1/1/2026

MPLS & VPLS Backbone Design based on Islington College Using GNS3 and MikroTik

MPLS & VPLS

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**Scenario**

Islington College operates a multi-block campus network consisting of 9 academic and administrative blocks. The college owns a public IPv4 address range (160.30.132.0/24), which must be used for router loopback interfaces within an MPLS backbone.

We are required to design, implement, and verify an MPLS-based core network using MikroTik routers in GNS3, providing VPLS-based Layer-2 connectivity across all blocks while using a centralized DHCP server.

The LONDON\_BLOCK is the main block, connected to the Internet (ISP), and all other blocks connect to it directly and via additional mesh links for redundancy and load balancing.

**Network Architecture and IP Addressing Plan:**

Core Design

* All block routers act as MPLS core routers
* OSPF is the IGP across all routers
* MPLS with LDP must be enabled on all core and mesh links
* ECMP / Load balancing must be implemented
* VPLS must be used to extend VLANs across all blocks
* No DHCP service should run on any router

Use the following explicit IP addressing scheme. All loopback addresses are from the public IPv4 range 160.30.132.0/24 (160.30.132.0 to 160.30.132.255). Do not use any other IPs for loopbacks or links.

**Block Routers and Loopback IPs**

* LONDON\_BLOCK (main block, connected to ISP): Loopback IP 160.30.132.1/32
* UK\_BLOCK: Loopback IP 160.30.132.11/32
* NEPAL\_BLOCK: Loopback IP 160.30.132.12/32
* HIMAL\_BLOCK: Loopback IP 160.30.132.13/32
* BRIT\_BLOCK: Loopback IP 160.30.132.14/32
* SKILL\_BLOCK: Loopback IP 160.30.132.15/32
* ALUMNI\_BLOCK: Loopback IP 160.30.132.16/32
* KUMARI \_BLOCK: Loopback IP 160.30.132.17/32

**Point-to-Point Links from LONDON\_BLOCK (Private IPs, /30 subnets):**

* LONDON\_BLOCK to UK\_BLOCK: 10.0.0.0/30 (LONDON\_BLOCK: 10.0.0.1, UK\_BLOCK: 10.0.0.2)
* LONDON\_BLOCK to NEPAL\_BLOCK: 10.0.0.4/30 (LONDON\_BLOCK: 10.0.0.5, NEPAL\_BLOCK: 10.0.0.6)
* LONDON\_BLOCK to HIMAL\_BLOCK: 10.0.0.8/30 (LONDON\_BLOCK: 10.0.0.9, HIMAL\_BLOCK: 10.0.0.10)
* LONDON\_BLOCK to BRIT\_BLOCK: 10.0.0.12/30 (LONDON\_BLOCK: 10.0.0.13, BRIT\_BLOCK: 10.0.0.14)
* LONDON\_BLOCK to SKILL\_BLOCK: 10.0.0.16/30 (LONDON\_BLOCK: 10.0.0.17, SKILL\_BLOCK: 10.0.0.18)
* LONDON\_BLOCK to KUMARI\_BLOCK: 10.0.0.20/30 (LONDON\_BLOCK: 10.0.0.21, KUMARI\_BLOCK: 10.0.0.22)
* LONDON\_BLOCK to ALUMNI\_BLOCK: 10.0.0.24/30 (LONDON\_BLOCK: 10.0.0.25, ALUMNI\_BLOCK: 10.0.0.26)

**Mesh Connections (Router-to-Router Private IPs, /30 subnets for redundancy):**

* UK\_BLOCK to NEPAL\_BLOCK: 10.0.0.28/30 (UK\_BLOCK: 10.0.0.29, NEPAL\_BLOCK: 10.0.0.30)
* UK\_BLOCK to HIMAL\_BLOCK: 10.0.0.32/30 (UK\_BLOCK: 10.0.0.34, HIMAL\_BLOCK: 10.0.0.33)
* NEPAL\_BLOCK to BRIT\_BLOCK: 10.0.0.36/30 (NEPAL\_BLOCK: 10.0.0.37, BRIT\_BLOCK: 10.0.0.38)
* HIMAL\_BLOCK to SKILL\_BLOCK: 10.0.0.40/30 (HIMAL\_BLOCK: 10.0.0.42, SKILL\_BLOCK: 10.0.0.41)
* BRIT\_BLOCK to KUMARI\_BLOCK: 10.0.0.44/30 (BRIT\_BLOCK: 10.0.0.46, KUMARI\_BLOCK: 10.0.0.45)
* SKILL\_BLOCK to ALUMNI\_BLOCK: 10.0.0.48/30 (SKILL\_BLOCK: 10.0.0.50, ALUMNI\_BLOCK: 10.0.0.49)
* ALUMNI\_BLOCK to KUMARI\_BLOCK: 10.0.0.52/30 (ALUMNI\_BLOCK: 10.0.0.53, KUMARI\_BLOCK: 10.0.0.54)

**VLANs and End-Device Subnets (Provided by Centralized DHCP):**

* VLAN 100 (STUDENT): 172.16.0.0/19 (capacity for 5,000 student IPs)
* VLAN 200 (TEACHER): 172.16.32.0/19 (capacity for 1,000 teacher IPs)
* VLAN 300 (STAFF): 172.16.36.0/21 (capacity for 2,000 staff IPs)

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## LONDON-BLOCK

**CMD**

|  |
| --- |
| /system identity set name=LONDON-BLOCK  /interface bridge add name=loopback comment="LONDON-BLOCK\_160.30.132.1\_LOOPBACK"  /ip address add address=160.30.132.1/32 interface=loopback comment="LONDON-BLOCK\_160.30.132.1\_LOOPBACK"  /tool/romon/set enabled=yes |

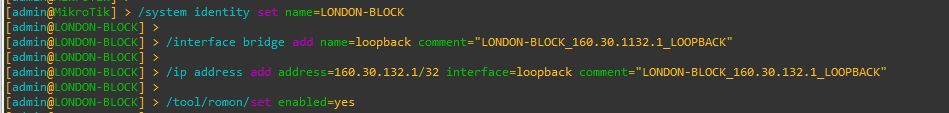


Figure 1: Set Identity, Loopback Address and RoMoN of LONDON\_BLOCK Router Through CMD

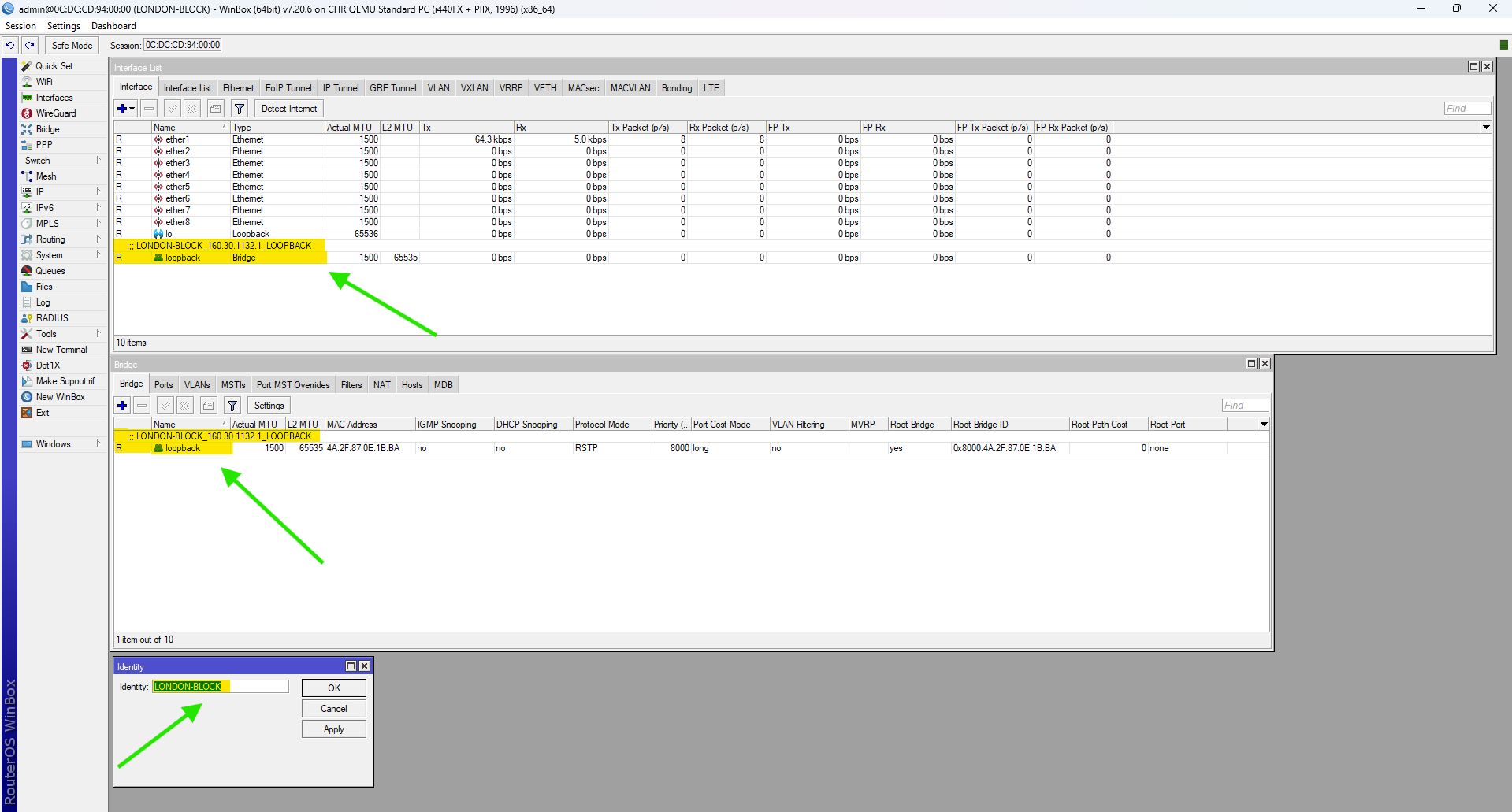


Figure 2: Set Identity, Loopback Address and RoMoN of LONDON\_BLOCK Router Through WINBOX

## UK-BLOCK

**CMD**

|  |
| --- |
| /system identity set name= UK-BLOCK  /interface bridge add name=loopback comment=" UK-BLOCK\_160.30.132.11\_LOOPBACK"  /ip address add address=160.30.132.11/32 interface=loopback comment=" UK-BLOCK\_160.30.132.11\_LOOPBACK"  /tool/romon/set enabled=yes |

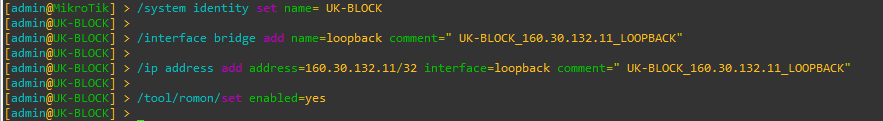


Figure 3: Set Identity, Loopback Address and RoMoN of UK-BLOCK Router Through CMD

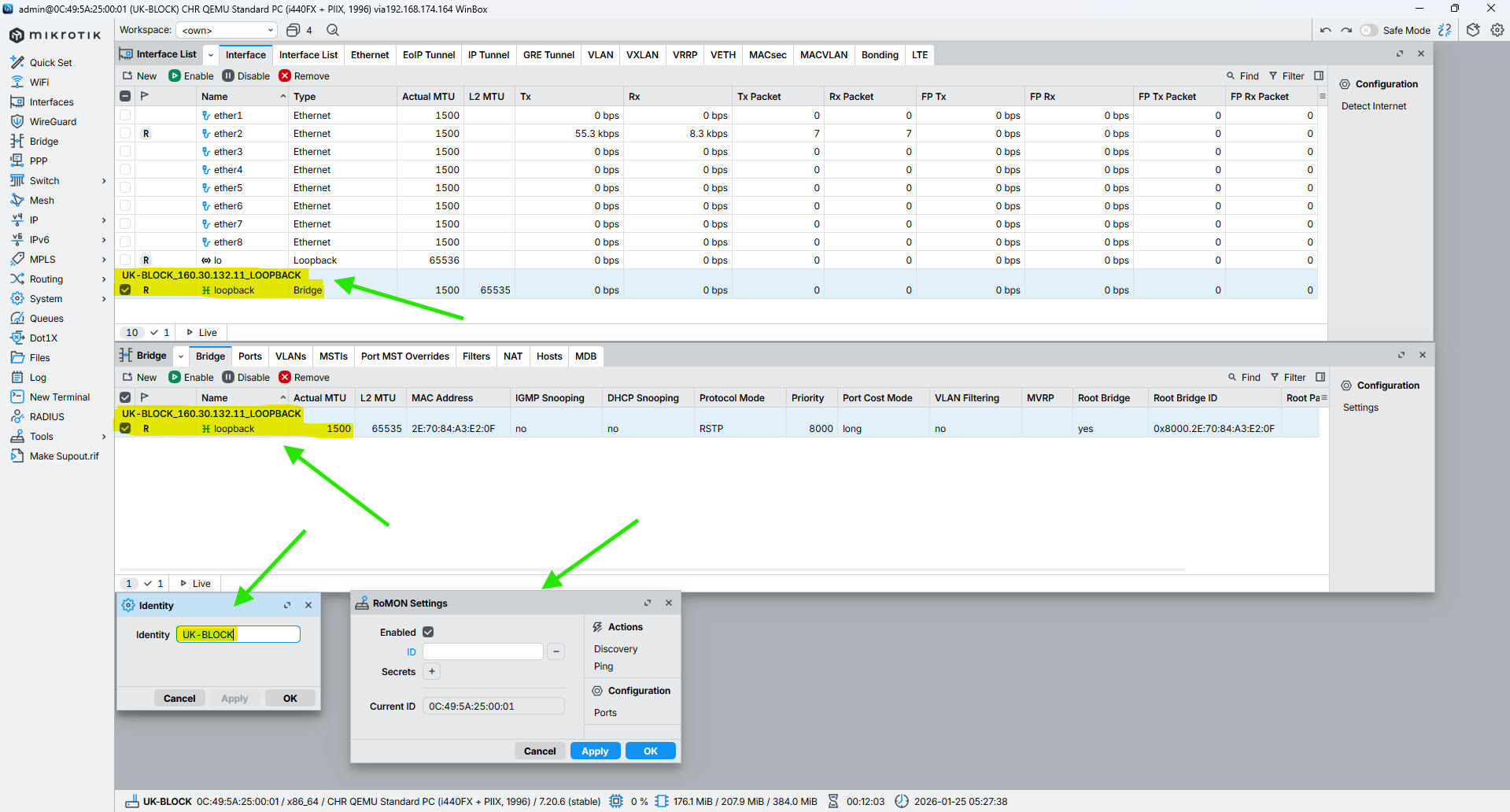


Figure 4: Set Identity, Loopback Address and RoMoN of UK-BLOCK Router Through WINBOX

## NEPAL-BLOCK

**CMD**

|  |
| --- |
| /system identity set name=NEPAL-BLOCK  /interface bridge add name=loopback comment="NEPAL-BLOCK\_160.30.132.12\_LOOPBACK"  /ip address add address=160.30.132.12/32 interface=loopback comment="NEPAL-BLOCK\_160.30.132.12\_LOOPBACK"  /tool/romon/set enabled=yes |

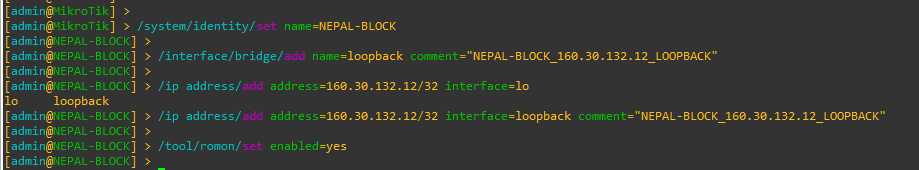


Figure 5: Set Identity, Loopback Address and RoMoN of NEPAL-BLOCK Router Through CMD



Figure 6: Set Identity, Loopback Address and RoMoN of NEPAL-BLOCK Router Through WINBOX

## HIMAL-BLOCK

**CMD**

|  |
| --- |
| /system identity set name=HIMAL-BLOCK  /interface bridge add name=loopback comment="HIMAL-BLOCK\_160.30.132.13\_LOOPBACK"  /ip address add address=160.30.132.13/32 interface=loopback comment="HIMAL-BLOCK\_160.30.132.13\_LOOPBACK"  /tool/romon/set enabled=yes |

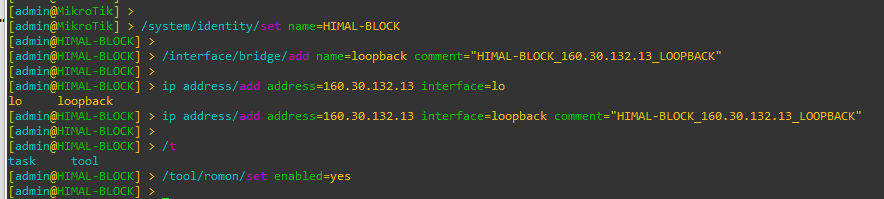


Figure 7: Set Identity, Loopback Address and RoMoN of NEPAL-BLOCK Router Through CMD



Figure 8: Set Identity, Loopback Address and RoMoN of NEPAL-BLOCK Router Through WINBOX

## BRIT-BLOCK

**CMD**

|  |
| --- |
| /system identity set name=BRIT-BLOCK  /interface bridge add name=loopback comment="BRIT-BLOCK\_160.30.132.14\_LOOPBACK"  /ip address add address=160.30.132.14/32 interface=loopback comment="BRIT-BLOCK\_160.30.132.14\_LOOPBACK"  /tool/romon/set enabled=yes |

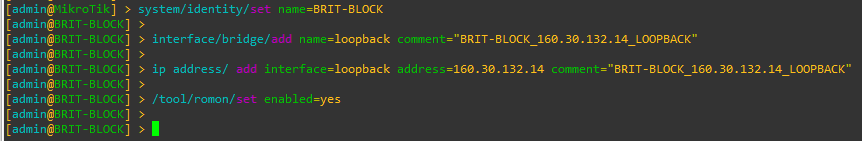


Figure 9: Set Identity, Loopback Address and RoMoN of BRIT-BLOCK Router Through CMD

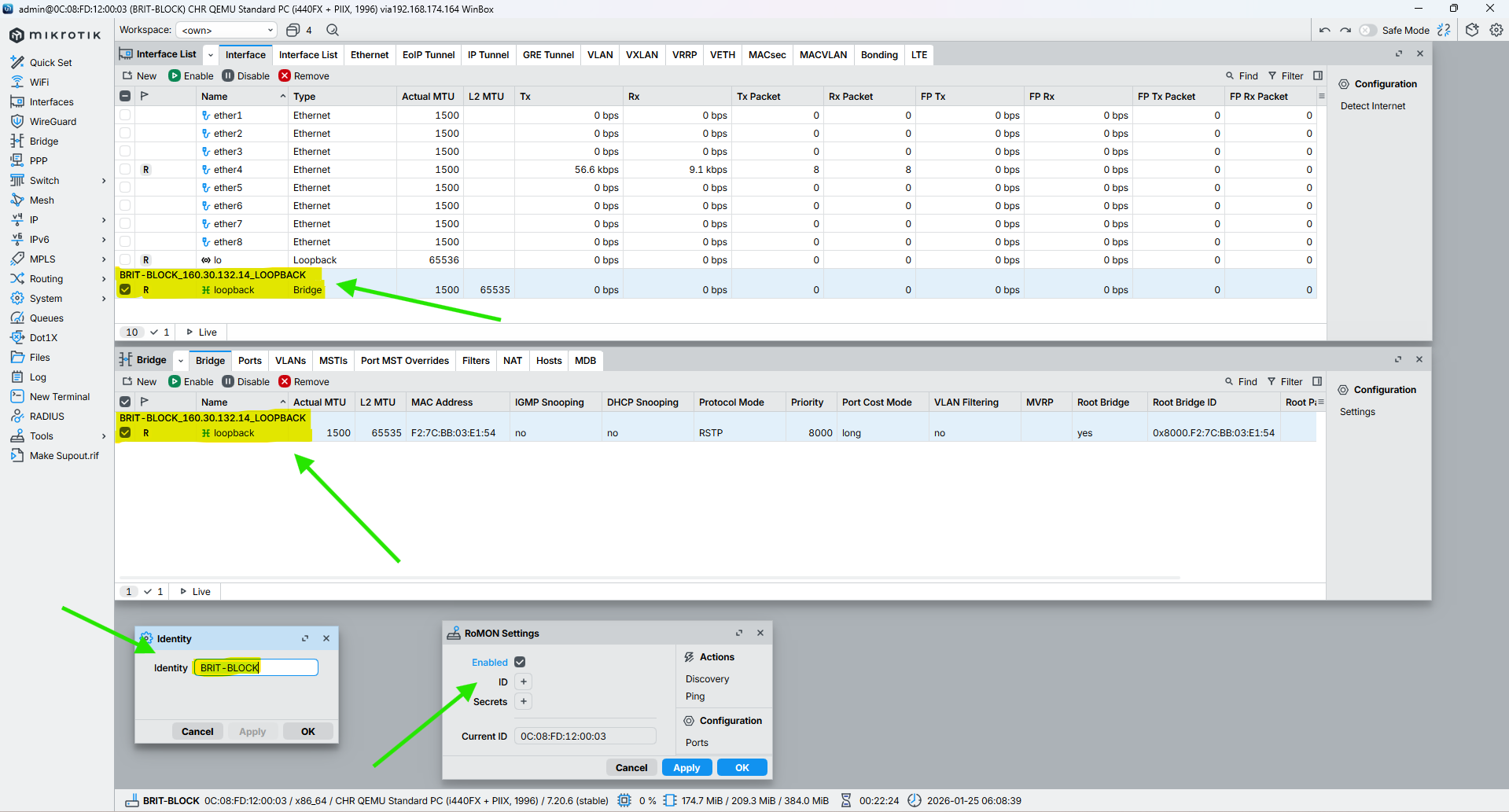


Figure 10: Set Identity, Loopback Address and RoMoN of BRIT-BLOCK Router Through WINBOX

## SKILL-BLOCK

**CMD**

|  |
| --- |
| /system identity set name=SKILL-BLOCK  /interface bridge add name=loopback comment="SKILL-BLOCK\_160.30.132.15\_LOOPBACK"  /ip address add address=160.30.132.15/32 interface=loopback comment="SKILL-BLOCK\_160.30.132.15\_LOOPBACK"  /tool/romon/set enabled=yes |

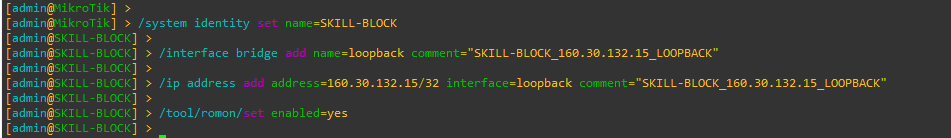


Figure 11: Set Identity, Loopback Address and RoMoN of SKILL-BLOCK Router Through CMD

Figure 12: Set Identity, Loopback Address and RoMoN of SKILL-BLOCK Router Through WINBOX

## ALUMNI-BLOCK

**CMD**

|  |
| --- |
| /system identity set name=ALUMNI-BLOCK  /interface bridge add name=loopback comment="ALUMNI-BLOCK\_160.30.132.16\_LOOPBACK"  /ip address add address=160.30.132.16/32 interface=loopback comment="ALUMNI-BLOCK\_160.30.132.16\_LOOPBACK"  /tool/romon/set enabled=yes |



Figure 13: Set Identity, Loopback Address and RoMoN of ALUMNI-BLOCK Router Through CMD

Figure 14: Set Identity, Loopback Address and RoMoN of ALUMNI-BLOCK Router Through WINBOX

## KUMARI-BLOCK

**CMD**

|  |
| --- |
| /system identity set name=KUMARI-BLOCK  /interface bridge add name=loopback comment="KUMARI-BLOCK\_160.30.132.17\_LOOPBACK"  /ip address add address=160.30.132.17/32 interface=loopback comment="KUMARI-BLOCK\_160.30.132.17\_LOOPBACK"  /tool/romon/set enabled=yes |

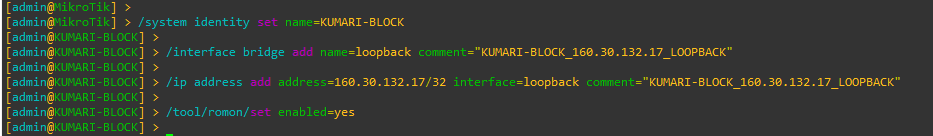


Figure 15: Set Identity, Loopback Address and RoMoN of KUMARI-BLOCK Router Through CMD



Figure 16: Set Identity, Loopback Address and RoMoN of KUMARI-BLOCK Router Through WINBOX

# Configuration IP in the Core Interface of all Routers

## LONDON-BLOCK

**CMD**

|  |
| --- |
| /ip address add address=10.0.0.1/30 interface=ether2 comment="NETWORK-ID\_10.0.0.0/30\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.1/30\_TO\_UK-BLOCK\_10.0.0.2/30"  /ip address add address=10.0.0.5/30 interface=ether3 comment="NETWORK-ID\_10.0.0.4/30\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.5/30\_TO\_NEPAL-BLOCK\_10.0.0.6/30"  /ip address add address=10.0.0.9/30 interface=ether4 comment="NETWORK-ID\_10.0.0.8/30\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.9/30\_TO\_HIMAL-BLOCK\_10.0.0.10/30"  /ip address add address=10.0.0.13/30 interface=ether5 comment="NETWORK-ID\_10.0.0.12/30\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.13/30\_TO\_BRIT-BLOCK\_10.0.0.14/30"  /ip address add address=10.0.0.17/30 interface=ether6 comment="NETWORK-ID\_10.0.0.16/30\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.17/30\_TO\_SKILL-BLOCK\_10.0.0.18/30"  /ip address add address=10.0.0.21/30 interface=ether7 comment="NETWORK-ID\_10.0.0.20/30\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.21/30\_TO\_ALUMNI-BLOCK\_10.0.0.22/30"  /ip address add address=10.0.0.25/30 interface=ether8 comment="NETWORK-ID\_10.0.0.24/30\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.25/30\_TO\_KUMARI-BLOCK\_10.0.0.26/30" |

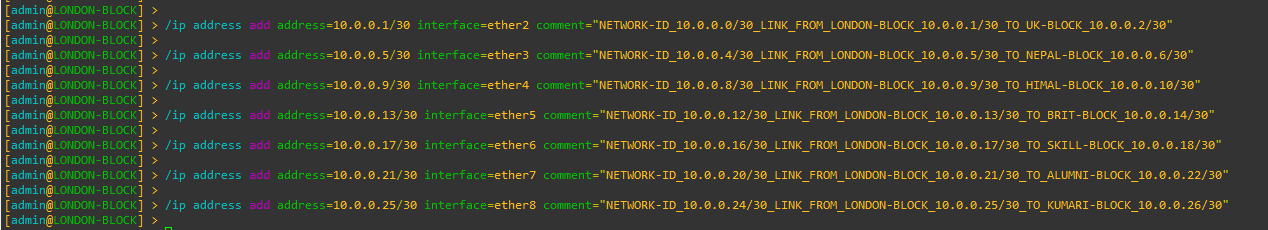


Figure 17: Configuration IP in the Core Interface of LONDON-BLOCK Router Through CMD



Figure 18: Configuration IP in the Core Interface of LONDON-BLOCK Router Through WINBOX

## UK-BLOCK

**CMD**

|  |
| --- |
| /ip address add address=10.0.0.2/30 interface=ether2 comment="NETWORK-ID\_10.0.0.0/30\_LINK\_FROM\_UK-BLOCK\_10.0.0.2/30\_TO\_LONDON-BLOCK\_10.0.0.1/30"  /ip address add address=10.0.0.29/30 interface=ether1 comment="NETWORK-ID\_10.0.0.28/30\_LINK\_FROM\_UK-BLOCK\_10.0.0.29/30\_TO\_NEPAL-BLOCK\_10.0.0.30/30"  /ip address add address=10.0.0.34/30 interface=ether3 comment="NETWORK-ID\_10.0.0.32/30\_LINK\_FROM\_UK-BLOCK\_10.0.0.34/30\_TO\_HIMAL-BLOCK\_10.0.0.33/30" |

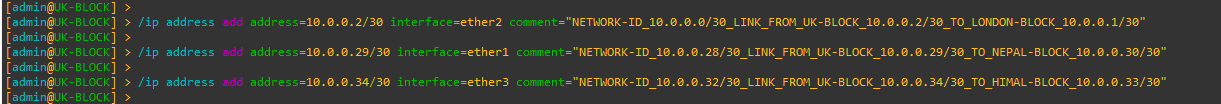


Figure 19: Configuration IP in the Core Interface of UK-BLOCK Router Through CMD

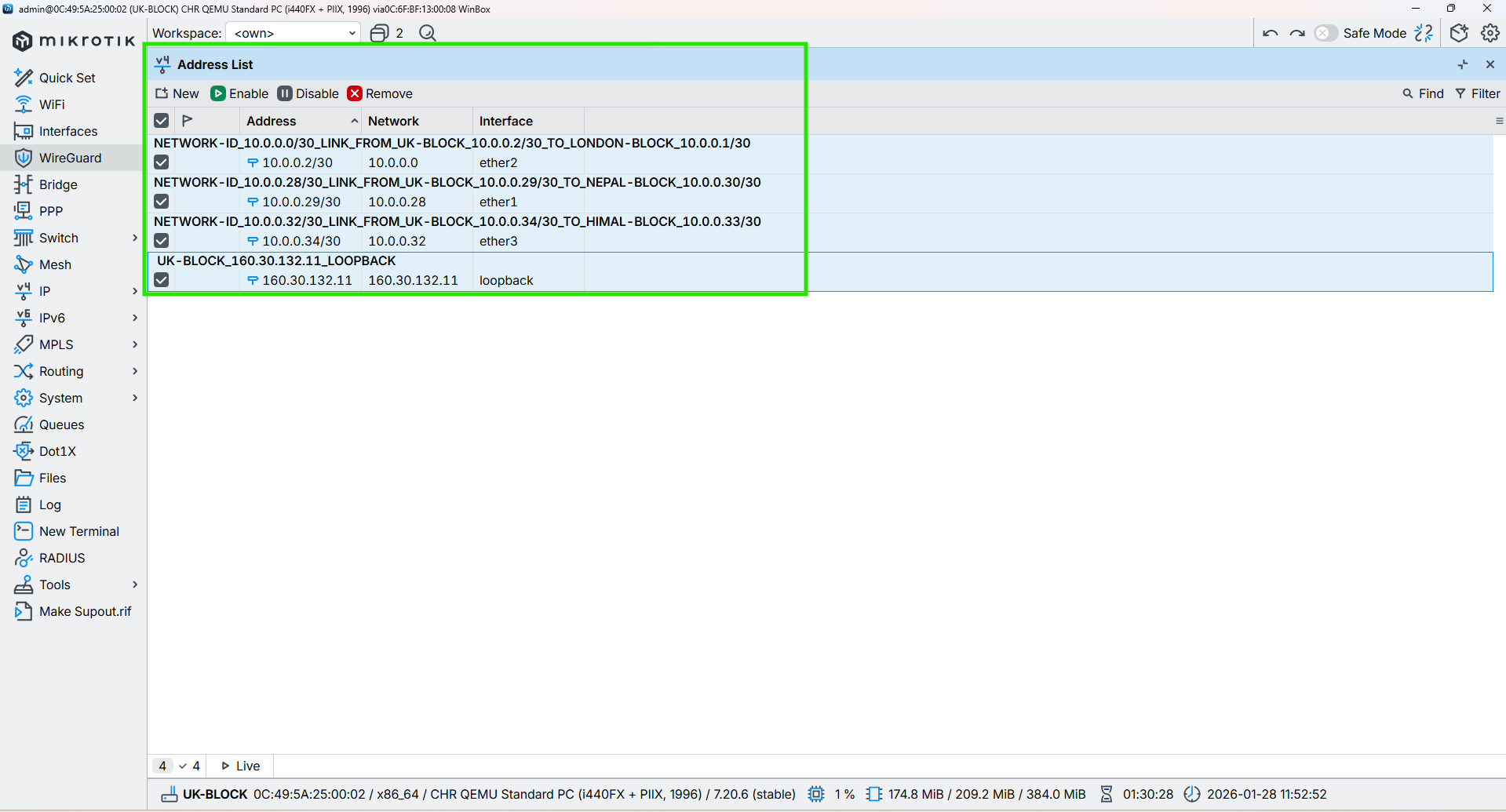


Figure 20: Configuration IP in the Core Interface of UK-BLOCK Router Through WINBOX

## NEPAL-BLOCK

**CMD**

|  |
| --- |
| /ip address add address=10.0.0.6/30 interface=ether3 comment="NETWORK-ID\_10.0.0.4/30\_LINK\_FROM\_NEPAL-BLOCK\_10.0.0.6/30\_TO\_LONDON-BLOCK\_10.0.0.5/30"  /ip address add address=10.0.0.30/30 interface=ether1 comment="NETWORK-ID\_10.0.0.28/30\_LINK\_FROM\_NEPAL-BLOCK\_10.0.0.30/30\_TO\_UK-BLOCK\_10.0.0.29/30"  /ip address add address=10.0.0.37/30 interface=ether2 comment="NETWORK-ID\_10.0.0.36/30\_LINK\_FROM\_NEPAL-BLOCK\_10.0.0.37/30\_TO\_BRIT-BLOCK\_10.0.0.38/30" |

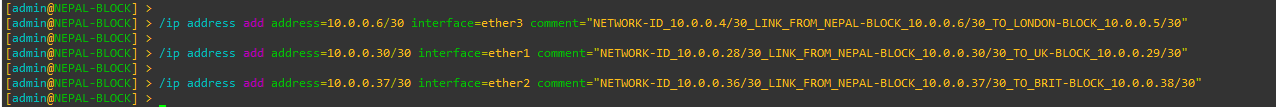


Figure 21: Configuration IP in the Core Interface of NEPAL-BLOCK Router Through CMD

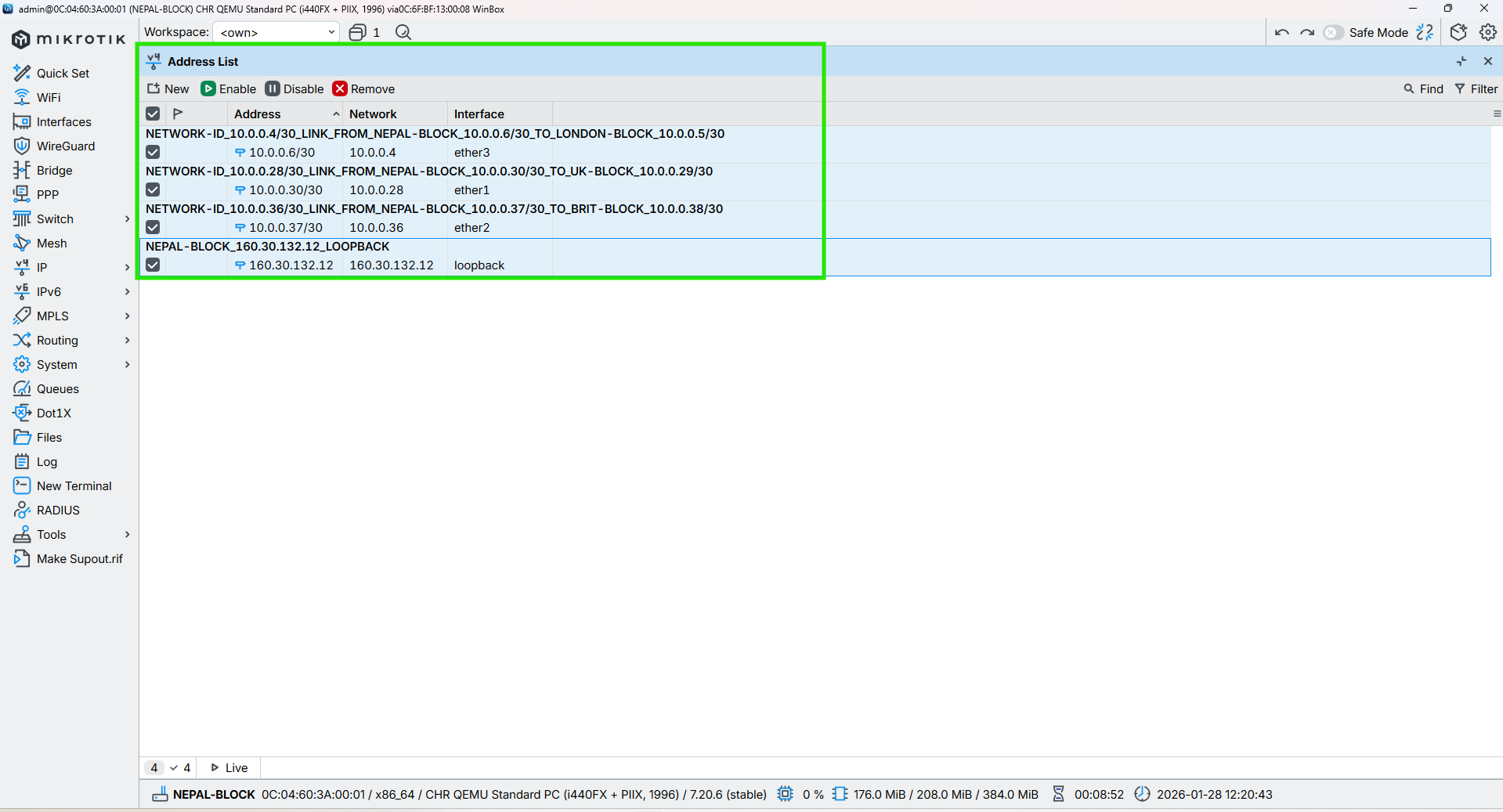


Figure 22: Configuration IP in the Core Interface of NEPAL-BLOCK Router Through WINBOX

## HIMAL-BLOCK

**CMD**

|  |
| --- |
| /ip address add address=10.0.0.33/30 interface=ether3 comment="NETWORK-ID\_10.0.0.32/30\_LINK\_FROM\_HIMAL-BLOCK\_10.0.0.33/30\_TO\_UK-BLOCK\_10.0.0.34/30"  /ip address add address=10.0.0.10/30 interface=ether4 comment="NETWORK-ID\_10.0.0.8/30\_LINK\_FROM\_HIMAL-BLOCK\_10.0.0.10/30\_TO\_LONDON-BLOCK\_10.0.0.9/30"  /ip address add address=10.0.0.42/30 interface=ether2 comment="NETWORK-ID\_10.0.0.40/30\_LINK\_FROM\_HIMAL-BLOCK\_10.0.0.42/30\_TO\_SKILL-BLOCK\_10.0.0.41/30"c |

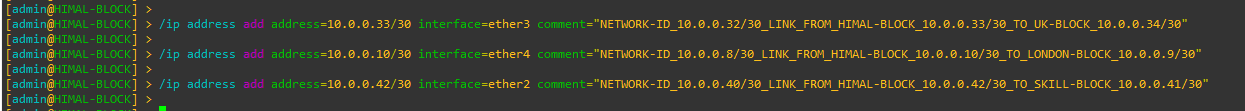


Figure 23: Configuration IP in the Core Interface of HIMAL-BLOCK Router Through CMD

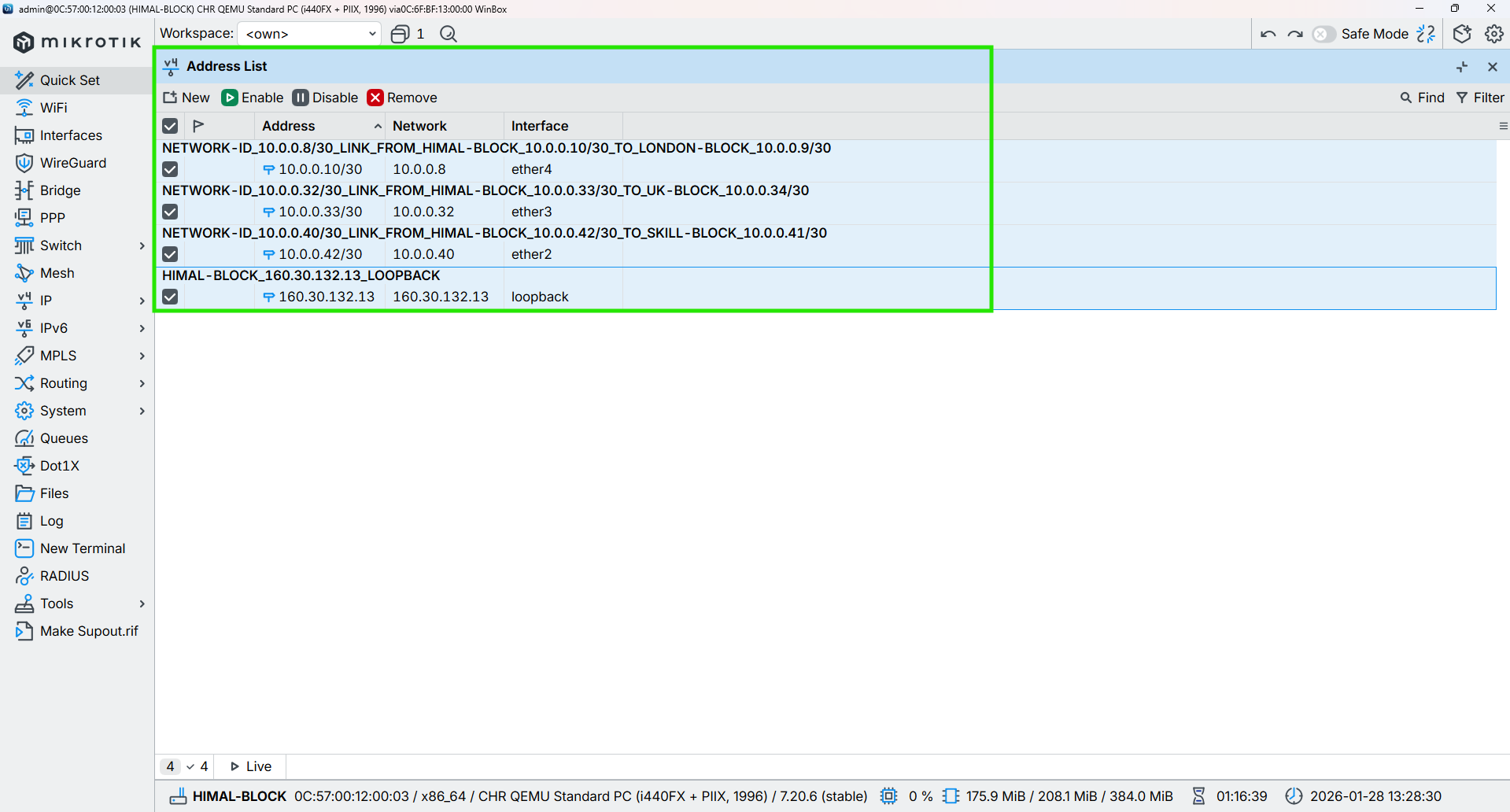


Figure 24: Configuration IP in the Core Interface of HIMAL-BLOCK Router Through WINBOX

## BRIT-BLOCK

**CMD**

|  |
| --- |
| /ip address add address=10.0.0.38/30 interface=ether2 comment="NETWORK-ID\_10.0.0.36/30\_LINK\_FROM\_BRIT-BLOCK\_10.0.0.38/30\_TO\_NEPAL-BLOCK\_10.0.0.37/30"  /ip address add address=10.0.0.14/30 interface=ether5 comment="NETWORK-ID\_10.0.0.12/30\_LINK\_FROM\_BRIT-BLOCK\_10.0.0.14/30\_TO\_LONDON-BLOCK\_10.0.0.13/30"  /ip address add address=10.0.0.46/30 interface=ether1 comment="NETWORK-ID\_10.0.0.44/30\_LINK\_FROM\_BRIT-BLOCK\_10.0.0.46/30\_TO\_KUMARI-BLOCK\_10.0.0.45/30" |

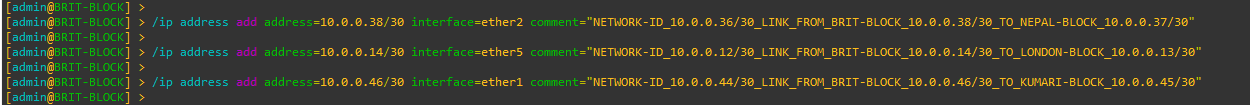


Figure 25: Configuration IP in the Core Interface of BRIT-BLOCK Router Through CMD

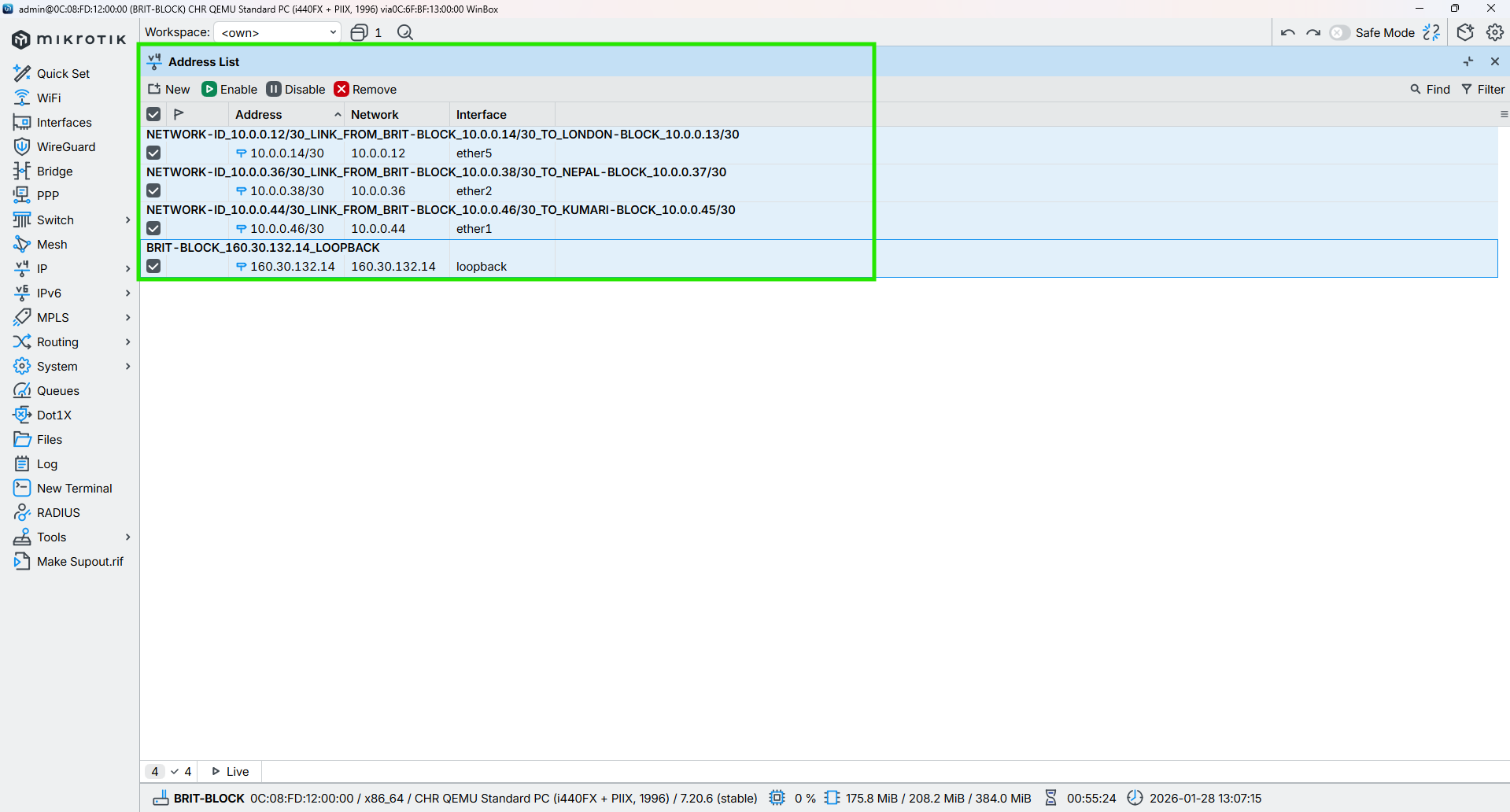


Figure 26: Configuration IP in the Core Interface of BRIT-BLOCK Router Through WINBOX

## SKILL-BLOCK

**CMD**

|  |
| --- |
| /ip address add address=10.0.0.41/30 interface=ether2 comment=”NETWORK-ID\_10.0.0.40/30\_LINK\_FROM\_SKILL-BLOCK\_10.0.0.41/30\_TO\_NEPAL-BLOCK\_10.0.0.42/30”  /ip address add address=10.0.0.18/30 interface=ether6 comment=”NETWORK-ID\_10.0.0.16/30\_LINK\_FROM\_SKILL-BLOCK\_10.0.0.18/30\_TO\_LONDON-BLOCK\_10.0.0.17/30”  /ip address add address=10.0.0.50/30 interface=ether1 comment=”NETWORK-ID\_10.0.0.48/30\_LINK\_FROM\_SKILL-BLOCK\_10.0.0.50/30\_TO\_KUMARI-BLOCK\_10.0.0.49/30” |



Figure 27: Configuration IP in the Core Interface of SKILL-BLOCK Router Through CMD

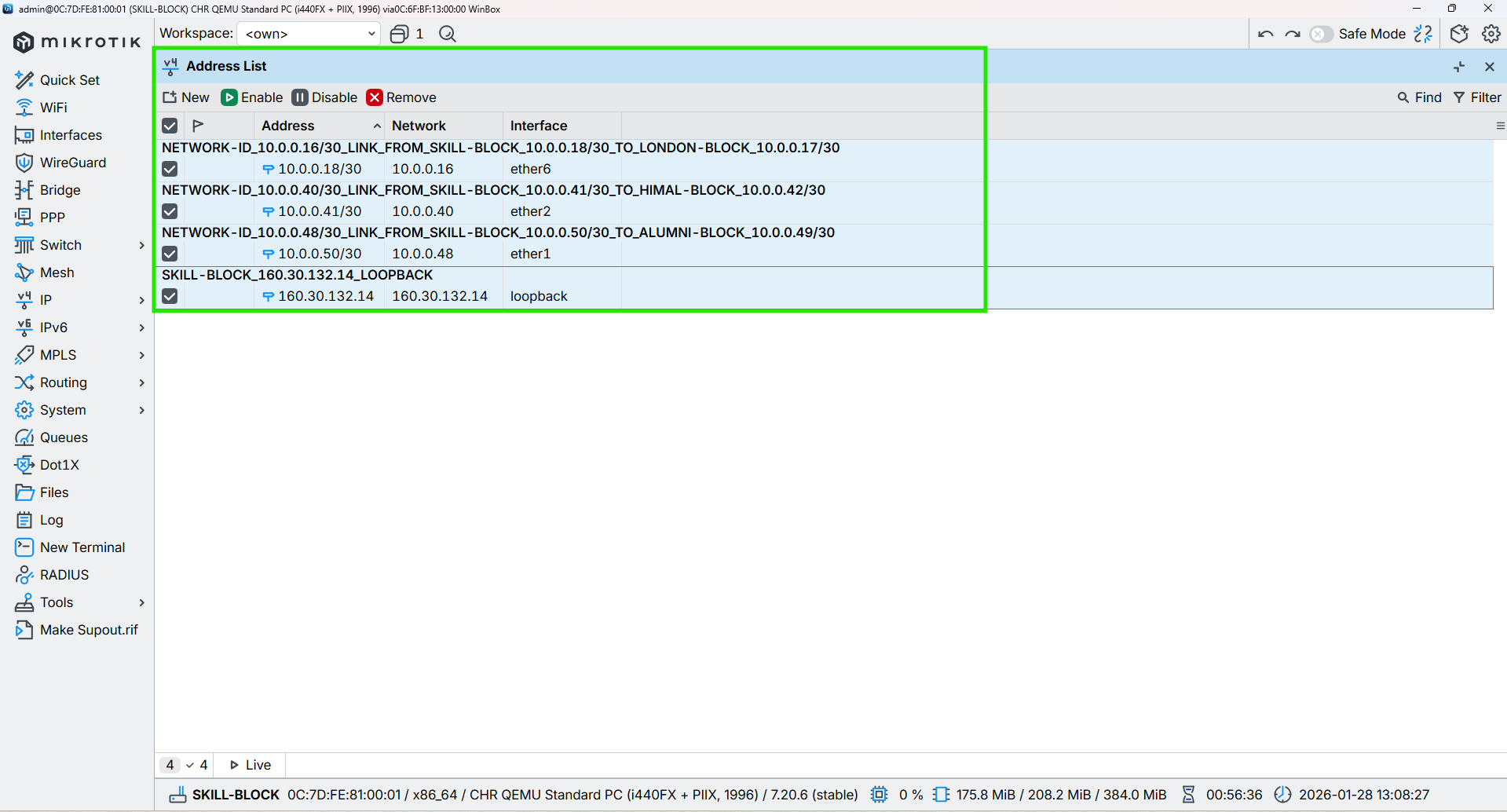


Figure 28: Configuration IP in the Core Interface of SKILL-BLOCK Router Through WINBOX

## ALUMNI-BLOCK

**CMD**

|  |
| --- |
| /ip address add address=10.0.0.22/30 interface=ether7 comment="NETWORK-ID\_10.0.0.20/30\_LINK\_FROM\_ALUMNI-BLOCK\_10.0.0.22/30\_TO\_LONDON-BLOCK\_10.0.0.21/30"  /ip address add address=10.0.0.49/30 interface=ether1 comment="NETWORK-ID\_10.0.0.48/30\_LINK\_FROM\_ALUMNI-BLOCK\_10.0.0.49/30\_TO\_SKILL-BLOCK\_10.0.0.50/30"  /ip address add address=10.0.0.53/30 interface=ether2 comment="NETWORK-ID\_10.0.0.52/30\_LINK\_FROM\_ALUMNI-BLOCK\_10.0.0.53/30\_TO\_KUMARI-BLOCK\_10.0.0.54/30" |

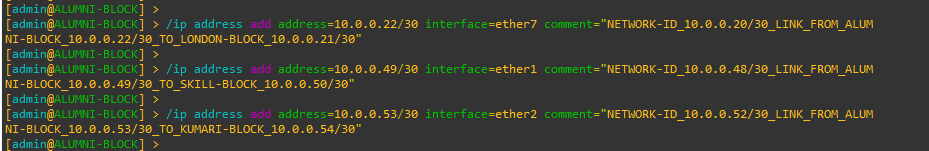


Figure 29: Configuration IP in the Core Interface of ALUMNI-BLOCK Router Through CMD

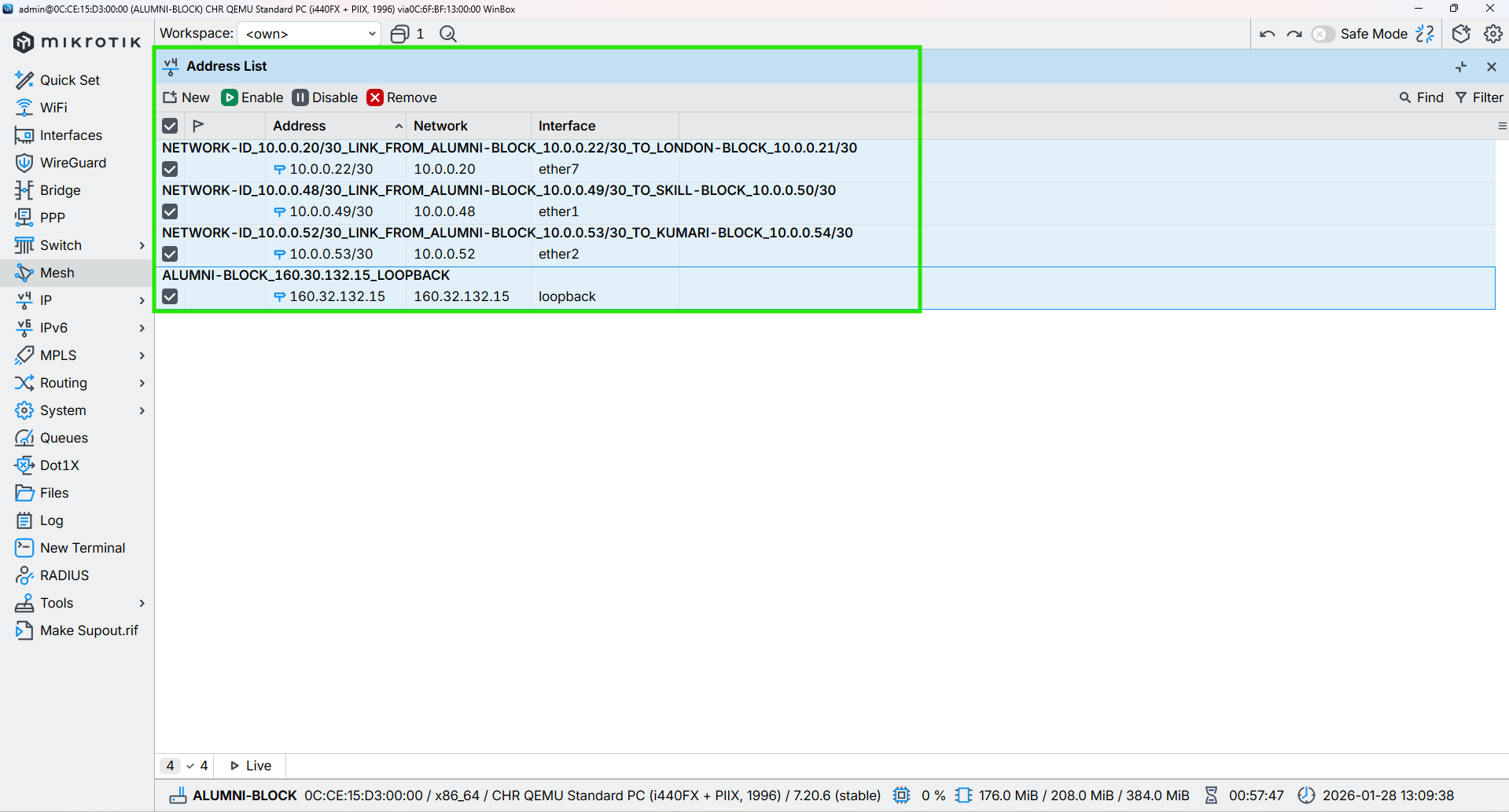


Figure 30: Configuration IP in the Core Interface of ALUMNI-BLOCK Router Through WINBOX

## KUMARI-BLOCK

**CMD**

|  |
| --- |
| /ip address add address=10.0.0.26/30 interface=ether8 comment="NETWORK-ID\_10.0.0.24/30\_LINK\_FROM\_KUMARI-BLOCK\_10.0.0.26/30\_TO\_LONDON-BLOCK\_10.0.0.25/30"  /ip address add address=10.0.0.54/30 interface=ether2 comment="NETWORK-ID\_10.0.0.52/30\_LINK\_FROM\_KUMARI-BLOCK\_10.0.0.54/30\_TO\_ALUMNI-BLOCK\_10.0.0.53/30"  /ip address add address=10.0.0.44/30 interface=ether1 comment="NETWORK-ID\_10.0.0.44/30\_LINK\_FROM\_KUMARI-BLOCK\_10.0.0.44/30\_TO\_BRIT-BLOCK\_10.0.0.46/30" |

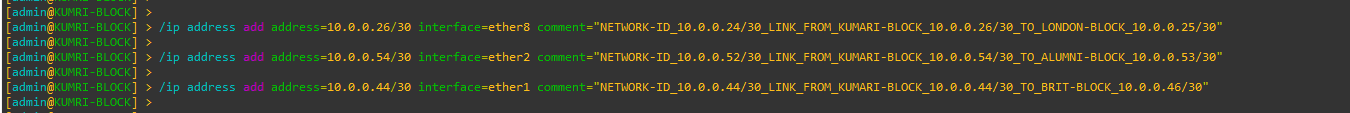


Figure 31: Configuration IP in the Core Interface of KUMARI-BLOCK Router Through CMD

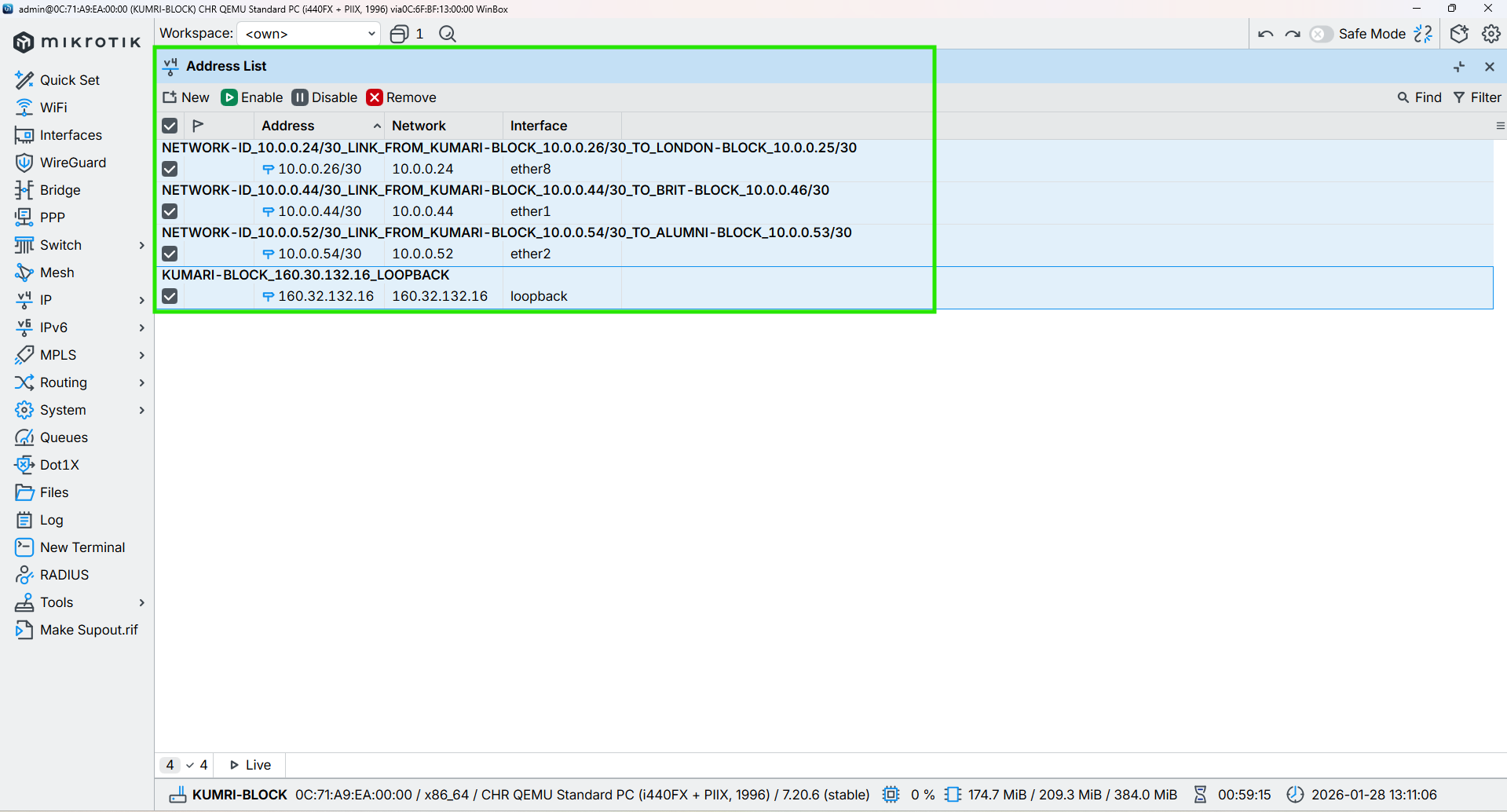


Figure 32: Configuration IP in the Core Interface of KUMARI-BLOCK Router Through WINBOX

# Configuration OSPF to all Core Routers

## LONDON-BLOCK

CMD

|  |
| --- |
| /routing ospf instance add name=OSPF\_LONDON\_BLOCK router-id=160.30.132.1 comment="OSPF instance for London block, router-id 160.30.132.1"  /routing ospf area add name=backbone area-id=0.0.0.0 instance=OSPF\_LONDON\_BLOCK comment="Backbone area 0.0.0.0 for London OSPF"  /routing ospf interface-template  add interfaces=loopback area=backbone passive comment="Loopback London router-id 160.30.132.1 (passive)"  add networks=10.0.0.0/30 interfaces=ether2 area=backbone comment="ETHER-2\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.1\_TO\_UK-BLOCK\_10.0.0.2"  add networks=10.0.0.4/30 interfaces=ether3 area=backbone comment="ETHER-3\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.5\_TO\_NEPAL-BLOCK\_10.0.0.6"  add networks=10.0.0.8/30 interfaces=ether4 area=backbone comment="ETHER-4\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.9\_TO\_HIMAL-BLOCK\_10.0.0.10"  add networks=10.0.0.12/30 interfaces=ether5 area=backbone comment="ETHER-5\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.13\_TO\_BRIT-BLOCK\_10.0.0.14"  add networks=10.0.0.16/30 interfaces=ether6 area=backbone comment="ETHER-6\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.17\_TO\_SKILL-BLOCK\_10.0.0.18"  add networks=10.0.0.20/30 interfaces=ether7 area=backbone comment="ETHER-7\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.21\_TO\_ALUMNI-BLOCK\_10.0.0.22"  add networks=10.0.0.24/30 interfaces=ether8 area=backbone comment="ETHER-8\_LINK\_FROM\_LONDON-BLOCK\_10.0.0.25\_TO\_KUMARI-BLOCK\_10.0.0.26" |



Figure 33: Configuration OSPF to Core LONDON-BLOCK Router Through CMD

|  |
| --- |
| Figure 34: Configuration OSPF Instances to Core LONDON-BLOCK Router Through WINBOX |
| Figure 35: Configuration OSPF Area to Core LONDON-BLOCK Router Through WINBOX |
| Figure 36: Configuration OSPF Interface-template to Core LONDON-BLOCK Router Through WINBOX |

## UK-BLOCK

CMD

|  |
| --- |
| /routing ospf instance add name=OSPF\_UK\_BLOCK router-id=160.30.132.11 comment="OSPF instance for UK block, router-id 160.30.132.11"  /routing ospf area add name=backbone area-id=0.0.0.0 instance=OSPF\_UK\_BLOCK comment="Backbone area 0.0.0.0 for UK OSPF"  /routing ospf interface-template  add interfaces=loopback area=backbone comment="Loopback UK router-id 160.30.132.11 (passive)"  add networks=10.0.0.0/30 interfaces=ether2 area=backbone comment="ETHER-2\_LINK\_FROM\_UK-BLOCK\_10.0.0.2\_TO\_LONDON-BLOCK\_10.0.0.1"  add networks=10.0.0.28/30 interfaces=ether1 area=backbone comment="ETHER-3\_LINK\_FROM\_UK-BLOCK\_10.0.0.29\_TO\_NEPAL-BLOCK\_10.0.0.30"  add networks=10.0.0.32/30 interfaces=ether3 area=backbone comment="ETHER-3\_LINK\_FROM\_UK-BLOCK\_10.0.0.34\_TO\_HIMAL-BLOCK\_10.0.0.33" |



Figure 37: Configuration OSPF to UK-BLOCK Router Through CMD

|  |
| --- |
| Figure 38: Configuration OSPF Instances to UK-BLOCK Router Through WINBOX |
| Figure 39: Configuration OSPF Area to UK-BLOCK Router Through WINBOX |
| Figure 40: Configuration OSPF Interface-template to UK-BLOCK Router Through WINBOX |

## NEPAL-BLOCK

**CMD**

|  |
| --- |
| /routing ospf instance add name=OSPF\_NEPAL\_BLOCK router-id=160.30.132.12 comment="OSPF instance for NEPAL block, router-id 160.30.132.12"  /routing ospf area add name=backbone area-id=0.0.0.0 instance=OSPF\_NEPAL\_BLOCK comment="Backbone area 0.0.0.0 for NEPAL OSPF"  /routing ospf interface-template  add interfaces=loopback area=backbone comment="Loopback NEPAL router-id 160.30.132.12 (passive)"  add networks=10.0.0.28/30 interfaces=ether1 area=backbone comment="ETHER-1\_LINK\_FROM\_NEPAL-BLOCK\_10.0.0.30\_TO\_UK-BLOCK\_10.0.0.29"  add networks=10.0.0.4/30 interfaces=ether3 area=backbone comment="ETHER-3\_LINK\_FROM\_NEPAL-BLOCK\_10.0.0.6\_TO\_LONDON-BLOCK\_10.0.0.5"  add networks=10.0.0.36/30 interfaces=ether2 area=backbone comment="ETHER-2\_LINK\_FROM\_NEPAL-BLOCK\_10.0.0.37\_TO\_BRIT-BLOCK\_10.0.0.38" |



Figure 41: Configuration OSPF to NEPAL-BLOCK Router Through CMD

|  |
| --- |
| Figure 42: Configuration OSPF Instances to NEPAL-BLOCK Router Through WINBOX |
| Figure 43: Configuration OSPF Area to NEPAL-BLOCK Router Through WINBOX |
| Figure 44: Configuration OSPF Interface-template to NEPAL-BLOCK Router Through WINBOX |

## HIMAL-BLOCK

CMD

|  |
| --- |
| /routing ospf instance add name=OSPF\_HIMAL\_BLOCK router-id=160.30.132.13 comment="OSPF instance for HIMAL block, router-id 160.30.132.13"  /routing ospf area add name=backbone area-id=0.0.0.0 instance=OSPF\_HIMAL\_BLOCK comment="Backbone area 0.0.0.0 for HIMAL OSPF"  /routing ospf interface-template  add interfaces=loopback area=backbone comment="Loopback HIMAL router-id 160.30.132.13 (passive)"  add networks=10.0.0.32/30 interfaces=ether3 area=backbone comment="ETHER-3\_LINK\_FROM\_HIMAL-BLOCK\_10.0.0.33\_TO\_UK-BLOCK\_10.0.0.34"  add networks=10.0.0.8/30 interfaces=ether4 area=backbone comment="ETHER-4\_LINK\_FROM\_HIMAL-BLOCK\_10.0.0.10\_TO\_LONDON-BLOCK\_10.0.0.9"  add networks=10.0.0.40/30 interfaces=ether2 area=backbone comment="ETHER-2\_LINK\_FROM\_HIMAL-BLOCK\_10.0.0.42\_TO\_SKILL-BLOCK\_10.0.0.41" |

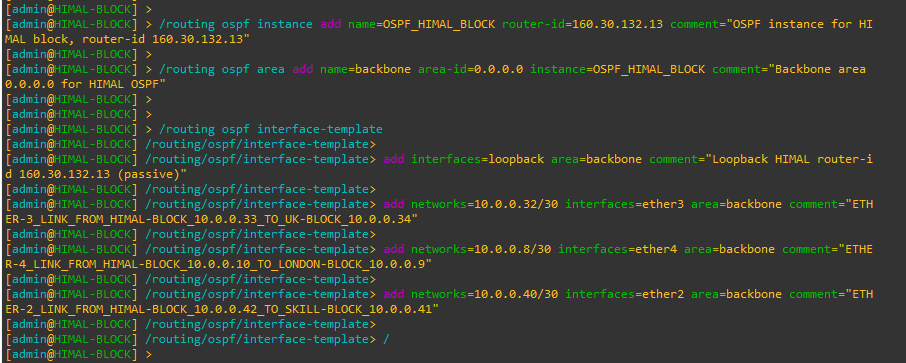


Figure 45: Configuration OSPF to HIMAL-BLOCK Router Through CMD

|  |
| --- |
| Figure 46: Configuration OSPF Instances to HIMAL-BLOCK Router Through WINBOX |
| Figure 47: Configuration OSPF Area to HIMAL-BLOCK Router Through WINBOX |
| Figure 48: Configuration OSPF Interface-template to HIMAL-BLOCK Router Through WINBOX |

## BRIT-BLOCK

**CMD**

|  |
| --- |
| /routing ospf instance add name=OSPF\_BRIT\_BLOCK router-id=160.30.132.14 comment="OSPF instance for BRIT block, router-id 160.30.132.14"  /routing ospf area add name=backbone area-id=0.0.0.0 instance=OSPF\_BRIT\_BLOCK comment="Backbone area 0.0.0.0 for BRIT OSPF"  /routing ospf interface-template  add interfaces=loopback area=backbone comment="Loopback BRIT router-id 160.30.132.14 (passive)"  add networks=10.0.0.36/30 interfaces=ether2 area=backbone comment="ETHER-2\_LINK\_FROM\_BRIT-BLOCK\_10.0.0.38\_TO\_NEPAL-BLOCK\_10.0.0.37"  add networks=10.0.0.12/30 interfaces=ether5 area=backbone comment="ETHER-5\_LINK\_FROM\_BRIT-BLOCK\_10.0.0.14\_TO\_LONDON-BLOCK\_10.0.0.13"  add networks=10.0.0.44/30 interfaces=ether1 area=backbone comment="ETHER-1\_LINK\_FROM\_BRIT-BLOCK\_10.0.0.46\_TO\_SKILL-BLOCK\_10.0.0.45" |

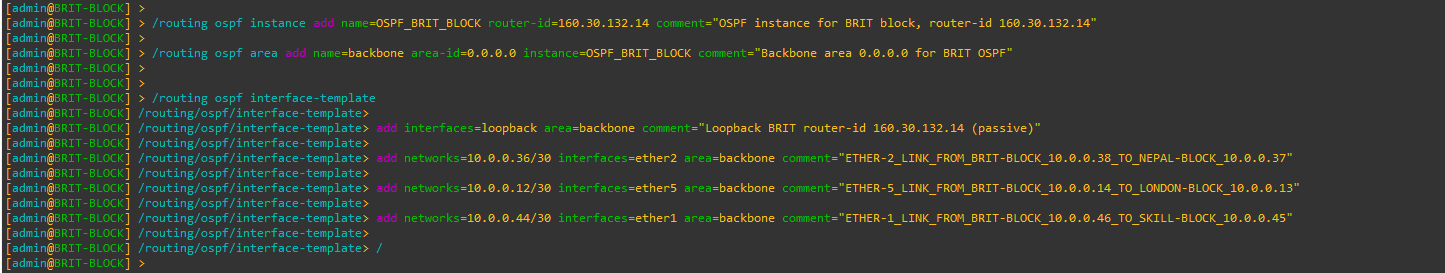


Figure 49: Configuration OSPF to BRIT-BLOCK Router Through CMD

|  |
| --- |
| Figure 50: Configuration OSPF Instances to BRIT-BLOCK Router Through WINBOX |
| Figure 51: Configuration OSPF Area to BRIT-BLOCK Router Through WINBOX |
| Figure 52: Configuration OSPF Interface-template to BRIT-BLOCK Router Through WINBOX |

## SKILL-BLOCK

CMD

|  |
| --- |
| /routing ospf instance add name=OSPF\_SKILL\_BLOCK router-id=160.30.132.15 comment="OSPF instance for SKILL block, router-id 160.30.132.15"  /routing ospf area add name=backbone area-id=0.0.0.0 instance=OSPF\_SKILL\_BLOCK comment="Backbone area 0.0.0.0 for SKILL OSPF"  /routing ospf interface-template  add interfaces=loopback area=backbone comment="Loopback SKILL router-id 160.30.132.15 (passive)"  add networks=10.0.0.40/30 interfaces=ether2 area=backbone comment="ETHER-2\_LINK\_FROM\_SKILL-BLOCK\_10.0.0.41\_TO\_HIMAL-BLOCK\_10.0.0.42"  add networks=10.0.0.16/30 interfaces=ether6 area=backbone comment="ETHER-6\_LINK\_FROM\_SKILL-BLOCK\_10.0.0.18\_TO\_LONDON-BLOCK\_10.0.0.17"  add networks=10.0.0.48/30 interfaces=ether1 area=backbone comment="ETHER-1\_LINK\_FROM\_SKILL-BLOCK\_10.0.0.50\_TO\_ALUMNI-BLOCK\_10.0.0.49" |

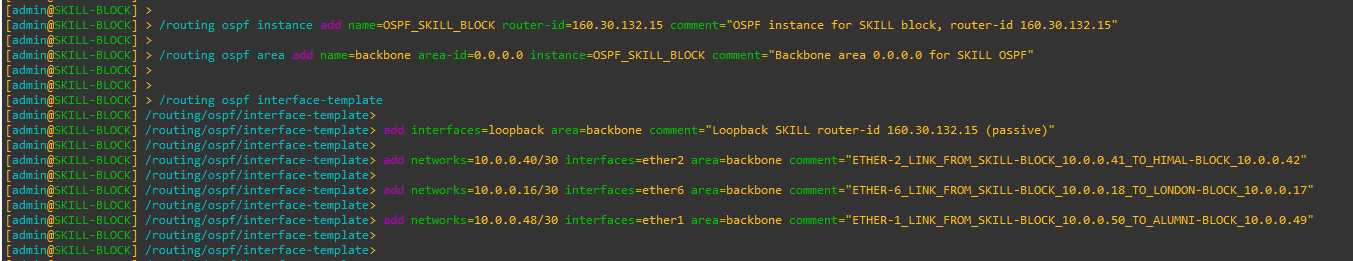


Figure 53: Configuration OSPF to SKILL-BLOCK Router Through CMD

|  |
| --- |
| Figure 54: Configuration OSPF Instances to SKILL-BLOCK Router Through WINBOX |
| Figure 55: Configuration OSPF Area to SKILL-BLOCK Router Through WINBOX |
| Figure 56: Configuration OSPF Interface-template to SKILL-BLOCK Router Through WINBOX |

## ALUMNI-BLOCK

CMD

|  |
| --- |
| /routing ospf instance add name=OSPF\_ALUMNI\_BLOCK router-id=160.30.132.16 comment="OSPF instance for ALUMNI block, router-id 160.30.132.16"  /routing ospf area add name=backbone area-id=0.0.0.0 instance=OSPF\_ALUMNI\_BLOCK comment="Backbone area 0.0.0.0 for ALUMNI OSPF"  /routing ospf interface-template  add interfaces=loopback area=backbone comment="Loopback ALUMNI router-id 160.30.132.16 (passive)"  add networks=10.0.0.48/30 interfaces=ether1 area=backbone comment="ETHER-1\_LINK\_FROM\_ALUMNI-BLOCK\_10.0.0.49\_TO\_SKILL-BLOCK\_10.0.0.50"  add networks=10.0.0.20/30 interfaces=ether7 area=backbone comment="ETHER-7\_LINK\_FROM\_ALUMNI-BLOCK\_10.0.0.22\_TO\_LONDON-BLOCK\_10.0.0.21"  add networks=10.0.0.52/30 interfaces=ether2 area=backbone comment="ETHER-2\_LINK\_FROM\_ALUMNI-BLOCK\_10.0.0.53\_TO\_KUMARI-BLOCK\_10.0.0.54" |

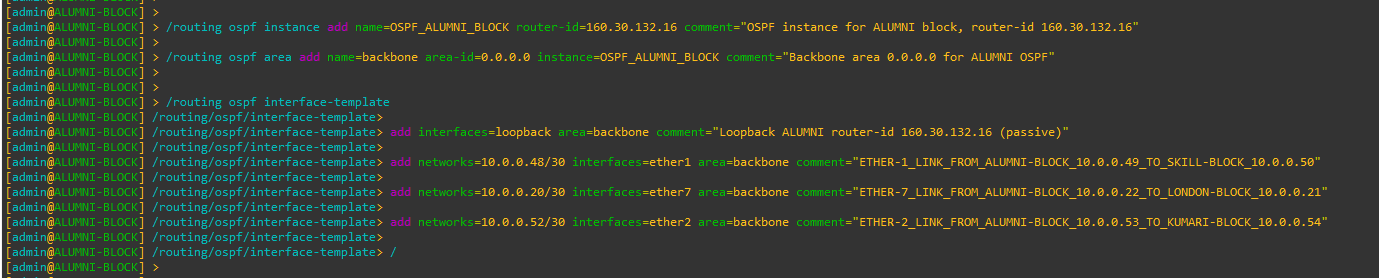


Figure 57: Configuration OSPF to ALUMNI-BLOCK Router Through CMD

|  |
| --- |
| Figure 58: Configuration OSPF Instances to ALUMNI-BLOCK Router Through WINBOX |
| Figure 59: Configuration OSPF Area to ALUMNI-BLOCK Router Through WINBOX |
| Figure 60: Configuration OSPF Interface-template to ALUMNI-BLOCK Router Through WINBOX |

## KUMARI-BLOCK

CMD

|  |
| --- |
| /routing ospf instance add name=OSPF\_KUMARI\_BLOCK router-id=160.30.132.17 comment="OSPF instance for KUMARI block, router-id 160.30.132.17"  /routing ospf area add name=backbone area-id=0.0.0.0 instance=OSPF\_KUMARI\_BLOCK comment="Backbone area 0.0.0.0 for KUMARI OSPF"  /routing ospf interface-template  add interfaces=loopback area=backbone comment="Loopback KUMARI router-id 160.30.132.17 (passive)"  add networks=10.0.0.44/30 interfaces=ether1 area=backbone comment="ETHER-1\_LINK\_FROM\_KUMARI-BLOCK\_10.0.0.45\_TO\_BRIT-BLOCK\_10.0.0.46"  add networks=10.0.0.24/30 interfaces=ether8 area=backbone comment="ETHER-8\_LINK\_FROM\_KUMARI-BLOCK\_10.0.0.26\_TO\_LONDON-BLOCK\_10.0.0.25"  add networks=10.0.0.52/30 interfaces=ether2 area=backbone comment="ETHER-2\_LINK\_FROM\_KUMARI-BLOCK\_10.0.0.54\_TO\_ALUMNI-BLOCK\_10.0.0.53" |



Figure 61: Configuration OSPF to KUMARI-BLOCK Router Through CMD

|  |
| --- |
| Figure 62: Configuration OSPF Instances to KUMARI-BLOCK Router Through WINBOX |
| Figure 63: Configuration OSPF Area to KUMARI-BLOCK Router Through WINBOX |
| Figure 64: Configuration OSPF Interface-template to KUMARI-BLOCK Router Through WINBOX |

# Configure Management Access from PC to MPLS Loopback

## PC (VMware Host) – Static Route Configuration

To allow the PC (VMware host) to reach the MPLS loopback network

160.30.132.0/24, a persistent static route is added on the PC pointing to the

LONDON-BLOCK management interface.

CMD (Windows PC)

|  |
| --- |
| route -p add 160.30.132.0 mask 255.255.255.0 192.168.174.173 |

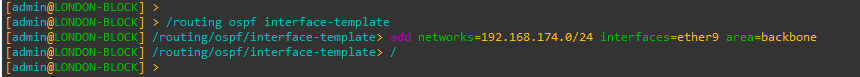


## UK-BLOCK – OSPF Configuration (No Management Network Advertisement)

LONDON-BLOCK acts as the central management gateway between the PC and the MPLS core. UK-BLOCK participates only in MPLS core OSPF.

The VMware management network must not be added to OSPF.

|  |
| --- |
| /routing ospf interface-template  add networks=192.168.174.0/24 interfaces=ether9 area=backbone  / |



## Disable RoMON temporarily to avoid confusion

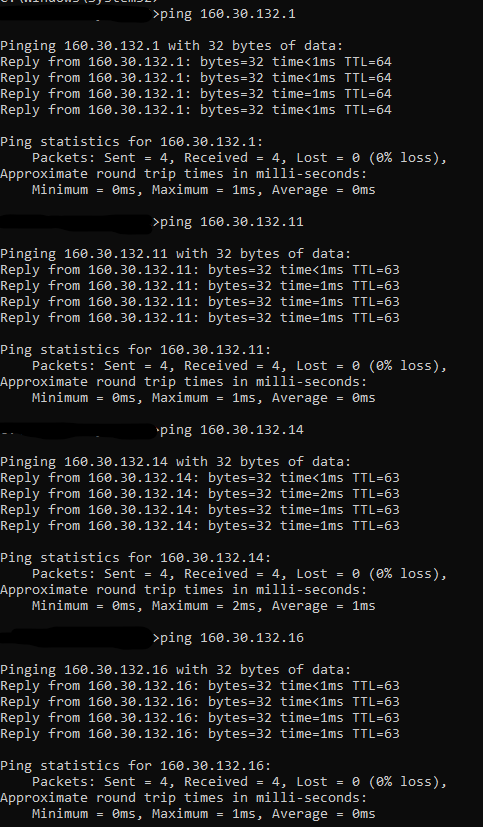
Cmd

|  |
| --- |
| /tool romon set enabled=no |

## End-to-End Verification (From PC)

Ping Test

|  |
| --- |
| ping 160.30.132.1  ping 160.30.132.11  ping 160.30.132.14  ping 160.30.132.16 |



# Configuration MPLS to all Core Routers

## LONDON-BLOCK

## UK-BLOCK

## NEPAL-BLOCK

## HIMAL-BLOCK

## BRIT-BLOCK

## SKILL-BLOCK

## ALUMNI-BLOCK

## KUMARI-BLOCK

# Configuration LDP on Interfaces of Core Interfaces Routers

## LONDON-BLOCK

## UK-BLOCK

## NEPAL-BLOCK

## HIMAL-BLOCK

## BRIT-BLOCK

## SKILL-BLOCK

## ALUMNI-BLOCK

## KUMARI-BLOCK

# Set MPLS MTU (Crucial for VPLS to prevent fragmentation)

## LONDON-BLOCK

## UK-BLOCK

## NEPAL-BLOCK

## HIMAL-BLOCK

## BRIT-BLOCK

## SKILL-BLOCK

## ALUMNI-BLOCK

## KUMARI-BLOCK

# VPLS Setup (Points to Points) Routers

## LONDON-BLOCK

## UK-BLOCK

## NEPAL-BLOCK

## HIMAL-BLOCK

## BRIT-BLOCK

## SKILL-BLOCK

## ALUMNI-BLOCK

## KUMARI-BLOCK

# VPLS Configuration for VLAN Transport

## LONDON-BLOCK

## UK-BLOCK

## NEPAL-BLOCK

## HIMAL-BLOCK

## BRIT-BLOCK

## SKILL-BLOCK

## ALUMNI-BLOCK

## KUMARI-BLOCK

# Centralized DHCP Server Configuration

## LONDON-BLOCK

## UK-BLOCK

## NEPAL-BLOCK

## HIMAL-BLOCK

## BRIT-BLOCK

## SKILL-BLOCK

## ALUMNI-BLOCK

## KUMARI-BLOCK

# Redundancy and Load Balancing

## LONDON-BLOCK

## UK-BLOCK

## NEPAL-BLOCK

## HIMAL-BLOCK

## BRIT-BLOCK

## SKILL-BLOCK

## ALUMNI-BLOCK

## KUMARI-BLOCK

# End-to-End Verification and Traffic Analysis

## LONDON-BLOCK

## UK-BLOCK

## NEPAL-BLOCK

## HIMAL-BLOCK

## BRIT-BLOCK

## SKILL-BLOCK

## ALUMNI-BLOCK

## KUMARI-BLOCK

# Network Topology and Diagrams

## Full Network Topology Diagram

## MPLS LSP Paths Illustration

## VPLS VLAN Extension Diagram

# Troubleshooting Guide

## Common OSPF Issues

## MPLS / LDP Problems

## VPLS VLAN Bridging Errors

## DHCP Failures

## ECMP / Load Balancing Verification Tips

# Security and Access Control

## Management Access (SSH / Winbox)

## ACLs / Firewall Rules for Router Interfaces

# 

# Conclusion and Future Enhancements

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