

## Scenario Interconnecting Remote Sites by IPv6

International Company BigShoe5, Ltd. has branches in London and Belfast. The local networks implement IPv6 networks only. Since the ISP provides only IPv4 connectivity, configure an IPv6 over IPv4 tunnel to connect local IPv6 LANs.

### Task 1 Basic Configuration

1. Cable the network topology. Configure routers ISP, London and Belfast.
2. Router configuration.
  - (a) Configure the router hostnames. Disable DNS lookup. Configure IPv4 addresses.
  - (b) Configure OSPF routing on routers for all IPv4 networks excluding the Internet link. Do not distribute OSPF updates to LANs or the Internet. Redistribute the default gateway towards the Internet.
  - (c) Configure PAT on the ISP. Permit NAT translation for all IPv4 networks.
2. Verify the connection.

### Task 2 IPv6 Configuration on London and Belfast.

1. Enable IPv6 routing on London and Belfast.
 

```
router(conf)# ipv6 unicast-routing
```
2. Configure static IPv6 addresses on loopbacks of Belfast and London.
 

```
router(conf)# interface <loopback>
router(conf-if)# ipv6 address <IPv6-address> / <prefix>; configure a global unique address (GUA)
router(conf-if)# no shutdown
```
3. Configure IPv6 address on London with SLAAC address assignment.
 

```
router(conf)# interface <intf>
router(conf-if)# ipv6 address <IPv6-address> / <prefix>; configure a global unique address (GUA)
router(conf-if)# ipv6 address fe80::1 link-local ; configure a link-local address (LLA)
router(conf-if)# no shutdown
```
4. Verify the connection.
 

```
router# show ipv6 interface brief
Ping from PC1 to London using LLA and GUA addresses.
```

### Task 3 Configure Stateless DHCPv6 server on Belfast.

1. Configure an IPv6 address on the Ethernet interface on Belfast.
 

```
router(conf-if)# ipv6 address <IPv6-address> / <prefix>; configure a global unique address (GUA)
```
2. Configure stateless DHCPv6 server on Belfast.
 

```
router(conf)# ipv6 dhcp pool <name>
router(conf-dhcp)# domain-name belfast.uk
router(conf-dhcp)# dns-server 2001:db8:4::1
router(conf-dhcp)# exit
router(conf)# interface <intf>
router(conf-if)# ipv6 dhcp server <name>
router(conf-if)# ipv6 nd other-config-flag
router(conf-if)# no shutdown
```

; define a DHCPv6 name  
; set a DNS domain  
; set a DNS server for IPv6

; assign the DHCPv6 server on the interface  
; set the other (O) flag for RA messages
3. Verify the settings and connection.
 

```
router# show ipv6 interface brief
Ping from PC2 to Belfast using LLA and GUA addresses.
```

### Task 4 Fill the assigned IPv6 addresses.

**London:**  
 IPv6 GUA on the LAN interface: \_\_\_\_\_

IPv6 LLA on the LAN interface: \_\_\_\_\_

**Belfast:**  
 IPv6 GUA on the LAN interface: \_\_\_\_\_

IPv6 LLA on the LAN interface: \_\_\_\_\_

MAC Address: \_\_\_\_\_

**PC:**  
 IPv6 GUA on the LAN interface: \_\_\_\_\_

IPv6 LLA on the LAN interface: \_\_\_\_\_

### Hints:

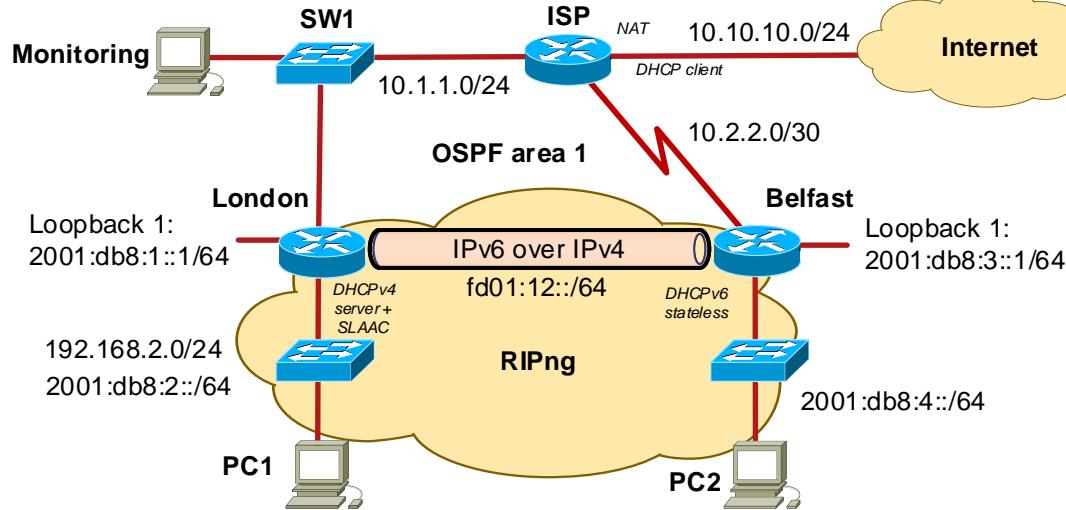
**# IPv6 address configuration**  
`router(conf)#IPv6 unicast-routing  
router(conf-if)# ipv6 address <prefix/mask>  
router(conf-if)# ipv6 address <link-addr> link-local`

**# IPv6 SLAAC configuration**  
`router(conf-if)# ipv6 address <prefix/mask>  
router(conf-if)# ipv6 address <link-addr> link-local  
router(conf-if)# no shutdown`

**# IPv6 Stateless DHCPv6 server**  
`router(conf)# ipv6 dhcp pool <name>  
router(conf-dhcp)# domain-name <domain>  
router(conf-dhcp)# dns-server <IPv6-address>  
router(conf-dhcp)# exit  
router(conf)# interface <intf>  
router(conf-if)# ipv6 dhcp server <name>  
router(conf-if)# ipv6 nd managed-config-flag`

**# IPv6 Statefull DHCPv6 server**  
`router(conf)# ipv6 dhcp pool <name>  
router(conf-dhcp)# domain-name <domain>  
router(conf-dhcp)# dns-server <IPv6-address>  
router(conf-dhcp)# exit  
router(conf)# interface <intf>  
router(conf-if)# ipv6 dhcp server <name>  
router(conf-if)# ipv6 nd managed-config-flag`

**# Verify the configuration**  
`router# show ipv6 interface brief  
router# show ipv6 route  
router# show ipv6 protocols`



## Task 5 Configure Tunnel IPv6 over IPv4

### 1. Configure the tunnel interface both on London and Belfast.

```
router(conf)# interface tunnel 1
router(conf-if)# ipv6 address <tunnel-IPv6-address> /<prefix>
router(conf-if)# tunnel source <interface>
router(conf-if)# tunnel destination <remote-IPv4-address>
router(conf-if)# tunnel mode ipv6ip
router(conf-if)# no shutdown
```

### 2. Verify the connection.

```
router# show ipv6 interface brief
router# show interface tunnel 1
router# ping <IPv6-address>
```

## Task 6 Configure RIPng Routing

### 1. Create a RIPng routing process on London and Belfast.

```
router(conf)# ipv6 router rip <process-name>
router(conf-rtf)# exit
```

### 2. Configure RIP routing on all IPv6 interfaces

```
router(conf-if)# ipv6 rip <process-name> enable
```

### 3. Verify the settings.

```
router# show ipv6 route rip
```

### 4. Verify connectivity between IPv6 devices.

Ping from PC1 to PC2 and loopbacks on London and Belfast.

## Task 7 Configure IPv4 Connectivity to PC1

### 1. Configure DHCPv4 server on London.

Use IPv4 address range 192.168.2.0/24. Exclude the first 10 addresses. Set DNS server to 10.10.10.1.

### 2. Add this IPv4 network to OSPF routing.

### 3. Enable NAT translation on ISP for this local IPv4 network.

## Task 8 Monitor IPv6 Encapsulation

### 1. Configure SPAN monitoring on SW1.

```
switch(conf)# monitor session <number> source interface <intf>
switch(conf)# monitor session <number> destination interface <intf>
switch# show monitor
```

### 2. Observe OSPF and RIPng packets in Wireshark. Describe their encapsulation.

OSPF Encapsulation:

L2 EtherType: \_\_\_\_\_

L3 layer: \_\_\_\_\_ L3 protocol: \_\_\_\_\_

L4 layer: \_\_\_\_\_

RIPng Encapsulation:

L2 EtherType: \_\_\_\_\_

L3 layer: \_\_\_\_\_ L3 protocol: \_\_\_\_\_

L3 next header: \_\_\_\_\_

L4 layer: \_\_\_\_\_ port no.: \_\_\_\_\_

L7 layer: \_\_\_\_\_

### 3. Ping from PC1 to PC2 and from PC1 to www.fit.vutbr.cz. Observe ICMP packets in Wireshark.

Ping PC1->PC2 over IPv6:

Src IPv4: \_\_\_\_\_

Dst IPv4: \_\_\_\_\_

Src IPv6: \_\_\_\_\_

Dst IPv6: \_\_\_\_\_

IPv6 Next header: : \_\_\_\_\_

Ping PC1 -> www.fit.vutbr.cz over IPv4:

Src IPv4: \_\_\_\_\_

Dst IPv4: \_\_\_\_\_

IP protocol no.: \_\_\_\_\_

ICMP type: \_\_\_\_\_

## Task 9 Save Configuration to the TFTP server

### 1. Launch TFTP64 application on PC1.

### 2. Upload configuration of London, Belfast, ISP, and SW1 to the TFTP server.

## Task 10 Finish the Lab

### 1. Erase configuration, switch off the PCs, and remove the cables.

#### Hints:

##### # IPv6 tunnel

```
router(conf)# interface tunnel <number>
router(conf-if)# ipv6 address <prefix/mask>
router(conf-if)# tunnel source <interface>
router(conf-if)# tunnel destination <remote-IPv4-address>
router(conf-if)# tunnel mode ipv6ip
```

##### # RIPng configuration

```
router(conf)# ipv6 router rip <process-name>
router(conf-if)# ipv6 rip <process-name> enable
```