SWINBURNE

CENTRE FOR ADVANCED INTERNET ARCHITECTURES

TNE20002/TNE70003

Topic 2: RIP Routing Protocol
V1.1

Routing Protocols

facilitate

the exchange of

routing information

between routers

Routing Protocols

- Discover remote networks
- Determine least cost paths to destination networks
- Maintain up-to-date routing information in tables
- Find a new least cost path if the current path is no longer available

Routing Protocols

Main components include:

- **Data structures** – A Routing Protocol uses **tables** for its operations. These tables are stored in RAM.

- **Routing protocol messages**
  - To discover neighboring routers,
  - To exchange routing information,
  - To learn and maintain accurate information about the network.

- **Algorithm** - for least cost path determination.

Routing Protocols

The routing table

contains

only

the least cost paths

to destination networks

Routing Protocols: Network Convergence

- The network has converged when all routers have complete and accurate information (in their tables) about the network topology.

- Not Instantaneous

- It takes time for routers to
  - share information (collaborate with other routers),
  - determine least cost paths (independent of other routers),
  - update their tables

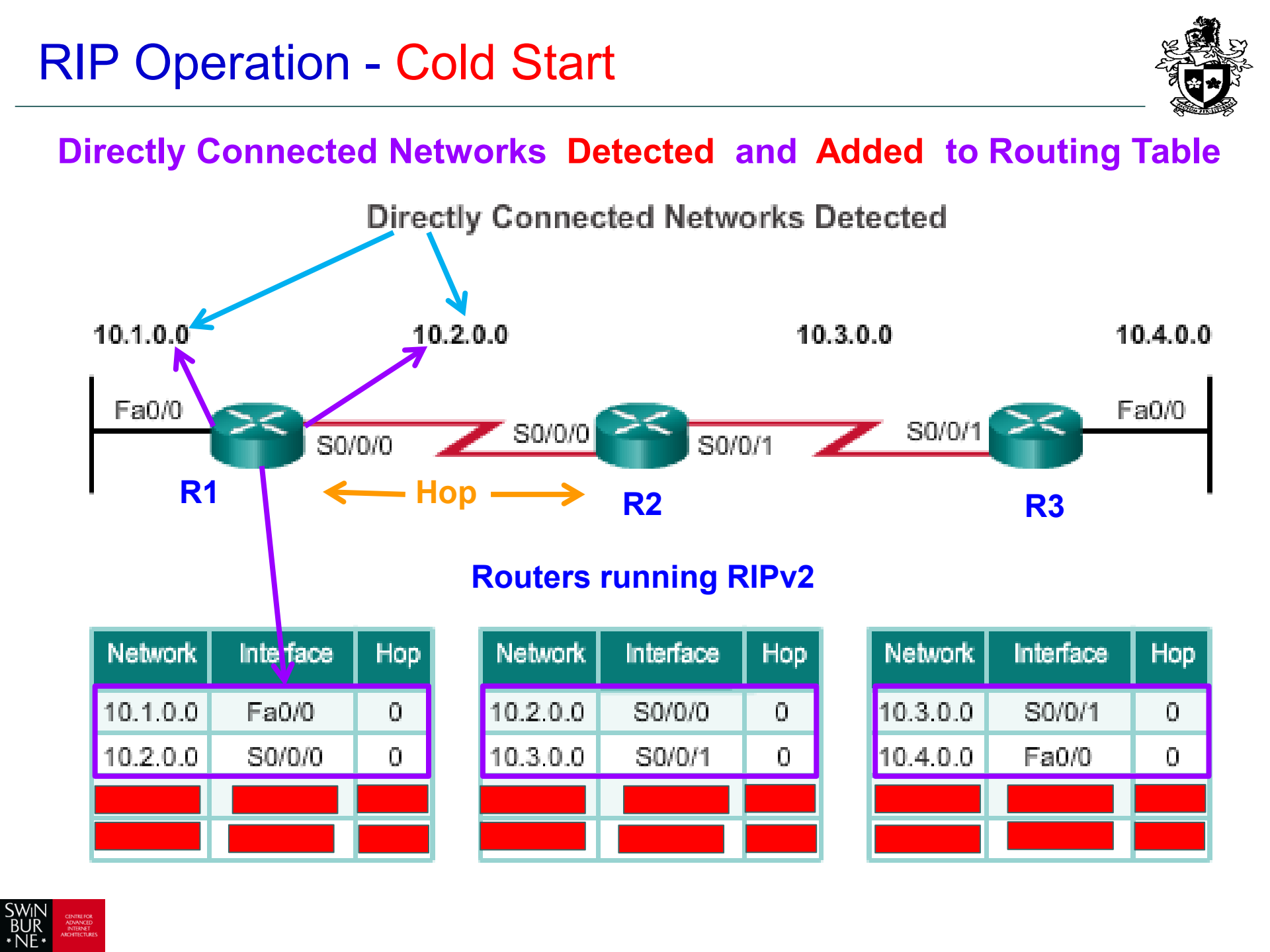
From

COLD Start

To

Network Convergence

RIP Operation - Cold Start



Directly Connected Networks Detected and Added to Routing Table

Routers running RIPv2

Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0

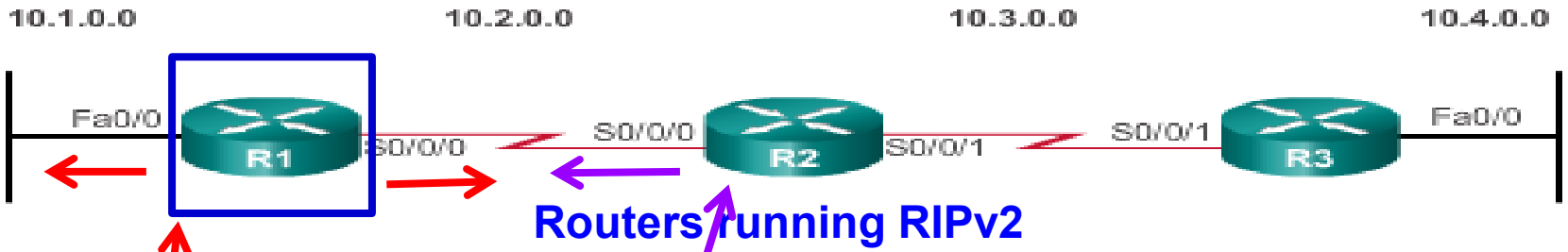
Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0

RIP Operation - Cold Start

Directly Connected Networks Detected and Added to Routing Table

- **R1** adds the 10.1.0.0 network available through Fa0/0 and 10.2.0.0 is available through S0/0/0.
- **R2** adds the 10.2.0.0 network available through S0/0/0 and 10.3.0.0 is available through S0/0/1.
- **R3** adds the 10.3.0.0 network available through S0/0/1 and 10.4.0.0 is available through Fa0/0.

RIP Operation – Exchanging Information



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0

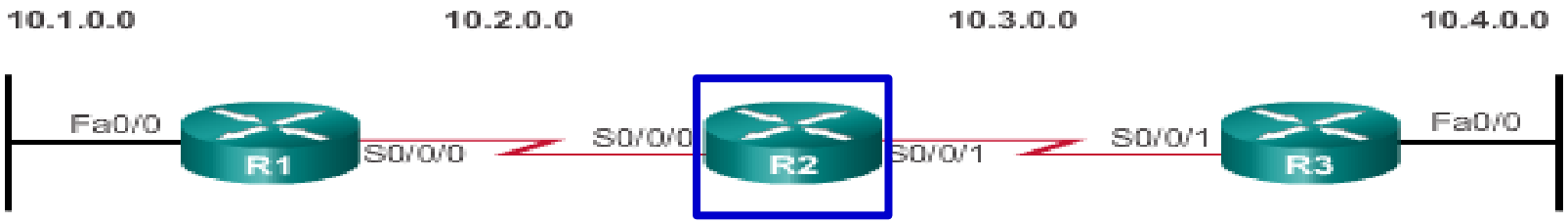
Network	Interface	Hop
10.3.0.0	S0/0/0	0
10.4.0.0	Fa0/0	0

R1:

- **Sends** an update about network **10.1.0.0** out **S0/0/0**
- **Sends** an update about network **10.2.0.0** out **Fa0/0**

- **Receives** update from **R2** about network **10.3.0.0** with a cost of **1** hop
- **Stores** network **10.3.0.0** in the routing table with a cost of **1** hop

RIP Operation - Exchanging Information



Routers running RIPv2

Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/0	0
10.4.0.0	Fa0/0	0

R2:

- **Sends** an update about network **10.3.0.0** out **S0/0/0**
- **Sends** an update about network **10.2.0.0** out **S0/0/1**
- **Receives** an update from **R1** about network **10.1.0.0** with a cost of **1**
- **Stores** network **10.1.0.0** in the routing table with a cost of **1**
- **Receives** an update from **R3** about network **10.4.0.0** with a cost of **1**
- **Stores** network **10.4.0.0** in the routing table with a cost of **1**

RIP Operation - Exchanging Information

Routers running RIPv2

Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/0	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1

R3:

- **Sends** an update about network **10.4.0.0** out **S0/0/1**
- **Sends** an update about network **10.3.0.0** out **Fa0/0**

- **Receives** an update from **R2** about network **10.2.0.0** with a cost of 1
- **Stores** network **10.2.0.0** in the routing table with a cost of **1**

RIP Operation – Exchanging Information

Routers running RIPv2

Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

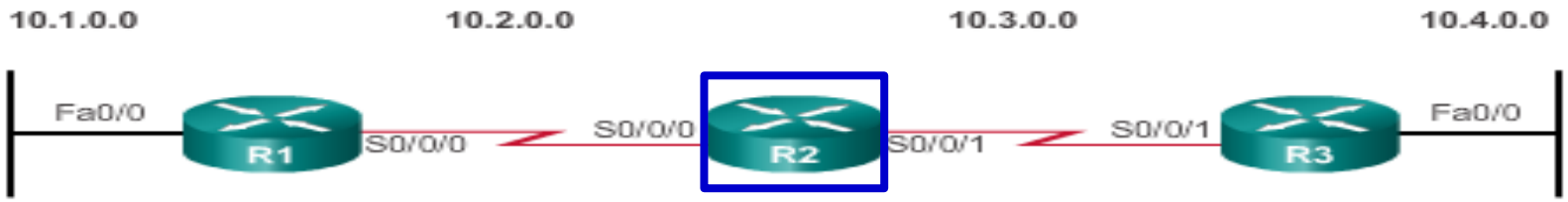
Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1

R1:

- **Sends** an update about network **10.1.0.0** out the **S0/0/0**
- **Sends** an update about networks **10.2.0.0** and **10.3.0.0** out the **Fa0/0**

- **Receives** an update from **R2** about network **10.4.0.0** with a cost of **2**
- **Stores** network **10.4.0.0** in the routing table with a cost of **2**

RIP Operation - Exchanging Information



Routers running RIPv2

Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1

R2:

- **Sends** an update about networks **10.3.0.0** and **10.4.0.0** out **S0/0/0**
- **Sends** an update about networks **10.1.0.0** and **10.2.0.0** out **S0/0/1**
- **Receives** an update from **R1** about network **10.1.0.0**. There is **no change**, therefore, the routing information remains the same.
- **Receives** an update from **R3** about network **10.4.0.0**. There is **no change**, therefore, the routing information remains the same.

!! RIP Convergence Achieved !!

Routers running RIPv2

Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

R3:

- **Sends** an update about network **10.4.0.0** out **S0/0/1**
- **Sends** an update about networks **10.2 0.0** and **10.3.0.0** out **Fa0/0**
- **Receives** an update from **R2** about network **10.1.0.0** with a cost of **2**
- **Stores** network **10.1.0.0** in the routing table with a cost of **2**
- **Receives** an update from **R2** about network **10.2.0.0** with a cost of **1**. There is **no change**; therefore, the routing information remains the same.

RIPv2

RIPv2

- RFC 1723 – 1994, RFC 2453 - 1998

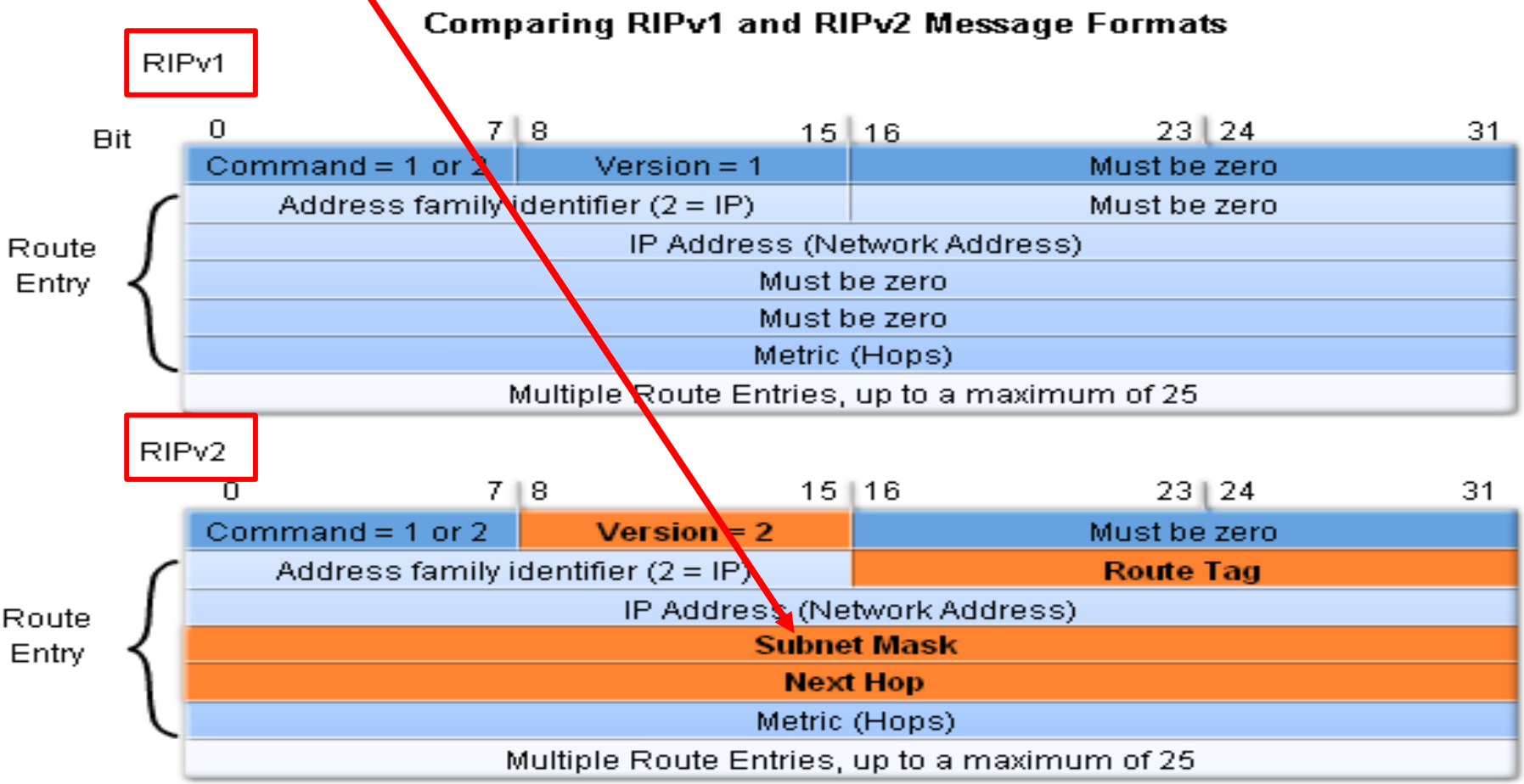
- Uses well known port 520
- Administrative distance 120
- Metric Hop Count
- Maximum Hop Limit 15

- Supports VLSM, includes subnet mask in RIP update
- Next hop address is included in update
- Periodic updates every 30 secs
- Triggered updates on link failure

- Routing updates are multicast, 224.0.0.9
- Use debug ip rip to view multicasting of updates
- The use of authentication is an option

Comparing RIPv2 & RIPv1 Message Formats

- RIPv2 Message format has extensions:
  - A subnet mask field
  - The addition of next hop address



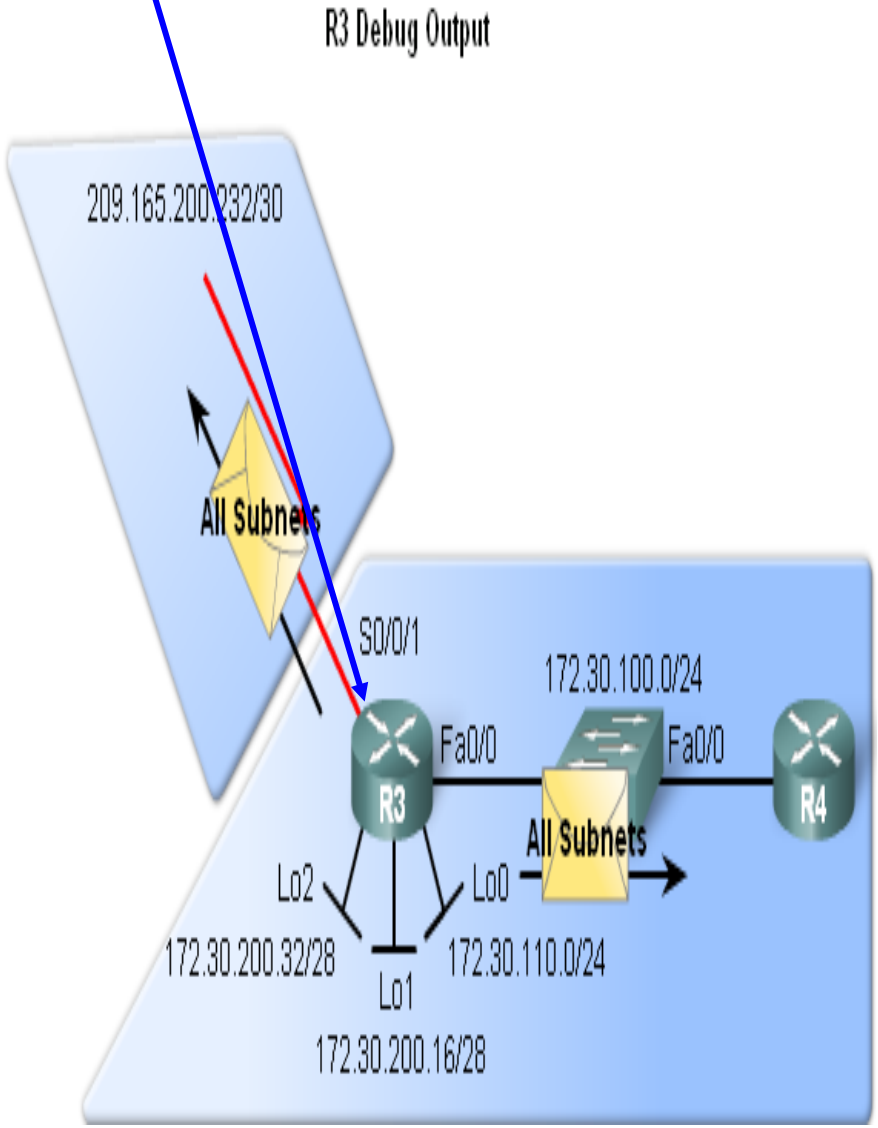
RIPv2 – Updates include (VLSM) Subnet Masks

Use the *debug ip rip*

R3 Debug Output

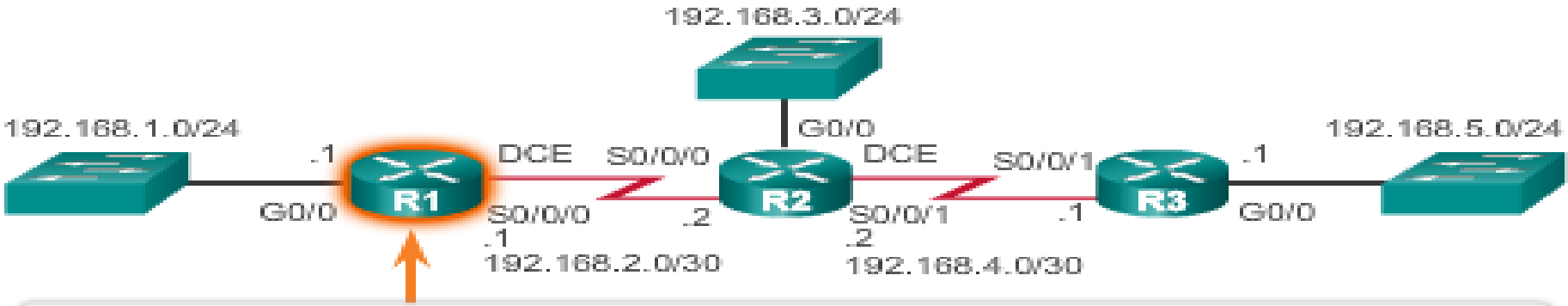
```
R3#debug ip rip
RIP protocol debugging is on
R3#
RIP: received v2 update from 209.165.200.233 on Serial0/0/1
     10.1.0.0/16 via 0.0.0.0 in 1 hops
     172.30.1.0/24 via 0.0.0.0 in 2 hops
     172.30.2.0/24 via 0.0.0.0 in 2 hops
     192.168.0.0/16 via 0.0.0.0 in 1 hops
     209.165.200.228/30 via 0.0.0.0 in 1 hops
R3#
RIP: sending v2 update to 224.0.0.9 via FastEthernet0/0 (172.30.100.1)
RIP: build update entries
        10.1.0.0/16 via 0.0.0.0, metric 2, tag 0
        172.30.1.0/24 via 0.0.0.0, metric 3, tag 0
        172.30.2.0/24 via 0.0.0.0, metric 3, tag 0
        172.30.110.0/24 via 0.0.0.0, metric 1, tag 0
        172.30.200.16/28 via 0.0.0.0, metric 1, tag 0
        172.30.200.32/28 via 0.0.0.0, metric 1, tag 0
        192.168.0.0/16 via 0.0.0.0, metric 2, tag 0
        209.165.200.228/30 via 0.0.0.0, metric 2, tag 0
        209.165.200.232/30 via 0.0.0.0, metric 1, tag 0
RIP: sending v2 update to 224.0.0.9 via Serial0/0/1 (209.165.200.234)
RIP: build update entries
        172.30.100.0/24 via 0.0.0.0, metric 1, tag 0
        172.30.110.0/24 via 0.0.0.0, metric 1, tag 0
        172.30.200.16/28 via 0.0.0.0, metric 1, tag 0
        172.30.200.32/28 via 0.0.0.0, metric 1, tag 0
```

RIPv2 supports VLSM



Enabling RIPv2

Enable and Verify RIPv2 on R1



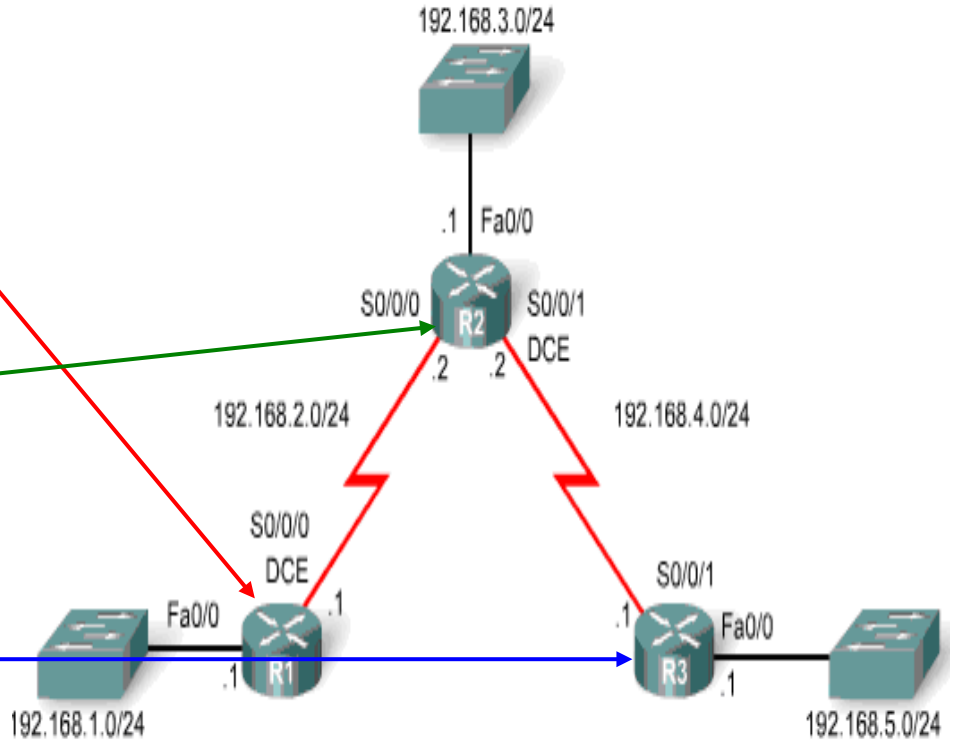

```
R1(config)# router rip
R1(config-router)# version 2
R1(config-router)# ^Z
R1#
R1# show ip protocols | section Default
  Default version control: send version 2, receive version 2
    Interface              Send  Recv  Triggered RIP  Key-chain
    GigabitEthernet0/0     2     2
    Serial0/0/0            2     2
R1#
```

RIPv2 – Advertising Directly Connected Networks

The network Command:

- Specifies network to be advertised
- Enables RIP on all interfaces that belong to the networks
- You advertise, only the directly connected networks, on any given router

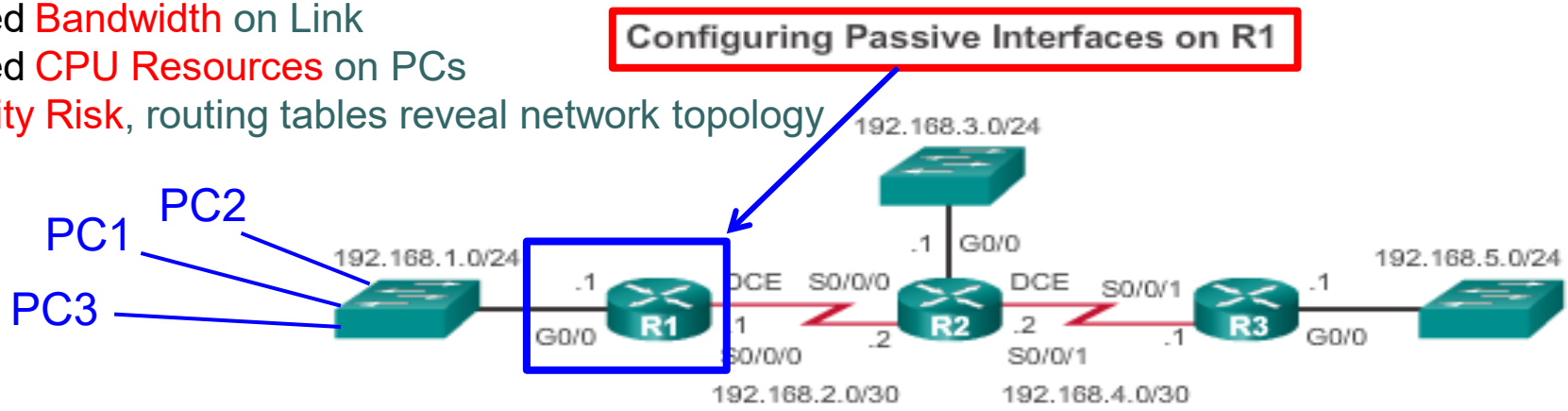
```
R1(config)# router rip
R1(config-router) version 2
R1(config-router) network 192.168.1.0
R1(config-router) network 192.168.2.0

R2(config)# router rip
R2(config-router) version 2
R2(config-router) network 192.168.2.0
R2(config-router) network 192.168.3.0
R2(config-router) network 192.168.4.0

R3(config)# router rip
R3(config-router) version 2
R3(config-router) network 192.168.4.0
R3(config-router) network 192.168.5.0
```



Configuring Passive Interfaces R1

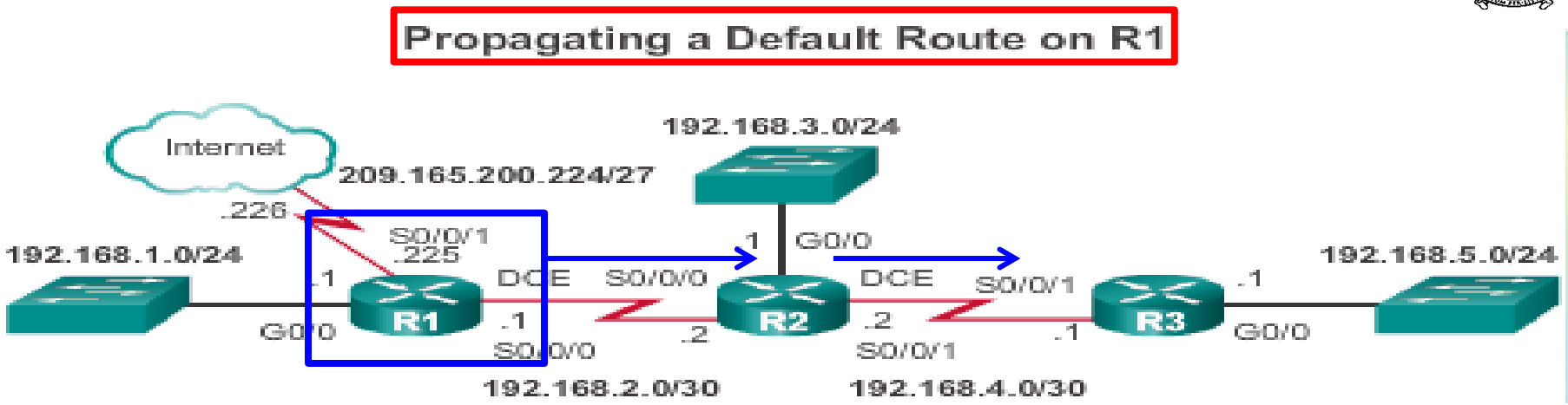
Sending out unneeded updates to LANs impacts the network:

- Wasted Bandwidth on Link
- Wasted CPU Resources on PCs
- Security Risk, routing tables reveal network topology




```
R1(config)# router rip
R1(config-router)# passive-interface g0/0
R1(config-router)# end
R1#
R1# show ip protocols | begin Default
  Default version control: send version 2, receive version 2
    Interface              Send  Recv  Triggered RIP  Key-chain
    Serial0/0/0            2     2
  Automatic network summarization is not in effect
  Maximum path: 4
  Routing for Networks:
    192.168.1.0
    192.168.2.0
  Passive Interface(s):
    GigabitEthernet0/0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.2.2           120     00:00:06
  Distance: (default is 120)

R1#
```

R1 Gateway Propagating a Default Route to R2,R3

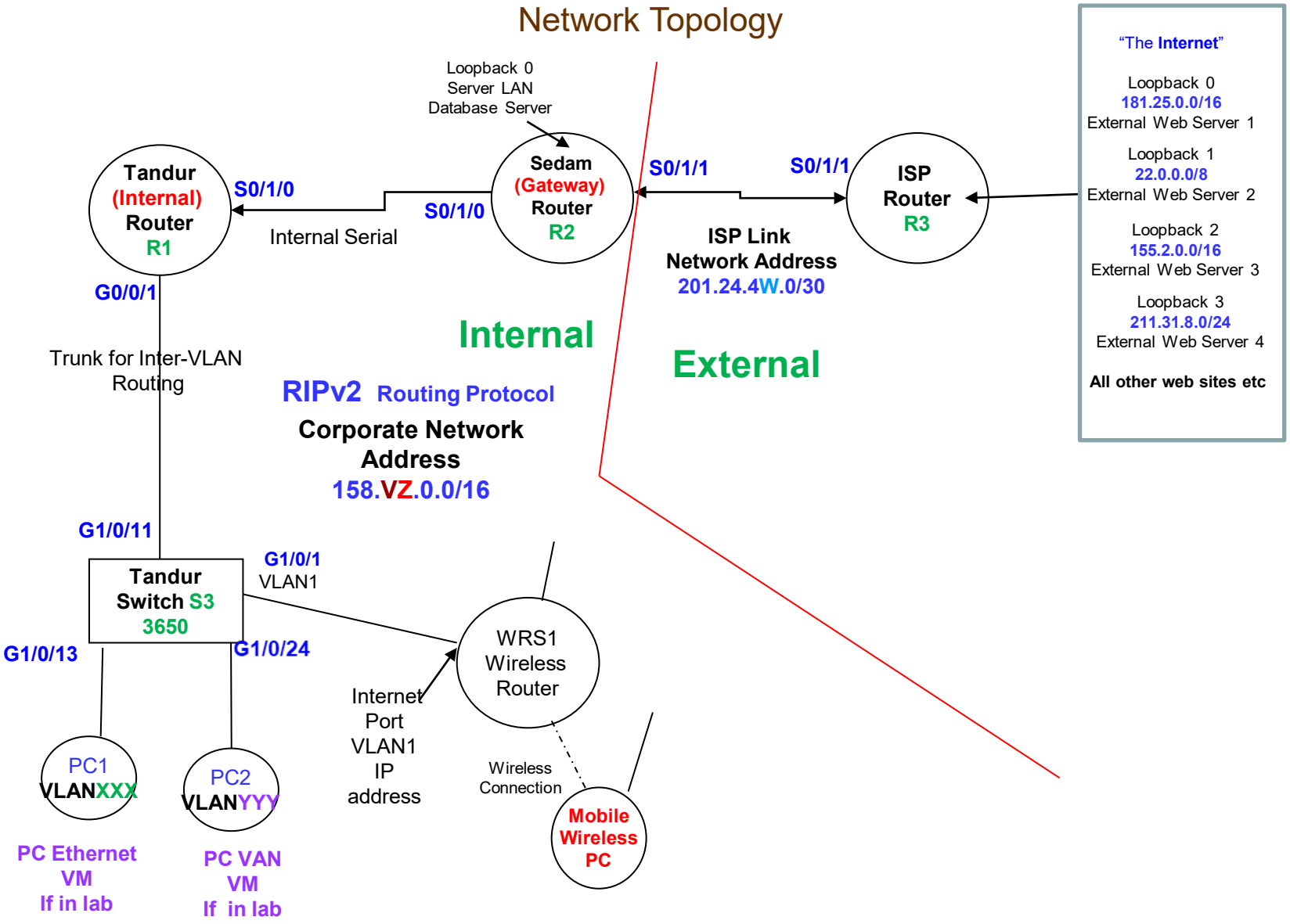



```
R1(config)# ip route 0.0.0.0 0.0.0.0 S0/0/1 209.165.200.226
R1(config)# router rip
R1(config-router)# default-information originate
R1(config-router)# ^Z
R1#
*Mar 10 23:33:51.801: %SYS-5-CONFIG_I: Configured from
console by console
R1# show ip route | begin Gateway
Gateway of last resort is 209.165.200.226 to network
0.0.0.0

S*      0.0.0.0/0 [1/0] via 209.165.200.226, Serial0/0/1
        192.168.1.0/24 is variably subnetted, 2 subnets, 2
masks
C          192.168.1.0/24 is directly connected,
GigabitEthernet0/0
L          192.168.1.1/32 is directly connected,
GigabitEthernet0/0
        192.168.2.0/24 is variably subnetted, 2 subnets, 2
masks
C          192.168.2.0/24 is directly connected, Serial0/0/0
L          192.168.2.1/32 is directly connected, Serial0/0/0
R       192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:08,
```

In Lab Scenario 1 RIP Routing Protocol – V1.0

A Network Configuration and Trouble Shooting Scenario

Network Topology



END