# UDLR
Unidirectional Link Routing

overview and examples

UDLR Tunnels

- **UDLR simulates a bi-directional link by tunneling over the return path**

- **Supports both IP unicast and multicast**

- **Supports all IP routing protocols (including IS-IS for IP)**

- **Supports address resolution via ARP and NHRP**

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Basic UDLR Tunnel Operation

unidirectional tunnel

Internet

A

unidirectional link

B

local net

C
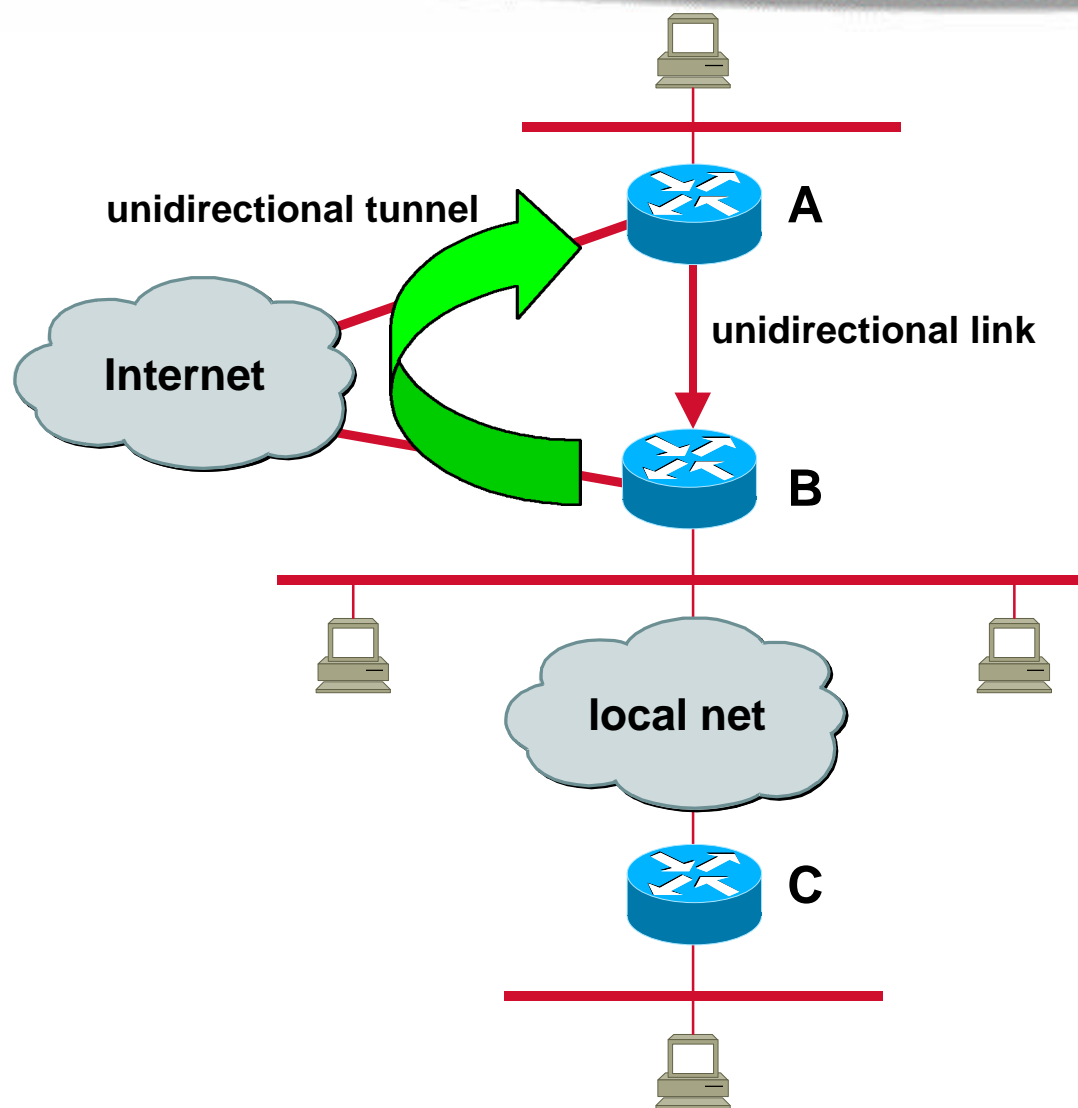
Traffic from the downstream network (B or C) destined for A's unidirectional interface will traverse the unidirectional tunnel.

Packets are encapsulated by B in a GRE IP packet and forwarded to upstream router A.

A decapsulates the GRE packet, and places the original packet on the input queue belonging to A's unidirectional link.

Access filters limit traffic on the upstream and downstream tunnel interfaces

IP, ARP, NHRP, and CLNS (for IS-IS IP routing) are supported.

Upstream router A's routing protocol must *never* advertise the tunnel subnet over the unidirectional link interface - this will cause a recursive tunnel in downstream routers.

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Mechanisms

Three mechanisms are available to implement unidirectional links:

- **UDLR-IGMP**

- **IGMP-Mroute Proxy**

- **UDLR-Tunnel**

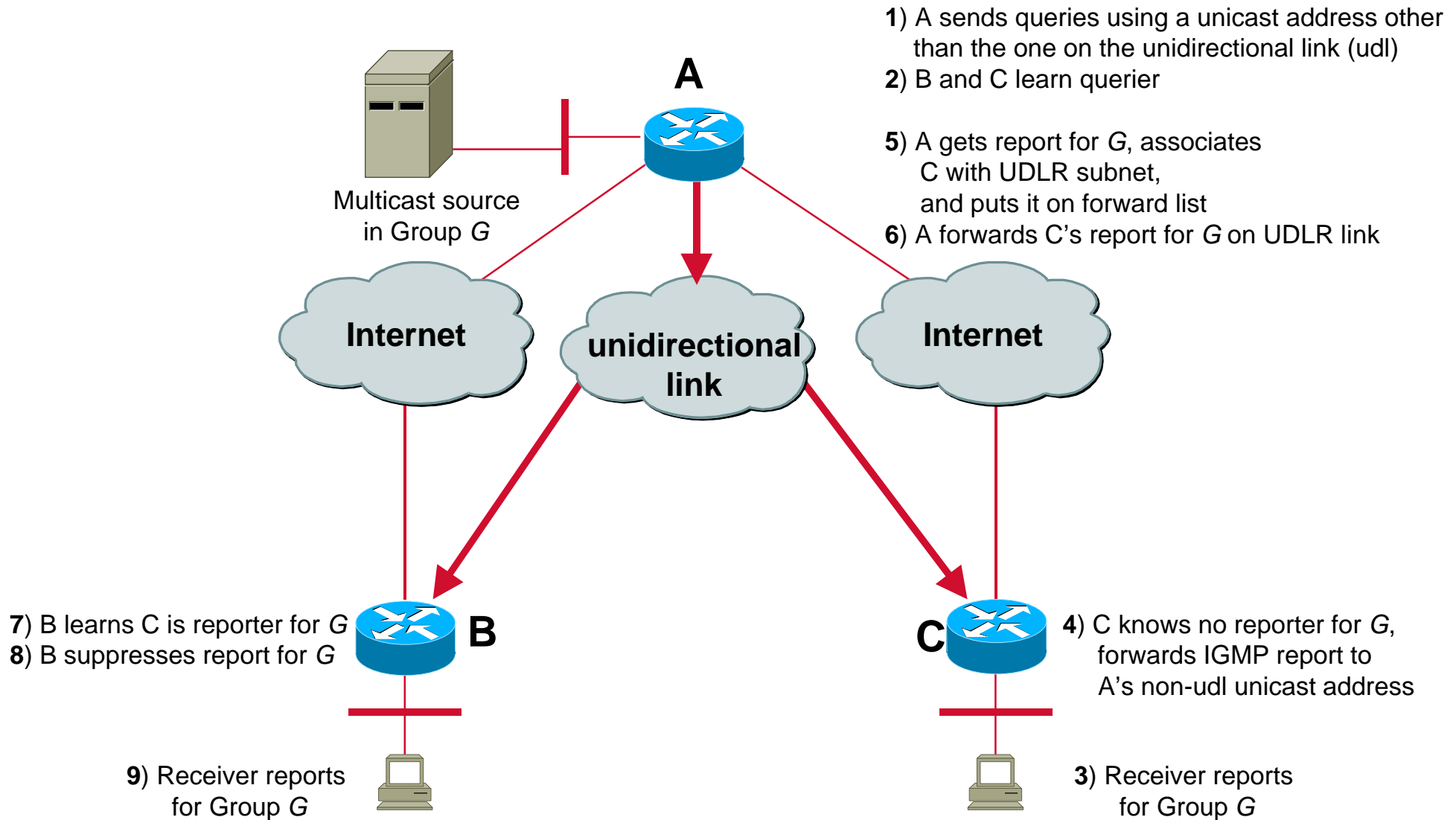# UDLR-IGMP

Detailed examples

What is UDLR-IGMP?
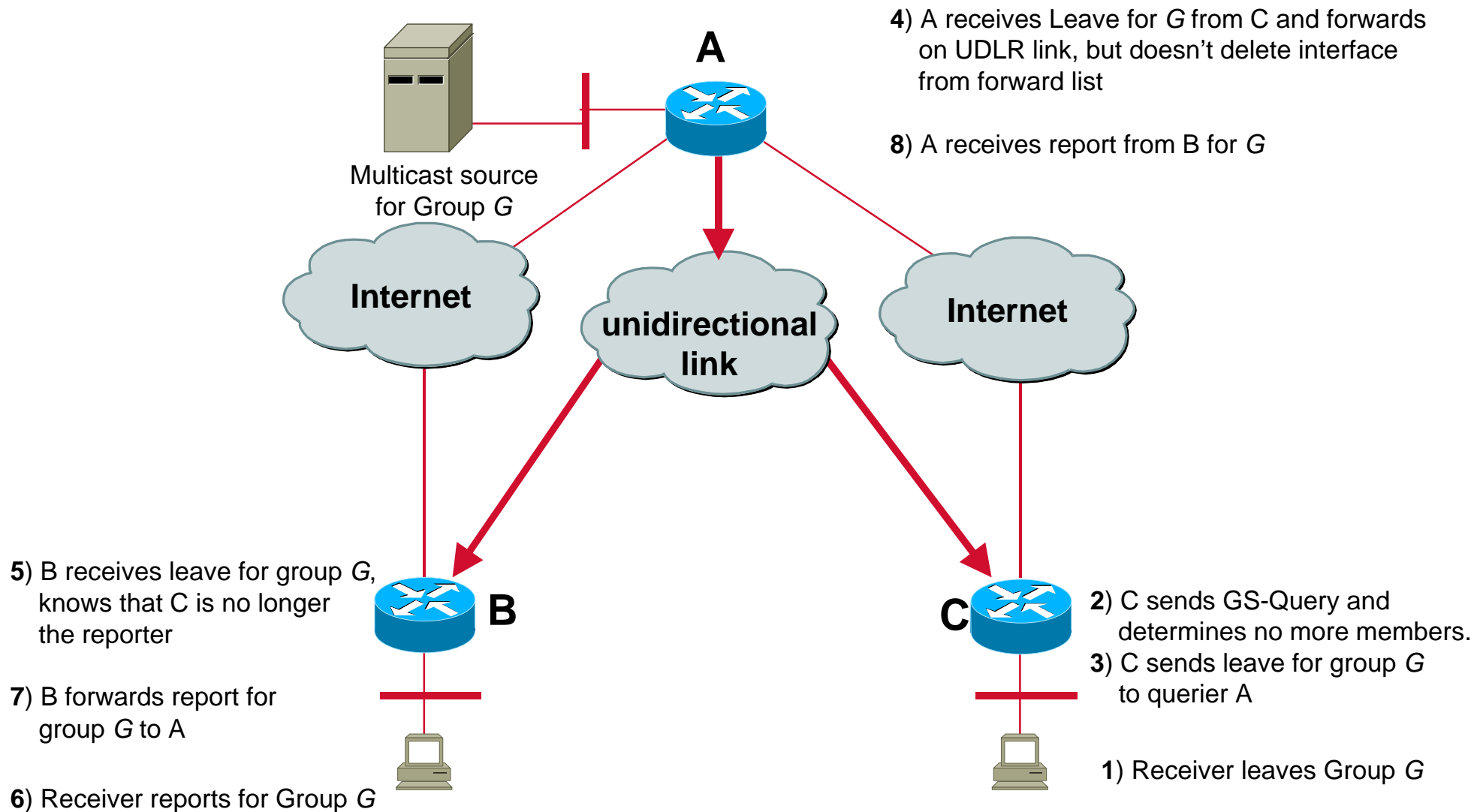
- A scalable mechanism to support IGMP joins over a unidirectional link.

- Upstream router queries for members with a unicast source address different than the satellite net.

- Downstream router forwards IGMP reports with TTL > 1 to the unicast querier address.

- Upstream router echoes IGMP report back out one-way link to suppress other downstream reports.

UDLR-IGMP Join

1) A sends queries using a unicast address other than the one on the unidirectional link (udl)

2) B and C learn querier

5) A gets report for *G*, associates C with UDLR subnet, and puts it on forward list

6) A forwards C's report for *G* on UDLR link

A

Multicast source in Group *G*

Internet

unidirectional link

Internet

7) B learns C is reporter for *G*

8) B suppresses report for *G*

B

C

4) C knows no reporter for *G*, forwards IGMP report to A's non-udl unicast address

9) Receiver reports for Group *G*

3) Receiver reports for Group *G*

UDLR-IGMP Leave

A

Multicast source
for Group *G*

Internet

**unidirectional
link**

Internet

B

C

4) A receives Leave for *G* from C and forwards
on UDLR link, but doesn't delete interface
from forward list

8) A receives report from B for *G*

5) B receives leave for group *G*,
knows that C is no longer
the reporter

7) B forwards report for
group *G* to A

6) Receiver reports for Group *G*

2) C sends GS-Query and
determines no more members.
3) C sends leave for group *G*
to querier A

1) Receiver leaves Group *G*

UDLR-IGMP example

Router A
interface ethernet 0
ip address 10.1.1.1 255.255.255.0
ip pim dense-mode
!
interface ethernet 1
ip address 10.2.1.1 255.255.255.0
ip pim dense-mode
ip igmp unidirectional link
!
interface ethernet 2
ip address 10.3.1.1 255.255.255.0

10.1.1.1

A

10.3.1.1

10.2.1.1

Internet

10.2.1.2

10.6.1.1

B
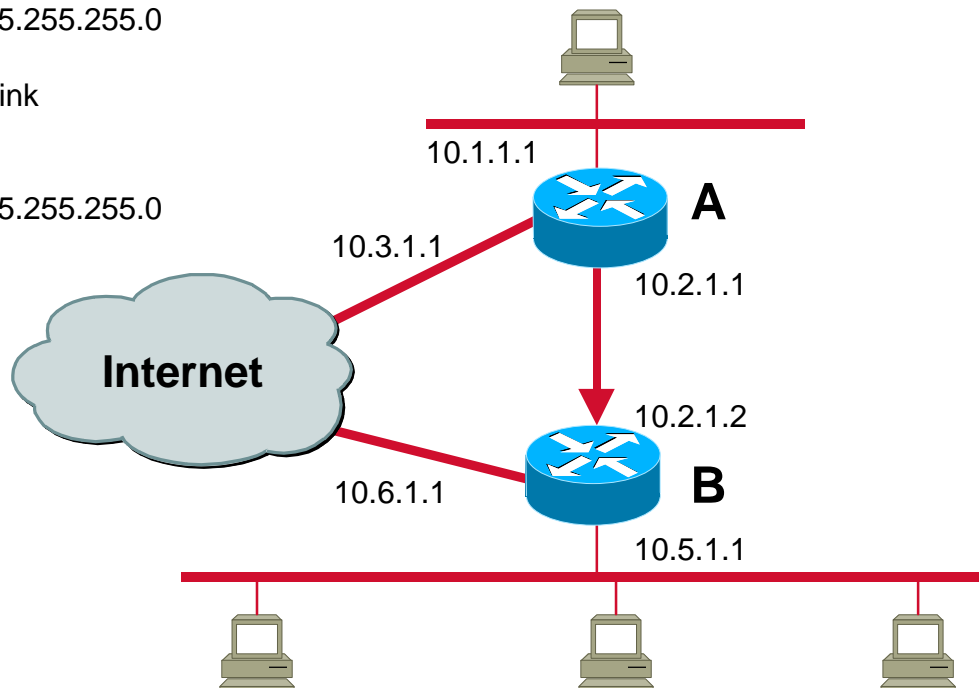
10.5.1.1

Router B
interface ethernet 0
ip address 10.2.1.2 255.255.255.0
ip pim dense-mode
ip igmp unidirectional link
!
interface ethernet 1
ip address 10.5.1.1 255.255.255.0
ip pim sparse-dense-mode
ip igmp helper-address udl ethernet 0
!
interface ethernet 2
ip address 10.6.1.1 255.255.255.0

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IGMP-Mroute proxy

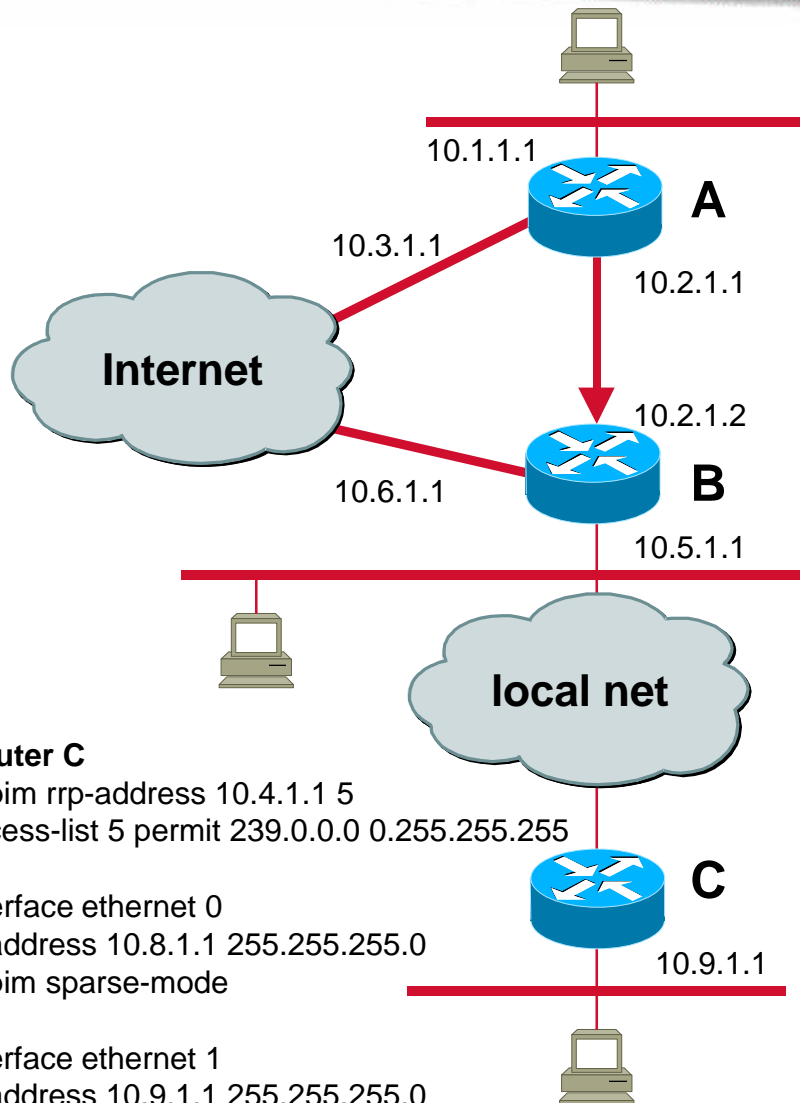## Detailed examples

IGMP-Mroute Proxy

- **UDLR-IGMP does not support the distribution of multicast groups beyond links directly connected to the downstream router.**

- **The IGMP-Mroute proxy overcomes this by forwarding an IGMP report to an interface for each group in the multicast routing table.**

- **In conjunction with UDLR-IGMP, IGMP reports are forwarded to an upstream router for each group in the mroute table.**

- **To populate the unidirectional downlink router's mroute table, other downstream routers enable PIM sparse mode and use the unidirectional downlink router as the rendezvous point.**

UDLR-IGMP with Mroute Proxy Operation

unidirectional tunnel

Internet

A

5) Router A creates and maintains a forwarding entry on the unidirectional link. Its behavior is the same as with UDLR-IGMP

unidirectional link

B

3) Router B receives the pim join and adds a forwarding entry for Group *G* on LAN B

4) Router B periodically checks its mroute table, and forwards an IGMP report for each group for which it is the reporter

LAN B

local net

C

2) Router C sends PIM join hop by hop to RP (router B)

1) User joins group *G*

UDLR-IGMP with Mroute Proxy

Router A
interface ethernet 0
ip address 10.1.1.1 255.255.255.0
ip pim dense-mode
!
Interface ethernet 1
ip address 10.2.1.1 255.255.255.0
ip pim dense-mode
ip igmp unidirectional link
!
Interface ethernet 2
ip address 10.3.1.1 255.255.255.0

Router B
ip pim rp-address 10.5.1.1 5
access-list 5 permit 239.0.0.0 0.255.255.255
!
interface loopback 0
ip address 10.7.1.1 255.255.255.0
ip pim dense-mode
ip igmp helper-address udl ethernet 0
ip igmp proxy-service

interface ethernet 0
ip address 10.2.1.2 255.255.255.0
ip pim dense-mode
ip igmp unidirectional link
!
interface ethernet 1
ip address 10.5.1.1 255.255.255.0
ip pim sparse-mode
ip igmp mroute-proxy loopback 0
!
interface ethernet 2
ip address 10.6.1.1 255.255.255.0

Router C
ip pim rrp-address 10.4.1.1 5
access-list 5 permit 239.0.0.0 0.255.255.255
!
interface ethernet 0
ip address 10.8.1.1 255.255.255.0
ip pim sparse-mode
!
interface ethernet 1
ip address 10.9.1.1 255.255.255.0
ip pim sparse-mode

Internet

local net

A
10.1.1.1
10.3.1.1
10.2.1.1

B
10.2.1.2
10.6.1.1
10.5.1.1

C
10.9.1.1

UDLR Tunnel

Detailed examples

UDLR Tunnel configuration

Router A
interface loopback 0
ip address 10.0.1.1 255.255.255.0
!
interface tunnel 0
ip address 10.4.1.1 255.255.255.0
tunnel source loopback 0
tunnel mode gre multipoint
tunnel key 5
tunnel udlr receive-only ethernet 1
!
interface ethernet 0
ip address 10.1.1.1 255.255.255.0
!
interface ethernet 1
ip address 10.2.1.1 255.255.255.0
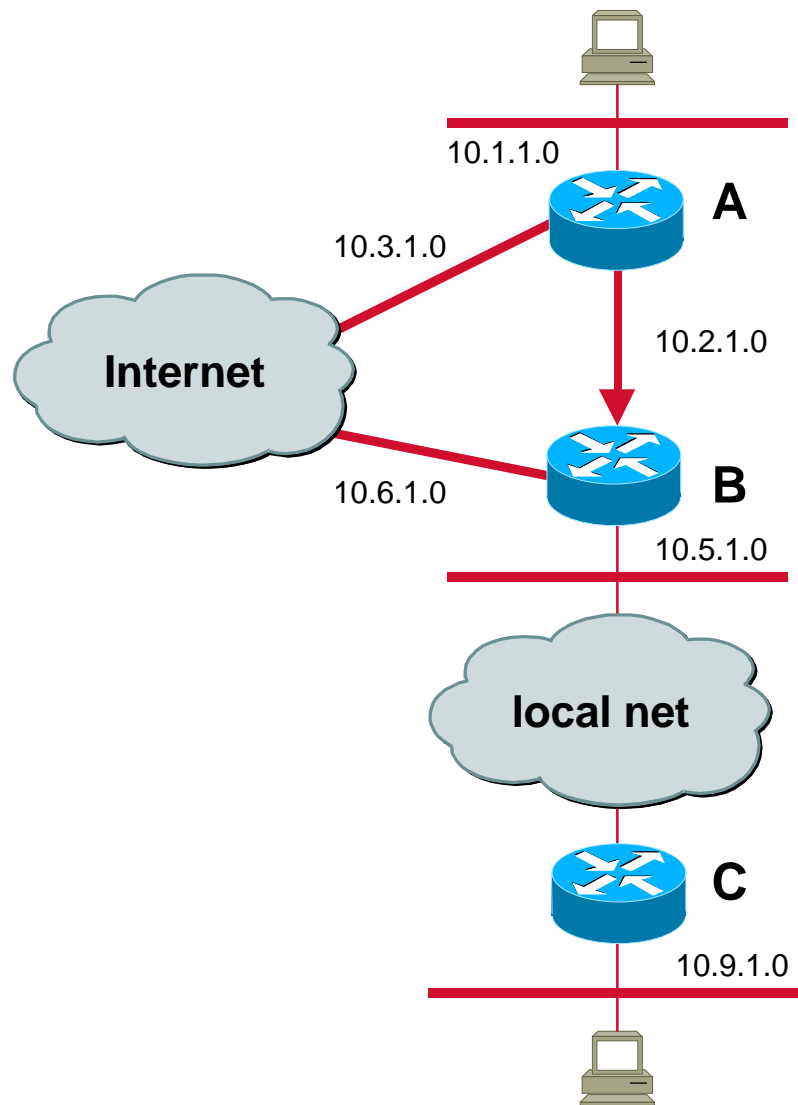!
interface ethernet 2
ip address 10.3.1.1 255.255.255.0
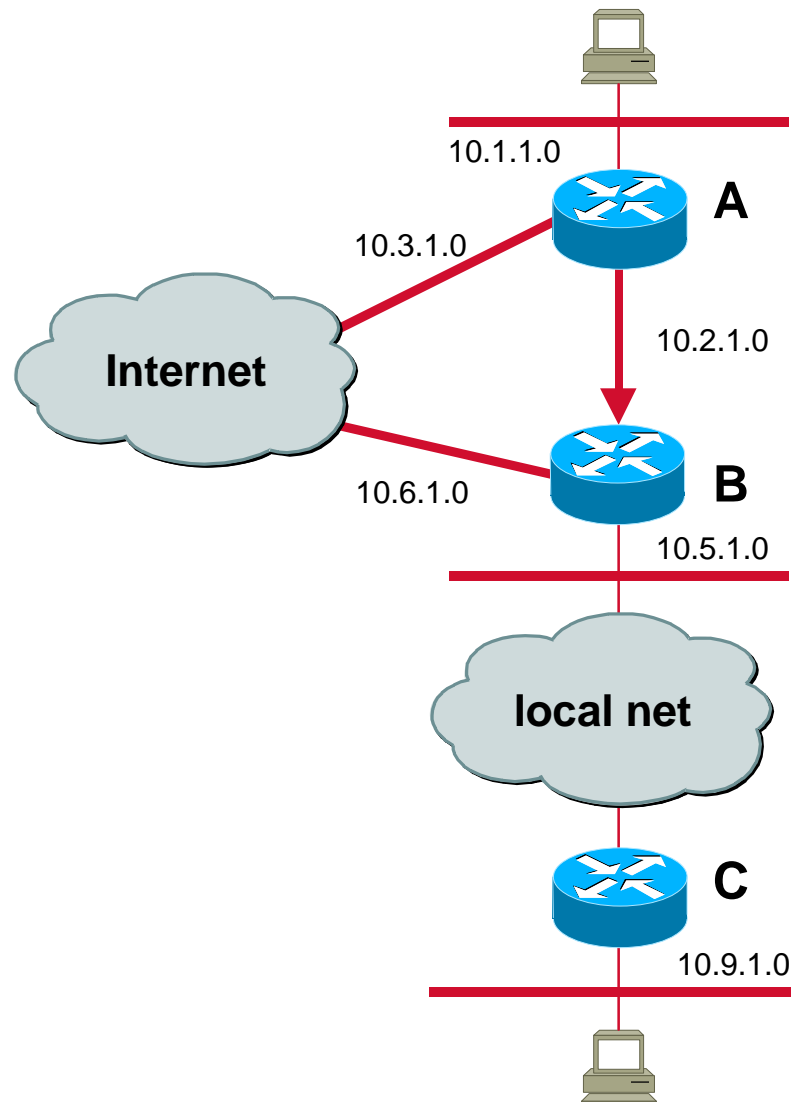
Router B
access-list 101 permit ospf any any
access-list 101 permit icmp any any
!
interface loopback 0
ip address 10.8.1.1 255.255.255.0
!
interface tunnel 0
ip address 10.7.1.1 255.255.255.0
ip access-group out 101
tunnel source loopback 0
tunnel destination 10.0.1.1
tunnel key 5
tunnel udlr send-only ethernet 0
tunnel udlr address-resolution
!
interface ethernet 0
ip address 10.2.1.2 255.255.255.0
no keepalive
!
interface ethernet 1
ip address 10.5.1.1 255.255.255.0
!
interface ethernet 2
ip address 10.6.1.1 255.255.255.0

10.1.1.0

A

10.3.1.0

10.2.1.0

Internet

B

10.6.1.0

10.5.1.0

local net

C

10.9.1.0

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UDLR Tunnel – with NHRP

10.1.1.0

10.3.1.0

A

Internet

10.2.1.0

10.6.1.0

B

10.5.1.0

local net

C

10.9.1.0

Router A
! Unidirectional link
interface ethernet 1
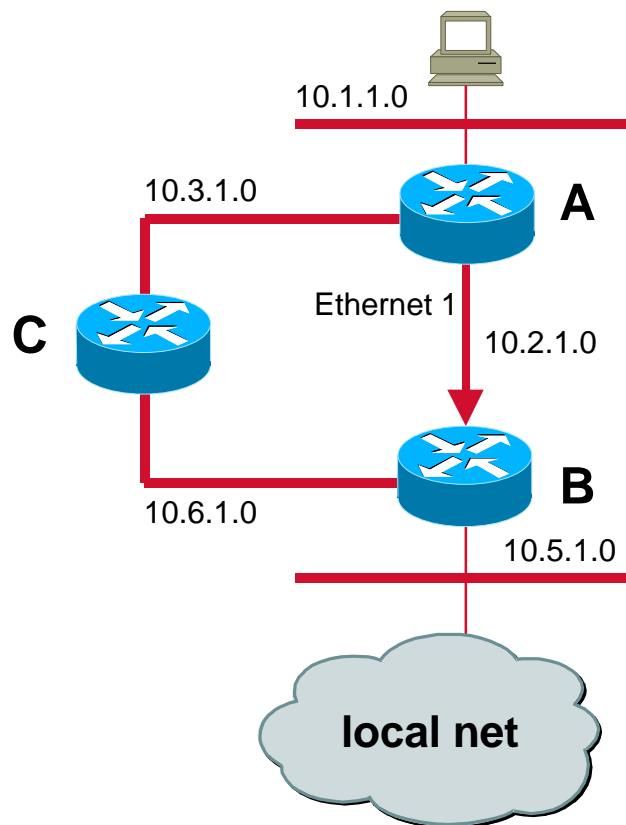ip address 10.2.1.1 255.255.255.0
ip nhrp network-id 5
ip nhrp server-only

Router B
! Unidirectional link
interface ethernet 0
ip address 10.2.1.2 255.255.255.0
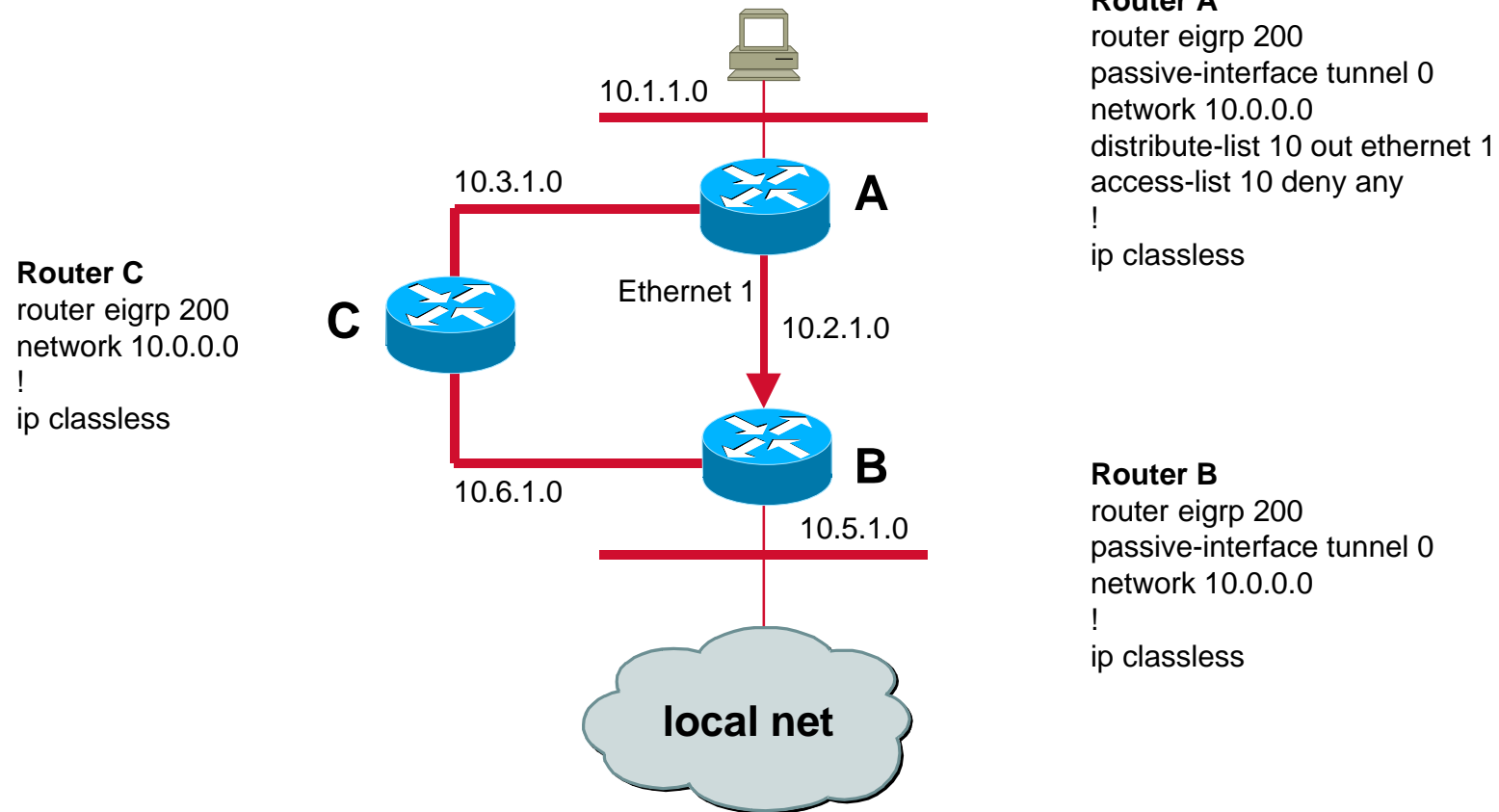ip nhrp network-id 5
ip nhrp nhs 10.2.1.1

www.cisco.com
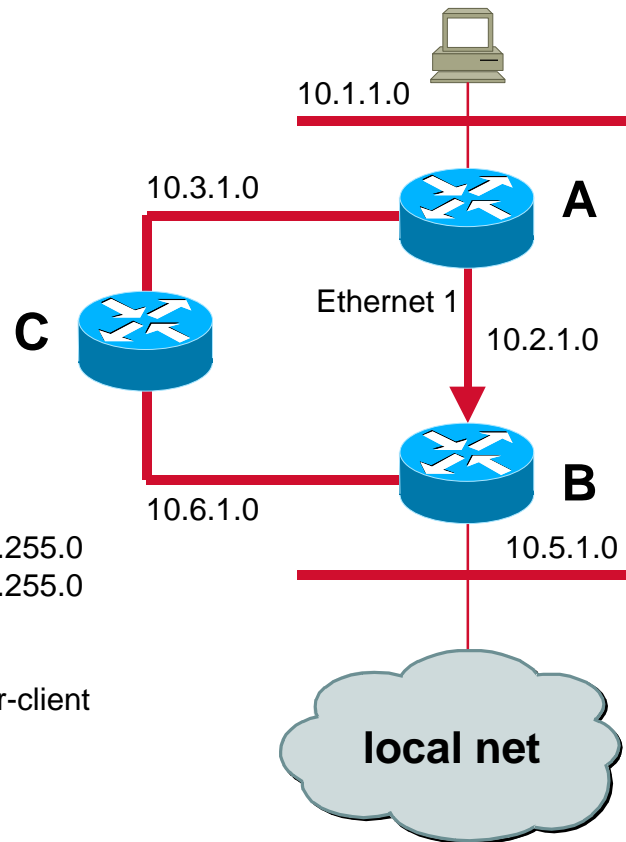
UDLR Tunnel – with RIP

Router A
router rip
version 2
passive-interface tunnel 0
network 10.0.0.0
distribute-list 10 out ethernet 1
access-list 10 deny any
!
ip classless

Router C
router rip
version 2
network 10.0.0.0
!
ip classless

Router B
router rip
version 2
passive-interface tunnel 0
network 10.0.0.0
!
ip classless

10.1.1.0

10.3.1.0

A

Ethernet 1

C

10.2.1.0

B

10.6.1.0

10.5.1.0

local net

UDLR Tunnel – with EIGRP

Router A
router eigrp 200
passive-interface tunnel 0
network 10.0.0.0
distribute-list 10 out ethernet 1
access-list 10 deny any
!
ip classless

Router C
router eigrp 200
network 10.0.0.0
!
ip classless

Router B
router eigrp 200
passive-interface tunnel 0
network 10.0.0.0
!
ip classless

10.1.1.0

10.3.1.0

A

C

Ethernet 1

10.2.1.0

10.6.1.0

B

10.5.1.0

local net

UDLR Tunnel – with IBGP

10.1.1.0

10.3.1.0

A

Ethernet 1

C

10.2.1.0

10.6.1.0

B

10.5.1.0

local net

Router A
router bgp 1
no synchronization
network 10.0.1.0 mask 255.255.255.0
network 10.1.1.0 mask 255.255.255.0
network 10.2.1.0 mask 255.255.255.0
network 10.3.1.0 mask 255.255.255.0
neighbor 10.2.1.2 remote-as 1
neighbor 10.3.1.2 remote-as 1
neighbor 10.2.1.2 distribute-list 10 out
!
access-list 10 deny any
!
ip classless

Router C
router bgp 1
no synchronization
network 10.3.1.0 mask 255.255.255.0
network 10.6.1.0 mask 255.255.255.0
neighbor 10.3.1.1 remote-as 1
neighbor 10.6.1.1 remote-as 1
neighbor 10.3.1.1 route-reflector-client
!
ip classless

Router B
router bgp 1
no synchronization
network 10.2.1.0 mask 255.255.255.0
network 10.5.1.0 mask 255.255.255.0
network 10.6.1.0 mask 255.255.255.0
neighbor 10.2.1.1 remote-as 1
neighbor 10.6.1.2 remote-as 1
!
ip classless

# UDLR Tunnel – with EBGP

Router A
router bgp 1
no synchronization
network 10.0.1.0 mask 255.255.255.0
network 10.1.1.0 mask 255.255.255.0
network 10.2.1.0 mask 255.255.255.0
network 10.3.1.0 mask 255.255.255.0
neighbor 10.2.1.2 remote-as 2
neighbor 10.3.1.2 remote-as 3
neighbor 10.2.1.2 distribute-list 10 out
!
access-list 10 deny any
!
ip classless

10.1.1.0

10.3.1.0

A

Ethernet 1

C

10.2.1.0
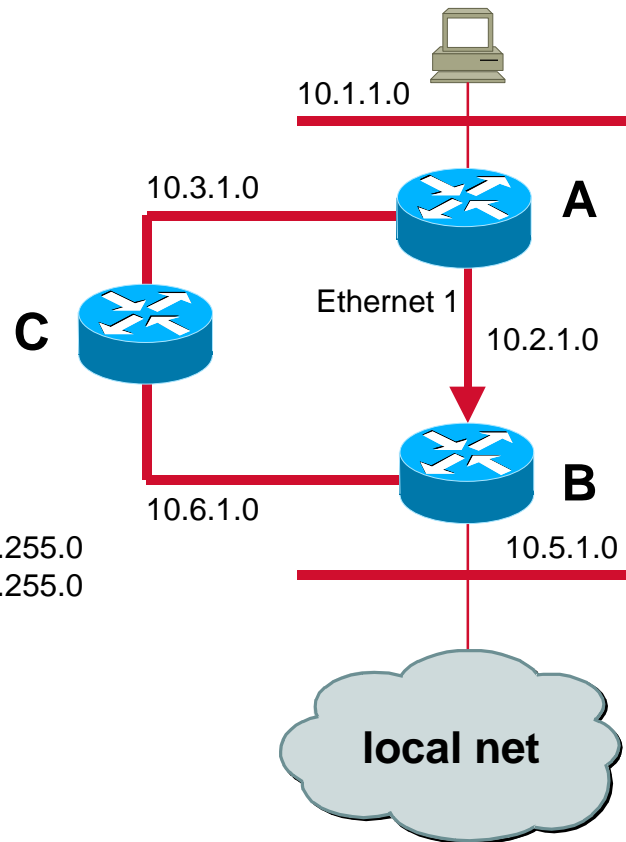
Router C
router bgp 3
no synchronization
network 10.3.1.0 mask 255.255.255.0
network 10.6.1.0 mask 255.255.255.0
neighbor 10.3.1.1 remote-as 1
neighbor 10.6.1.1 remote-as 2
!
ip classless

B

10.6.1.0

10.5.1.0

local net

Router B
router bgp 2
no synchronization
network 10.2.1.0 mask 255.255.255.0
network 10.5.1.0 mask 255.255.255.0
network 10.6.1.0 mask 255.255.255.0
neighbor 10.2.1.1 remote-as 1
neighbor 10.6.1.2 remote-as 3
!
ip classless

UDLR Tunnel – with OSPF

10.1.1.0

10.3.1.0

A

Ethernet 1

C

10.2.1.0
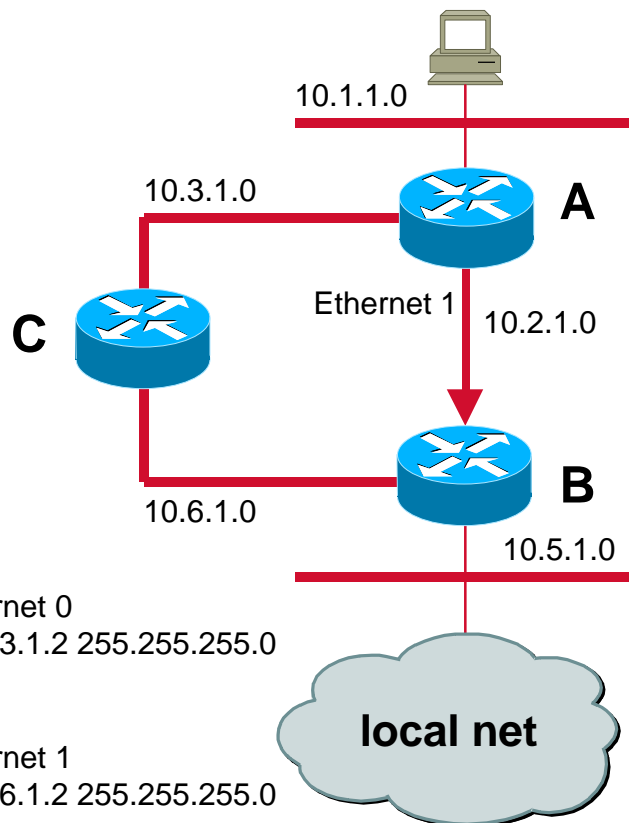
B

10.6.1.0

10.5.1.0

local net
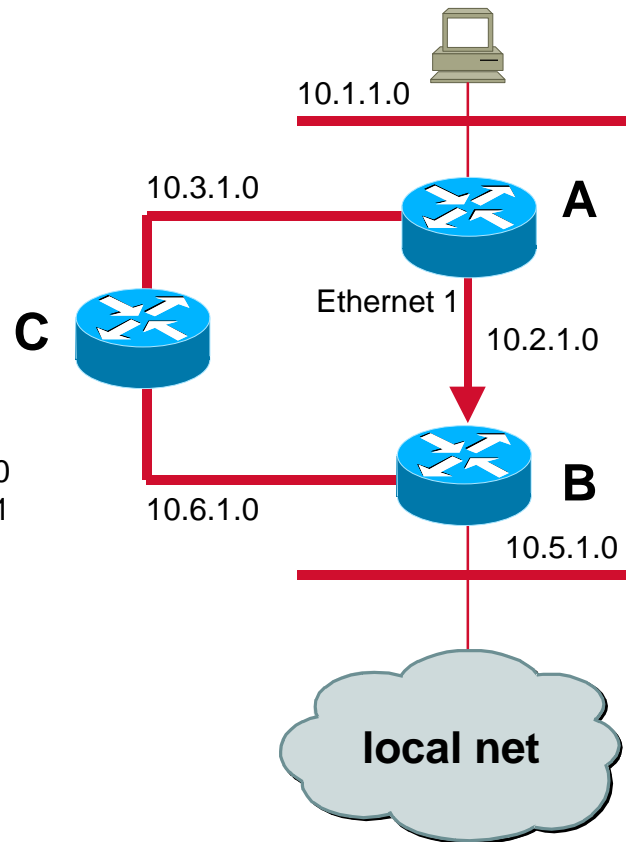
Router C
router ospf 200
network 10.3.1.0 0.0.0.15 area 0
network 10.6.1.0 0.0.0.15 area 1
!
ip classless

Router A
interface tunnel 0
ip address 10.4.1.1 255.255.255.0
!
router ospf 200
passive-interface tunnel 0
! Don't advertise the tunnel subnet over the udl
area 0 range 10.0.1.0 255.255.255.0 not-advertise
network 10.0.1.0 0.0.0.15 area 0
network 10.1.1.0 0.0.0.15 area 0
network 10.3.1.0 0.0.0.15 area 0
network 10.2.1.0 0.0.0.15 area 1
!
ip classless

Router B
router ospf 200
passive-interface tunnel 0
network 10.2.1.0 0.0.0.15 area 1
network 10.5.1.0 0.0.0.15 area 1
network 10.6.1.0 0.0.0.15 area 1
!
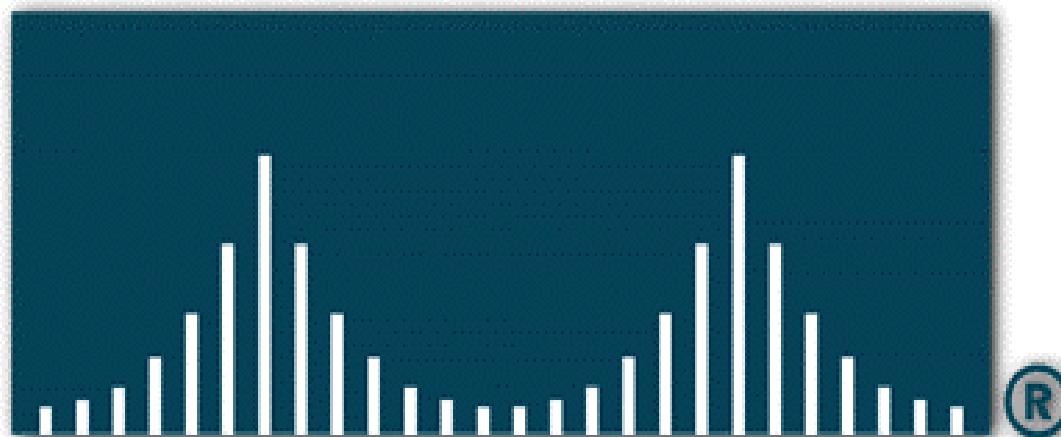ip classless

UDLR Tunnel – with ISIS

10.1.1.0

10.3.1.0

C

Ethernet 1   10.2.1.0

A

B

10.6.1.0

10.5.1.0

local net

Router A
interface tunnel 0
ip address 10.4.1.1 255.255.255.0
ip router isis 2
!
interface ethernet 0
ip address 10.1.1.1 255.255.255.0
ip router isis 2
!
interface ethernet 1
ip address 10.2.1.1 255.255.255.0
ip router isis 1
!
interface ethernet 2
ip address 10.3.1.1 255.255.255.0
ip router isis 2
!
router isis 1
network 47.0001.0000.0000.000a.00
is-type level-1
router isis 2
passive-interface tunnel 0
network 47.0002.0000.0000.000a.00
!
ip classless

Router B
interface tunnel 0
ip address 10.4.1.1 255.255.255.0
!
interface ethernet 0
ip address 10.2.1.2 255.255.255.0
ip router isis 1
!
interface ethernet 1
ip address 10.5.1.1 255.255.255.0
ip router isis 1
!
interface ethernet 2
ip address 10.6.1.1 255.255.255.0
!
router isis 1
network 47.0001.0000.0000.000b.00
is-type level-1
!
ip default-route 0.0.0.0 0.0.0.0 10.6.1.2
!
ip classless

Router C
interface ethernet 0
ip address 10.3.1.2 255.255.255.0
ip router isis 2
!
interface ethernet 1
ip address 10.6.1.2 255.255.255.0
ip router isis 1
!
router isis 1
network 47.0001.0000.0000.000c.00
is-type level-1
router isis 2
network 47.0002.0000.0000.000c.00
!
ip classless