a table of detected wireless networks. The first row of the table is circled in red, showing an AP with address E4:8D:8C:BF:71:63 and SSID PPH. Other networks listed include Atm_Pari..., Superson..., MMSPO..., i-BEAM VIP, MTCRE, i-BEAM, and i-BEAM-AP.

| | Address | SSID | Channel | Signa... | Noise... | Signa... | Radio Name | RouterO... |
|-------|-------------------|-------------|-----------|----------|----------|----------|----------------|------------|
| APRB | E4:8D:8C:BF:71:63 | PPH | 2412/2... | -42 | -114 | 72 | E48D8CBF7163 | 6.36 |
| AP | 44:D9:E7:FA:4A:17 | Atm_Pari... | 2412/2... | -77 | -114 | 37 | | |
| AP | 58:6D:8F:A5:DD:63 | | 2412/2... | -83 | -114 | 31 | | |
| APR | DC:9F:DB:56:E4:42 | Superson... | 2452/2... | -95 | -113 | 18 | NanoStation M2 | 2.9.31 |
| APRWB | 4E:5E:0C:16:40:D6 | MMSPO... | 2462/2... | -51 | -119 | 68 | i-BEAM-AP | 6.36 |
| APRB | 4E:5E:0C:16:40:D7 | i-BEAM VIP | 2462/2... | -51 | -119 | 68 | i-BEAM-AP | 6.36 |
| APRB | 4E:5E:0C:16:40:D8 | MTCRE | 2462/2... | -51 | -119 | 68 | i-BEAM-AP | 6.36 |
| APRWB | 4C:5E:0C:16:40:D6 | i-BEAM | 2462/2... | -52 | -119 | 67 | i-BEAM-AP | 6.36 |
| AP | 34:CD:BE:59:75:5B | | 2462/2... | -85 | -119 | 34 | | |

WIRELESS SECURITY PROFILE CONFIGURATION

The screenshot displays the Mikrotik WinBox interface. On the left, the 'Wireless Tables' window shows a table with one entry: 'default' with mode 'none'. On the right, the 'Security Profile <default>' configuration window is open, showing the 'General' tab. The configuration includes fields for Name, Mode, Authentication Types, Unicast and Group Ciphers, WPA and WPA2 Pre-Shared Keys, Supplicant Identity, Group Key Update, Management Protection, and Management Protection Key.

Wireless Tables

| Name | Mode | Authentication... |
|---------|------|-------------------|
| default | none | |

1 item (1 selected)

Security Profile <default>

General | RADIUS | EAP | Static Keys

Name: default

Mode: dynamic keys

Authentication Types: ☒ WPA PSK ☒ WPA2 PSK
☐ WPA EAP ☐ WPA2 EAP

Unicast Ciphers: ☒ aes ccm ☐ tkip

Group Ciphers: ☒ aes ccm ☐ tkip

WPA Pre-Shared Key: 123456789

WPA2 Pre-Shared Key: 123456789

Supplicant Identity: MikroTik

Group Key Update: 00:05:00

Management Protection: disabled

Management Protection Key:

default

BRANCH ROUTER EOIP TUNNEL CONFIG

The screenshot shows the MikroTik WinBox interface for configuring an EOIP Tunnel. The left sidebar has the 'Interfaces' menu item circled in red. The 'New Interface' dialog is open, with the 'General' tab selected. The 'Name' field is 'EOIP-TO-HUB', 'Type' is 'EoIP Tunnel', and 'MTU' is set to the default. The 'Local Address' is 10.100.0.2 and the 'Remote Address' is 10.100.0.1, both highlighted with a red box. The 'Tunnel ID' is 10. The 'Interface List' on the left shows 'wlan1' selected. The 'Session' bar at the top shows the user is 'admin' with IP 'fe80::e68d:8cff:fece:c2d7%3'.

admin@[fe80::e68d:8cff:fece:c2d7%3] (MikroTik) - WinBox v6.38rc10 on hAP (mipsbe)

Session Settings Dashboard

Safe Mode Session: [fe80::e68d:8cff:fece:c2d7:3]

RouterOS WinBox

Quick Set
CAPsMAN
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
MetaROUTER
Partition
Make Supout.nif
Manual
New WinBox

Interface List

| Interface | Name |
|-----------|--------|
| R | ether1 |
| R | ether2 |
| R | ether3 |
| R | ether4 |
| R | ether5 |
| R | wlan1 |

New Interface

General Loop Protect Status Traffic

Name: EOIP-TO-HUB

Type: EoIP Tunnel

MTU: []

Actual MTU: []

L2 MTU: []

MAC Address: 02:F5:BA:22:09:AA

ARP: enabled

ARP Timeout: []

Local Address: 10.100.0.2

Remote Address: 10.100.0.1

Tunnel ID: 10

IPsec Secret: []

Keepalive: []

DSCP: inherit

Dont Fragment: no

☒ Clamp TCP MSS

☒ Allow Fast Path

OK
Cancel
Apply
Disable
Comment
Copy
Remove
Torch

local address = WAN Public IP (in this case , please use WLAN IP)

Remote address= WAN-IP of Remote Branch (in this case please use wlan ip of Hub Router)

BRANCH ROUTER BRIDGE CONFIG

admin@E4:8D:8C:BF:71:5F (HUB-ROUTER) - WinBox v6.36 on hAP (mipsbe)

Session Settings Dashboard

Safe Mode Session: E4:8D:8C:BF:71:5F

- Quick Set
- CAPsMAN
- Interfaces
- Wireless
- Bridge
- PPP
- Switch
- Mesh
- IP
- IPv6
- MPLS
- Routing
- System
- Queues
- Files
- Log
- Radius
- Tools
- New Terminal
- MetaROUTER

Bridge

Bridge

Ports

Filters

NAT

Hosts

+

-

✓

✗

📄

🔍

Find

| Interface | Bridge | Priority (h... | Path Cost | Horizon | Role | Root Pat |
|-------------------|------------|----------------|-----------|---------|-----------------|----------|
| ↕EOIP-TO-BRANCH01 | HUB-BRIDGE | 80 | 10 | | designated port | |
| ↕EOIP-TO-BRANCH02 | HUB-BRIDGE | 80 | 10 | | designated port | |
| ↕ether2 | HUB-BRIDGE | 80 | 10 | | designated port | |

3 items

PING TO HUB LAN

```
C:\Windows\system32\cmd.exe - ping 192.168.99.10

C:\Users\E5-473G>ping 192.168.99.100 -t

Pinging 192.168.99.100 with 32 bytes of data:
Reply from 192.168.99.100: bytes=32 time=11ms TTL=128
Reply from 192.168.99.100: bytes=32 time=1ms TTL=128
Reply from 192.168.99.100: bytes=32 time=3ms TTL=128
Reply from 192.168.99.100: bytes=32 time=1ms TTL=128
```

PING FROM BRANCH TO BRANCH

```
C:\Windows\system32\cmd.exe - ping 192.168.99.2
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 1ms
Control-C
^C
C:\Users\E5-473G>ping 192.168.99.2 -t

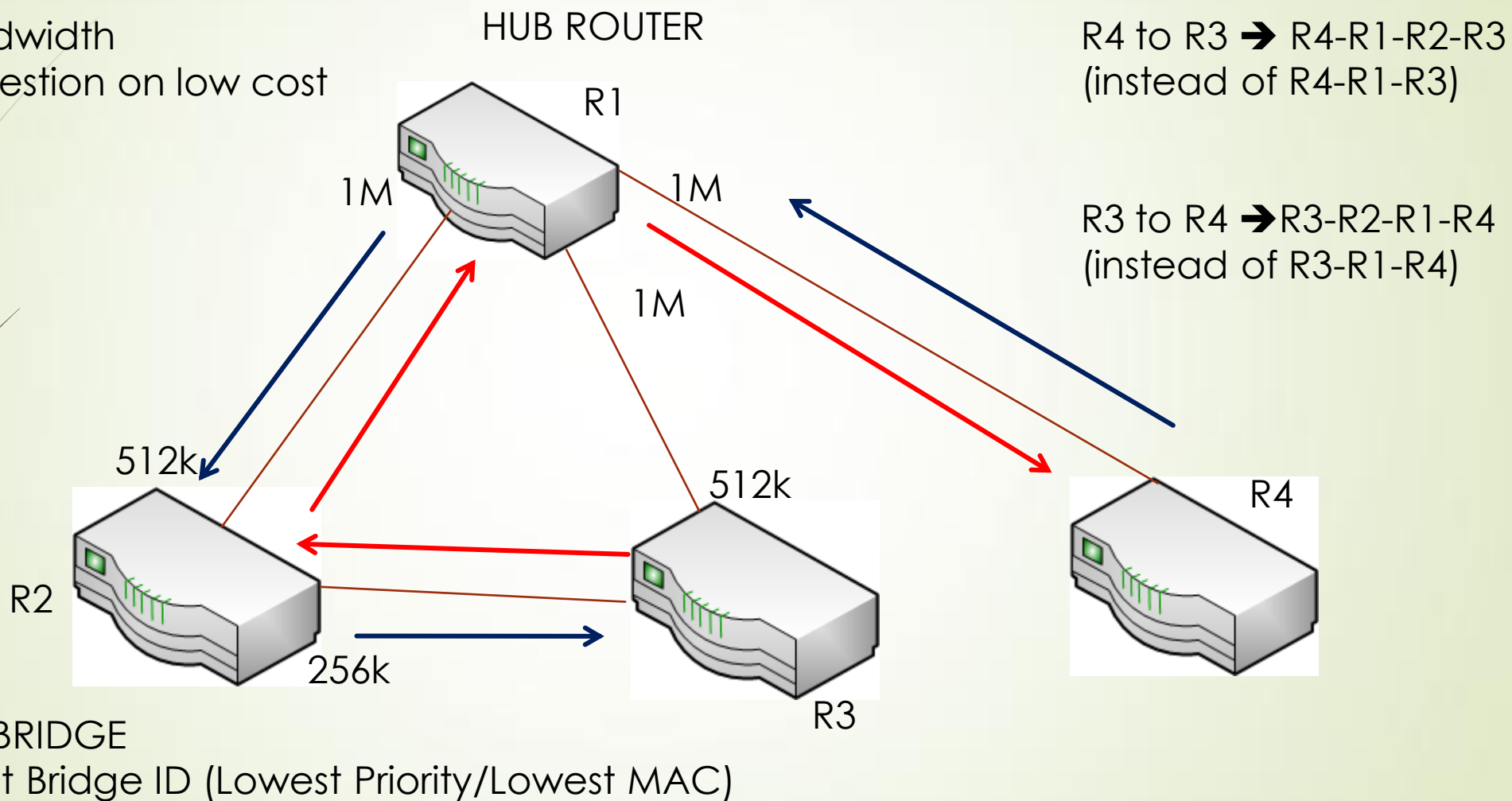
Pinging 192.168.99.2 with 32 bytes of data:
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=10ms TTL=128
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=15ms TTL=128
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=2ms TTL=128
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=4ms TTL=128
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=1ms TTL=128
Reply from 192.168.99.2: bytes=32 time=5ms TTL=128
Reply from 192.168.99.2: bytes=32 time=10ms TTL=128
Reply from 192.168.99.2: bytes=32 time=3ms TTL=128
Reply from 192.168.99.2: bytes=32 time=3ms TTL=128
```

SPANNING TREE PROTOCOL

- 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

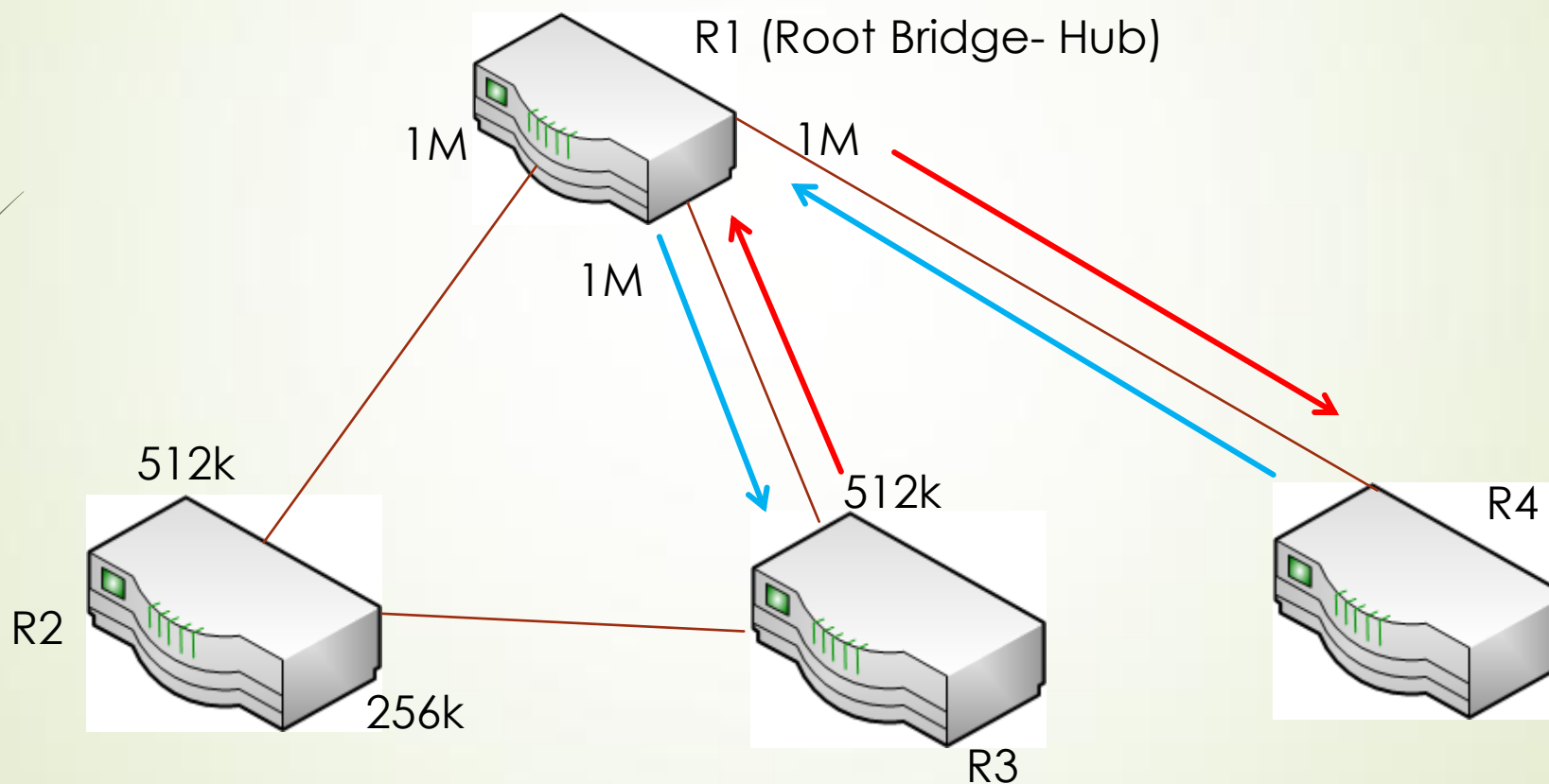
Potential Issue In Hub and Spoke

- Wastes bandwidth
- Traffic Congestion on low cost bandwidth



Solution !!!

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



ROOT BRIDGE SETTING

| | L2 MTU | Tx | Rx | Tx Packet (|
|---|--------|----|----|-------------|
| Interface <HUB-BRIDGE> | | | | |
| General STP Status Traffic | | | | |
| Protocol Mode: <input type="radio"/> none <input type="radio"/> stp <input checked="" type="radio"/> rstp | | | | |
| Priority: 1000 <small>hex</small> | | | | |
| Max Message Age: 00:00:20 | | | | |
| Forward Delay: 00:00:15 | | | | |
| Transmit Hold Count: 6 | | | | |
| Ageing Time: 00:05:00 | | | | |

set Priority=1000 (hex)
to be root bridge

OK
Cancel
Apply
Disable
Comment
Copy
Remove
Torch

VERIFICATION OF ROOT BRIDGE

admin@E4:8D:8C:BF:71:5F (HUB-ROUTER) - WinBox v6.36 on hAP (mipsbe)

Session Settings Dashboard

Safe Mode Session: E4:8D:8C:BF:71:5F

Interface <HUB-BRIDGE>

General STP Status Traffic

Last Link Down Time:

Last Link Up Time: Mar/13/2017 00:00:58

Link Downs: 0

☒ Root Bridge

Root Bridge ID: 0x1000.E4:8D:8C:BF:71:5F

Root Path Cost: 0

Root Port: none

Port Count: 3

Designated Port Count: 3

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Torch

Quick Set

CAPsMAN

Interfaces

Wireless

Bridge

PPP

Switch

Mesh

IP

IPv6

MPLS

Routing

System

Queues

Q & A Section!!!

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

THANKS FOR
YOUR ATTENTION!!!!