Comprehensive Multi-Protocol Redistribution: Troubleshooting and Implementation Guide

Network Configuration and Troubleshooting Report

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Contents

1 Executive Summary

This report documents the complete implementation and troubleshooting process for mutual redistribution between three routing protocols: EIGRP Autonomous System 11, RIPv2, and OSPF Area 1. The project involved configuring two redistribution routers to enable seamless communication across multiple routing domains.

1.1 Key Challenges Addressed

- Routes failing to propagate beyond immediate neighbors
- Overlapping network statements causing protocol boundary confusion
- Split-horizon blocking route advertisement on serial interfaces
- Proper external route marking (D EX, O E2) not appearing

1.2 Final Outcome

Both redistribution implementations were successfully completed with:

Full route propagation throughout all routing domains

Proper external route marking on all routers

No routing loops or suboptimal routing

Complete end-to-end connectivity across all protocols

2 Network Topology Overview

2.1 Routing Protocol Domains

- **EIGRP 11 Domain:** Core enterprise routing protocol
- **RIPv2 Domain:** Legacy network integration
- **OSPF Area 1:** Dedicated area for specific segments

2.2 Redistribution Points

1. **Router 6:** RIPv2 ↔ EIGRP 11
2. **Router 5:** OSPF Area 1 ↔ EIGRP 11

3 Case Study 1: RIPv2 and EIGRP 11 Redistribution

3.1 Router 6 Configuration Details

3.1.1 Interface Configuration

3.1.2 Neighbor Information

- **EIGRP Neighbor:** 114.195.112.49 (via Serial0/0/0)
- **RIP Neighbor:** 114.195.112.66 (via Serial0/1/0)

Interface	IP Address	Protocol
Serial0/0/0	114.195.112.50/30	EIGRP 11
Serial0/1/0	114.195.112.65/30	RIPv2

Table 1: Router 6 Interface Details

3.2 Initial Problem Description

3.2.1 Symptoms Observed

1. Router 6 itself showed both EIGRP and RIP routes correctly
2. Immediate neighbors (directly connected) received redistributed routes
3. **Critical Issue:** Routes did NOT propagate to distant routers
4. EIGRP routers beyond 114.195.112.49 could not see RIP networks
5. RIP routers beyond 114.195.112.66 could not see EIGRP networks

3.2.2 Initial Problematic Configuration

Listing 1: Router 6 - Initial Configuration (Flawed)

```
router eigrp 11
 redistribute rip metric 10000 1 255 1 1500
 network 114.195.112.0 0.0.7.255        ! Problem: Too broad
 network 114.0.0.0                       ! Problem: Covers both
    interfaces
 network 114.195.112.48 0.0.0.3
 no auto-summary

router rip
 version 2
 redistribute eigrp 11 metric 1
 network 114.0.0.0
 no auto-summary
```

3.3 Root Cause Analysis - Router 6

3.3.1 Problem 1: Overlapping Network Statements

Issue: Multiple EIGRP network statements covered both the EIGRP and RIP interfaces.

- `network 114.195.112.0 0.0.7.255` covered Serial0/0/0 (EIGRP) AND Serial0/1/0 (RIP)
- `network 114.0.0.0` covered all interfaces in the 114.0.0.0/8 range
- This caused EIGRP to run on BOTH interfaces simultaneously

Impact:

- EIGRP treated RIP networks as internal routes instead of external
- Routes were marked as "D" (internal) instead of "D EX" (external)
- Redistribution logic failed because EIGRP thought it already owned those routes

3.3.2 Problem 2: Split-Horizon on Serial Interfaces

The Split-Horizon Rule: A router will not advertise routes back out the same interface where they were learned.

How this affected Router 6:

1. Router 6 learned EIGRP routes from 114.195.112.49 on Serial0/0/0
2. Router 6 redistributed RIP routes into EIGRP
3. When trying to advertise these RIP routes to other EIGRP neighbors via Serial0/0/0, split-horizon BLOCKED the advertisement
4. Same issue occurred on Serial0/1/0 for RIP routes

Result: Only the immediate neighbor received redistributed routes; propagation stopped there.

3.4 Solution Implementation - Router 6

3.4.1 Step 1: Remove Overlapping Network Statements

Listing 2: Cleaning EIGRP Configuration

```
Router# configure terminal
Router(config)# router eigrp 11
Router(config-router)# no network 114.195.112.0 0.0.7.255
Router(config-router)# no network 114.0.0.0
Router(config-router)# exit
```

3.4.2 Step 2: Configure Clean, Specific Network Statements

Listing 3: Proper Network Configuration for Router 6

```
Router(config)# router eigrp 11
Router(config-router)# network 114.195.112.48 0.0.0.3
Router(config-router)# redistribute rip metric 10000 10 255 1 1500
Router(config-router)# no auto-summary
Router(config-router)# exit

Router(config)# router rip
Router(config-router)# version 2
Router(config-router)# network 114.195.112.0
Router(config-router)# redistribute eigrp 11 metric 1
Router(config-router)# no auto-summary
Router(config-router)# exit
```

Key Changes:

- EIGRP: Only `network 114.195.112.48 0.0.0.3` (covers Serial0/0/0 only)
- RIP: `network 114.195.112.0` (classful, covers Serial0/1/0)
- Fixed redistribution metric for EIGRP: changed from `10000 1` to `10000 10`

3.4.3 Step 3: Disable Split-Horizon (Critical Fix)

Listing 4: Disabling Split-Horizon on Serial Interfaces

```
Router(config)# interface Serial0/0/0
Router(config-if)# no ip split-horizon eigrp 11
Router(config-if)# exit

Router(config)# interface Serial0/1/0
Router(config-if)# no ip split-horizon
Router(config-if)# exit

Router(config)# end
Router# write memory
```

3.5 Final Working Configuration - Router 6

Listing 5: Complete Corrected Configuration for Router 6

```
router eigrp 11
 redistribute rip metric 10000 10 255 1 1500
 network 114.195.112.48 0.0.0.3
 no auto-summary

router rip
 version 2
 redistribute eigrp 11 metric 1
 network 114.195.112.0
 no auto-summary

interface Serial0/0/0
 ip address 114.195.112.50 255.255.255.252
 no ip split-horizon eigrp 11

interface Serial0/1/0
 ip address 114.195.112.65 255.255.255.252
 no ip split-horizon
```

3.6 Verification Results - Router 6

3.6.1 From Distant EIGRP Router

Routes from RIP domain appearing as EIGRP External:

Listing 6: EIGRP Router - show ip route — include EX

```
D EX 14.195.112.68/30 [170/21026560] via 114.195.112.42
D EX 114.195.96.0/22 [170/21026560] via 114.195.112.42
D EX 114.195.112.52/30 [170/21026560] via 114.195.112.42
D EX 114.195.112.56/30 [170/21026560] via 114.195.112.42
D EX 114.195.112.60/30 [170/21026560] via 114.195.112.42
D EX 114.195.112.72/30 [170/21026560] via 114.195.112.42
D EX 114.195.112.160/29 [170/21026560] via 114.195.112.42
D EX 114.195.112.168/29 [170/21026560] via 114.195.112.42
D EX 114.195.112.176/29 [170/21026560] via 114.195.112.42
```

Success Indicators:

- Routes marked as "D EX" (EIGRP External) - AD 170
- 9+ RIP networks visible throughout EIGRP domain
- Routes propagating beyond immediate neighbor

3.6.2 From Distant RIP Router

Routes from EIGRP domain appearing as RIP routes:

Listing 7: RIP Router - show ip route (partial)

```
R 208.64.0.0/15 [120/3] via 208.69.76.201
R 208.69.64.0/22 [120/3] via 208.69.76.201
R 208.69.68.0/22 [120/3] via 208.69.76.201
R 208.69.72.0/23 [120/3] via 208.69.76.201
R 208.69.76.32/29 [120/3] via 208.69.76.201
R 208.69.76.140/30 [120/3] via 208.69.76.201
R 208.69.76.164/30 [120/3] via 208.69.76.201
R 208.69.76.168/30 [120/3] via 208.69.76.201
R 208.69.76.172/30 [120/3] via 208.69.76.201
R 208.69.76.176/30 [120/3] via 208.69.76.201
```

Success Indicators:

- EIGRP networks appearing as RIP routes (marked "R") - AD 120
- Hop count properly incremented ([120/3] shows 3 hops)
- 10+ EIGRP networks visible throughout RIP domain

4 Case Study 2: OSPF Area 1 and EIGRP 11 Redistribution

4.1 Router 5 Configuration Details

4.1.1 Interface Configuration

Interface	IP Address	Protocol
Serial0/0/0	114.195.112.30/30	OSPF Area 1
Serial0/1/0	114.195.112.33/30	EIGRP 11

Table 2: Router 5 Interface Details

4.1.2 Neighbor Information

- **OSPF Neighbor:** 114.195.112.29 (via Serial0/0/0)
- **EIGRP Neighbor:** 114.195.112.34 (via Serial0/1/0)

4.2 Initial Problem Description - Router 5

4.2.1 Symptoms Observed

1. OSPF routes were successfully redistributing into EIGRP domain
2. **Critical Issue:** EIGRP routes were NOT fully propagating into OSPF domain

3. Some EIGRP routes visible on immediate OSPF neighbor
4. Most EIGRP routes missing on distant OSPF routers

4.2.2 Initial Problematic Configuration

Listing 8: Router 5 - Initial Configuration (Flawed)

```
router eigrp 11
 redistribute ospf 1 metric 10000 100 255 1 1500
 network 114.195.112.0 0.0.7.255         ! Problem: Too broad
 network 114.195.112.32 0.0.0.3          ! Problem: OSPF interface!

router ospf 1
 log-adjacency-changes
 redistribute eigrp 11 subnets
 network 114.195.112.0 0.0.7.255 area 1 ! Problem: Too broad
 network 114.195.112.28 0.0.0.3 area 1
 network 114.195.112.0 0.0.0.3 area 1   ! Problem: Duplicate

router rip
 network 114.0.0.0                      ! Problem: Unnecessary
```

4.3 Root Cause Analysis - Router 5

4.3.1 Problem 1: Protocol Interface Confusion

Critical Error: The EIGRP configuration included the OSPF interface!

- `network 114.195.112.32 0.0.0.3` is the OSPF interface (Serial0/1/0)
- This caused EIGRP to run on the OSPF interface
- OSPF networks were treated as internal EIGRP routes instead of redistributed external routes

4.3.2 Problem 2: Overlapping OSPF Network Statements

Issue: Multiple overlapping OSPF network statements:

- `network 114.195.112.0 0.0.7.255 area 1` covered both interfaces
- `network 114.195.112.0 0.0.0.3 area 1` was redundant
- This created routing confusion and suboptimal path selection

4.3.3 Problem 3: Unnecessary RIP Configuration

Router 5 had RIP configuration remnants that were not needed and potentially interfered with EIGRP/OSPF redistribution.

4.3.4 Problem 4: Split-Horizon (Same as Router 6)

Split-horizon was enabled on both serial interfaces, preventing proper route propagation beyond immediate neighbors.

4.4 Solution Implementation - Router 5

4.4.1 Step 1: Correct EIGRP Network Statements

Listing 9: Fixing EIGRP Configuration on Router 5

```
Router# configure terminal
Router(config)# router eigrp 11
Router(config-router)# no network 114.195.112.0 0.0.7.255
Router(config-router)# no network 114.195.112.32 0.0.0.3
Router(config-router)# network 114.195.112.32 0.0.0.3
Router(config-router)# redistribute ospf 1 metric 10000 10 255 1 1500
Router(config-router)# no auto-summary
Router(config-router)# exit
```

Wait - there was an error in the initial fix! The correct EIGRP interface is Serial0/1/0 (114.195.112.33), which is in the 114.195.112.32/30 subnet.

4.4.2 Step 2: Correct OSPF Network Statements

Listing 10: Fixing OSPF Configuration on Router 5

```
Router(config)# router ospf 1
Router(config-router)# no network 114.195.112.0 0.0.7.255 area 1
Router(config-router)# no network 114.195.112.0 0.0.0.3 area 1
Router(config-router)# network 114.195.112.28 0.0.0.3 area 1
Router(config-router)# redistribute eigrp 11 subnets
Router(config-router)# exit
```

Key Point: The `subnets` keyword in OSPF redistribution is CRITICAL. Without it, OSPF only redistributes classful networks, not subnets.

4.4.3 Step 3: Remove Unnecessary RIP Configuration

Listing 11: Removing RIP Configuration

```
Router(config)# no router rip
```

4.4.4 Step 4: Disable Split-Horizon

Listing 12: Disabling Split-Horizon on Router 5

```
Router(config)# interface Serial0/0/0
Router(config-if)# no ip split-horizon
Router(config-if)# exit

Router(config)# interface Serial0/1/0
Router(config-if)# no ip split-horizon eigrp 11
Router(config-if)# exit

Router(config)# end
Router# write memory
```

4.5 Final Working Configuration - Router 5

Listing 13: Complete Corrected Configuration for Router 5

```
router eigrp 11
 redistribute ospf 1 metric 10000 10 255 1 1500
 network 114.195.112.32 0.0.0.3
 no auto-summary

router ospf 1
 log-adjacency-changes
 redistribute eigrp 11 subnets
 network 114.195.112.28 0.0.0.3 area 1

interface Serial0/0/0
 ip address 114.195.112.30 255.255.255.252
 no ip split-horizon

interface Serial0/1/0
 ip address 114.195.112.33 255.255.255.252
 no ip split-horizon eigrp 11
```

4.6 Verification Results - Router 5

4.6.1 From Router 5 Itself

Listing 14: Router 5 - show ip route (partial)

```
D EX 14.195.112.68/30 [170/22050560] via 114.195.112.34
D    114.192.0.0/15 [90/21026560] via 114.195.112.34
O    114.194.0.0/18 [110/193] via 114.195.112.29
O    114.194.64.0/18 [110/193] via 114.195.112.29
O    114.194.128.0/18 [110/129] via 114.195.112.29
O IA 114.194.192.0/18 [110/577] via 114.195.112.29
D    114.195.64.0/20 [90/21026560] via 114.195.112.34
O    114.195.80.0/20 [110/65] via 114.195.112.29
D EX 114.195.96.0/22 [170/22050560] via 114.195.112.34
D    114.195.100.0/22 [90/21026560] via 114.195.112.34
O E2 114.195.104.0/22 [110/20] via 114.195.112.29
```

Success Indicators:

- Mixed routing table showing both EIGRP (D, D EX) and OSPF (O, O IA, O E2) routes
- D EX routes = RIP networks redistributed through EIGRP
- O E2 routes = EIGRP networks from other redistribution point

4.6.2 From Distant EIGRP Router

Listing 15: EIGRP Router - show ip route — include EX (partial)

```
D EX 114.194.0.0/18 [170/21026560] via 114.195.112.45
D EX 114.194.64.0/18 [170/21026560] via 114.195.112.45
D EX 114.194.128.0/18 [170/21026560] via 114.195.112.45
D EX 114.194.192.0/18 [170/21026560] via 114.195.112.45
D EX 114.195.0.0/19 [170/21026560] via 114.195.112.45
D EX 114.195.32.0/19 [170/21026560] via 114.195.112.45
```

```
D EX 114.195.80.0/20 [170/21026560] via 114.195.112.45
D EX 114.195.104.0/22 [170/21026560] via 114.195.112.45
D EX 114.195.112.0/30 [170/21026560] via 114.195.112.45
D EX 114.195.112.4/30 [170/21026560] via 114.195.112.45
D EX 114.195.112.8/30 [170/21026560] via 114.195.112.45
D EX 114.195.112.16/30 [170/21026560] via 114.195.112.45
D EX 114.195.112.20/30 [170/21026560] via 114.195.112.45
D EX 114.195.112.24/30 [170/21026560] via 114.195.112.45
D EX 114.195.112.28/30 [170/21026560] via 114.195.112.45
D EX 114.195.112.120/29 [170/21026560] via 114.195.112.45
D EX 114.195.112.128/29 [170/21026560] via 114.195.112.45
D EX 114.195.112.136/29 [170/21026560] via 114.195.112.45
```

Outstanding Success:

- 29+ OSPF networks visible as EIGRP External routes
- All routes marked with AD 170 (correct for EIGRP external)
- Complete propagation throughout EIGRP domain

4.6.3 From Distant OSPF Router

Listing 16: OSPF Router - show ip route ospf (partial)

```
O E2 14.195.112.68/30 [110/20] via 114.195.112.6
O E2 114.192.0.0/15 [110/20] via 114.195.112.6
O    114.194.0.0/18 [110/65] via 114.195.112.2
O    114.194.64.0/18 [110/193] via 114.195.112.6
O E2 114.195.32.0/19 [110/20] via 114.195.112.6
O E2 114.195.64.0/20 [110/20] via 114.195.112.6
O E2 114.195.96.0/22 [110/20] via 114.195.112.6
O E2 114.195.100.0/22 [110/20] via 114.195.112.6
O E2 114.195.104.0/22 [110/20] via 114.195.112.6
O E2 114.195.108.0/22 [110/20] via 114.195.112.6
O E2 114.195.112.36/30 [110/20] via 114.195.112.6
O E2 114.195.112.40/30 [110/20] via 114.195.112.6
O E2 114.195.112.44/30 [110/20] via 114.195.112.6
O E2 114.195.112.48/30 [110/20] via 114.195.112.6
O E2 114.195.112.52/30 [110/20] via 114.195.112.6
O E2 114.195.112.56/30 [110/20] via 114.195.112.6
O E2 114.195.112.60/30 [110/20] via 114.195.112.6
O E2 114.195.112.64/30 [110/20] via 114.195.112.6
O E2 114.195.112.72/30 [110/20] via 114.195.112.6
O E2 114.195.112.144/29 [110/20] via 114.195.112.6
O E2 114.195.112.152/29 [110/20] via 114.195.112.6
O E2 114.195.112.160/29 [110/20] via 114.195.112.6
O E2 114.195.112.168/29 [110/20] via 114.195.112.6
O E2 114.195.112.176/29 [110/20] via 114.195.112.6
```

Excellent Results:

- 25+ EIGRP networks visible as OSPF External Type 2 (O E2)
- All routes with AD 110 and metric 20 (default OSPF external metric)
- Complete propagation throughout OSPF domain

5 Technical Deep Dive

5.1 Why Split-Horizon Must Be Disabled

5.1.1 Normal Split-Horizon Behavior

Split-horizon is a loop prevention mechanism that states:

> ”A router should not advertise a route back out the same interface from which it was learned.”

5.1.2 Why Split-Horizon Breaks Redistribution

In a redistribution scenario on serial interfaces:

1. Router learns routes from Protocol A Neighbor on Serial0/0/0
2. Router redistributes routes from Protocol B into Protocol A
3. To propagate these redistributed routes to other Protocol A neighbors on the same interface (Serial0/0/0), the router must advertise out the same interface
4. Split-horizon blocks this advertisement by default
5. Result: Only the immediate neighbor sees redistributed routes; propagation stops

5.1.3 Example: Router 6 with Split-Horizon Enabled

Scenario:

```
[EIGRP Router A] <-- Se0/0/0 --> [Router 6] <-- Se0/1/0 --> [RIP Router B]
                                      |
                                      v
                                 [EIGRP Router C]
                                 (Also on Se0/0/0 segment)
```

With split-horizon enabled:

1. Router 6 learns EIGRP routes from Router A via Se0/0/0
2. Router 6 redistributes RIP routes into EIGRP
3. Router 6 tries to advertise redistributed RIP routes to Router C via Se0/0/0
4. Split-horizon blocks: ”Don’t advertise out the same interface!”
5. Router C never receives the redistributed RIP routes

With split-horizon disabled:

1. Same initial conditions
2. Router 6 redistributes RIP routes into EIGRP
3. Router 6 successfully advertises redistributed RIP routes to Router C via Se0/0/0
4. Router C receives and propagates the routes further
5. Full route propagation achieved

5.2 The Importance of Specific Network Statements

5.2.1 Why Overlapping Network Statements Are Problematic

When multiple network statements cover the same interface or overlapping ranges:

1. **Protocol Boundary Confusion:** The routing protocol runs on interfaces it shouldn't
2. **Internal vs External Misclassification:** Routes are treated as internal instead of external
3. **Redistribution Failure:** The protocol thinks it already owns the routes, so redistribution doesn't work
4. **Suboptimal Routing:** Multiple paths to the same destination with different metrics

5.2.2 Correct Approach: One Interface, One Protocol

Best Practice:

- Each interface should belong to exactly ONE routing protocol
- Network statements should be as specific as possible
- Use wildcard masks to target exact subnets in EIGRP
- OSPF network statements should precisely match interface subnets
- RIP inherently uses classful boundaries, so use passive interfaces to exclude unwanted interfaces

5.3 Administrative Distance and Route Selection

5.3.1 Administrative Distance Table

Route Source	Administrative Distance
Directly Connected	0
Static Route	1
EIGRP Summary	5
EIGRP Internal	90
OSPF	110
RIP	120
EIGRP External	170
Unknown	255

Table 3: Administrative Distance Values

5.3.2 Route Selection in Redistributed Networks

When the same destination is reachable via multiple routing protocols:

1. **Step 1:** Compare Administrative Distance (lower wins)
2. **Step 2:** If AD is equal, compare metric (protocol-specific)
3. **Step 3:** Install best route(s) in routing table

Example from Router 5:

```
Network 114.195.112.28/30:
- Available via OSPF: O [110/128]
- Available via EIGRP External: D EX [170/21026560]
- OSPF wins (110 < 170)
- Installed route: O 114.195.112.28/30 [110/128]
```

5.4 OSPF External Route Types

5.4.1 Type 1 (E1) vs Type 2 (E2)

Type 1 External (E1):

- Metric = External cost + Internal OSPF cost
- Metric increases as the route propagates through OSPF domain
- More accurate cost representation
- Used when you want to consider the total path cost

Type 2 External (E2 - Default):

- Metric = External cost only (internal OSPF cost ignored)
- Metric remains constant throughout OSPF domain
- Default behavior for redistributed routes
- Used when external metric is more significant than internal cost

In our implementation: All EIGRP routes redistributed into OSPF appeared as O E2 with metric 20 (default).

5.5 Why the "subnets" Keyword is Critical in OSPF

5.5.1 OSPF Redistribution Behavior

Without the `subnets` keyword:

```
router ospf 1
 redistribute eigrp 11    ! Only classful networks redistributed
```

With the `subnets` keyword:

```
router ospf 1
 redistribute eigrp 11 subnets    ! All subnets redistributed
```

5.5.2 Why This Matters

Modern networks use VLSM (Variable Length Subnet Masking) and CIDR. Without the `subnets` keyword:

- Only classful networks (10.0.0.0/8, 172.16.0.0/12, 192.168.0.0/16) are redistributed
- All subnets like 114.195.112.32/30, 114.195.112.48/30 would be IGNORED
- Result: Most routes don't appear in OSPF domain

Always use `subnets` when redistributing into OSPF!

6 Verification Commands Reference

6.1 Essential Verification Commands

6.1.1 Basic Connectivity and Configuration

```
show ip interface brief
show running-config
show running-config | section router
show running-config | section interface
```

6.1.2 Routing Protocol Status

```
show ip protocols
show ip route
show ip route eigrp
show ip route ospf
show ip route rip
```

6.1.3 Neighbor Verification

```
show ip eigrp neighbors
show ip ospf neighbor
show ip rip database
```

6.1.4 External Route Verification

```
show ip route | include EX      # EIGRP External routes
show ip route | include E2      # OSPF External Type 2 routes
show ip route | include D       # All EIGRP routes
show ip route | include O       # All OSPF routes
show ip route | include R       # All RIP routes
```

6.1.5 Detailed Protocol Information

```
show ip eigrp topology
show ip ospf database
show ip ospf border-routers
show ip protocols summary
```

6.1.6 Split-Horizon Verification

```
show ip interface Serial0/0/0
show ip interface Serial0/1/0
show ip interface Serial0/0/0 | include split
show ip interface Serial0/1/0 | include split
```

7 Troubleshooting Flowchart

7.1 Redistribution Not Working - Diagnostic Steps

7.1.1 Step 1: Verify Redistribution Configuration

```
show running-config | section router
show ip protocols
```

Check for:

- Redistribution commands present
- Correct metrics configured
- `subnets` keyword in OSPF redistribution

7.1.2 Step 2: Check Network Statements

```
show ip protocols
```

Look for:

- Overlapping network statements
- Wrong interfaces included in routing protocols
- Missing network statements for active interfaces

7.1.3 Step 3: Verify Routes on Redistribution Router

```
show ip route
show ip route eigrp
show ip route ospf
show ip route rip
```

Confirm:

- Both source and destination protocol routes visible
- Routes marked correctly (D vs D EX, O vs O E2)

7.1.4 Step 4: Check Immediate Neighbors

```
# On neighbor router:
show ip route
show ip route | include EX
show ip route | include E2
```

If routes visible on immediate neighbor but NOT distant routers:

- Split-horizon is likely enabled
- Disable split-horizon on redistribution router's interfaces

7.1.5 Step 5: Verify Split-Horizon Status

```
show ip interface Serial0/0/0 | include split
```

Expected output after fix:

```
Split horizon is disabled
```

7.2 Common Mistakes and Solutions

Mistake	Symptom	Solution
Overlapping network statements	Routes show as internal (D, O) instead of external (D EX, O E2)	Use specific network statements for each protocol
Split-horizon enabled	Routes only reach immediate neighbors	Disable split-horizon on serial interfaces
Missing `subnets` keyword in OSPF	Subnets not appearing in OSPF domain	Add `subnets` to OSPF redistribution command
Wrong interface in network statement	Protocol running on wrong interface	Correct network statement to match only intended interface
Missing `no auto-summary`	Routes being summarized to classful boundaries	Add `no auto-summary` to EIGRP and RIP
Incorrect redistribution metrics	Routes installed but not optimal	Adjust redistribution metrics appropriately

Table 4: Common Configuration Mistakes

8 Performance Considerations

8.1 Redistribution Overhead

8.1.1 CPU and Memory Impact

Redistribution increases router resource usage:

- Additional routing table entries
- More frequent routing updates
- Increased CPU cycles for route calculation
- Memory for storing multiple protocol databases

8.1.2 Mitigation Strategies

1. Use route filtering to limit redistributed routes
2. Implement route summarization where possible
3. Use passive interfaces to reduce unnecessary updates
4. Monitor router CPU and memory usage

8.2 Convergence Time

Different protocols have different convergence characteristics:

- **EIGRP:** Fast (sub-second with DUAL algorithm)
- **OSPF:** Moderate (seconds, depends on timers and network size)
- **RIP:** Slow (30-second updates, counting to infinity issues)

Impact on redistributed networks:

- Slowest protocol determines overall convergence
- RIP can introduce significant delays
- Consider using EIGRP stub routing or OSPF areas to contain instability

9 Security Considerations

9.1 Redistribution as a Security Concern

9.1.1 Potential Risks

1. **Information Leakage:** Internal network topology exposed across domains
2. **Route Injection:** Malicious routes could be injected through one protocol
3. **Routing Loops:** Misconfiguration can create loops and network instability
4. **Unauthorized Access:** Routes to sensitive networks propagated unintentionally

9.2 Best Practices for Secure Redistribution

9.2.1 Route Filtering

Implement distribute lists or prefix lists to control which routes are redistributed:

Listing 17: Example Route Filtering

```
# Create access list for allowed routes
access-list 10 permit 114.195.0.0 0.0.255.255
access-list 10 deny any

# Apply to redistribution
router eigrp 11
 redistribute ospf 1 metric 10000 10 255 1 1500
 distribute-list 10 out ospf 1
```

9.2.2 Route Tagging

Use route tags to track route origins and prevent loops:

Listing 18: Route Tagging Example

```
route-map EIGRP-TO-OSPF permit 10
 set tag 100

router ospf 1
 redistribute eigrp 11 subnets route-map EIGRP-TO-OSPF
```

9.2.3 Administrative Distance Manipulation

Adjust AD to prefer certain protocols:

```
router eigrp 11
 distance eigrp 90 160  # Internal 90, External 160
```

10 Advanced Configurations

10.1 Multiple Redistribution Points

When multiple routers perform redistribution between the same protocols:

10.1.1 Challenges

- Routing loops
- Suboptimal routing
- Route flapping
- Counting to infinity (in distance-vector protocols)

10.1.2 Solutions

1. **Route tagging:** Tag routes at redistribution points and filter based on tags
2. **AD manipulation:** Prefer routes from specific redistribution points
3. **Distribute lists:** Prevent routes from being redistributed back
4. **Route maps:** Complex filtering and policy-based routing

10.2 Route Summarization at Redistribution Points

Reduce routing table size by summarizing routes:

Listing 19: EIGRP Summarization

```
interface Serial0/0/0
 ip summary-address eigrp 11 114.195.0.0 255.255.0.0
```

Listing 20: OSPF Summarization

```
router ospf 1
 summary-address 114.195.0.0 255.255.0.0
```

11 Lessons Learned and Best Practices

11.1 Key Takeaways from Implementation

11.1.1 Configuration Principles

1. **One Interface, One Protocol:** Never let multiple routing protocols run on the same interface unless explicitly designed for it
2. **Specific Network Statements:** Use precise network statements targeting only the intended interfaces

3. **Disable Split-Horizon:** Always disable split-horizon on serial interfaces when redistribution is needed
4. **Use `subnets` in OSPF:** Never forget the `subnets` keyword when redistributing into OSPF
5. **Disable Auto-Summary:** Modern networks require `no auto-summary` on both EIGRP and RIP

11.1.2 Verification Methodology

1. **Start at the redistribution router:** Verify routes from both protocols visible
2. **Check immediate neighbors:** Confirm external routes are received
3. **Test distant routers:** Ensure routes propagate throughout the entire domain
4. **Verify external marking:** Routes should show as D EX, O E2, etc.
5. **Test connectivity:** Ping between endpoints to confirm end-to-end reachability

11.1.3 Troubleshooting Approach

1. **Layer by layer:** Start with physical/interface issues, then move to protocol configuration
2. **Use show commands extensively:** `show ip route`, `show ip protocols`, `show running-config`
3. **Compare expected vs actual:** Know what routes SHOULD appear and compare with reality
4. **Check split-horizon first:** This is the most common cause of redistribution issues
5. **Document changes:** Keep track of configuration changes for rollback if needed

11.2 Production Deployment Recommendations

11.2.1 Pre-Deployment Checklist

Test configuration in lab environment

Document all network statements and interface assignments

Create rollback plan

Schedule maintenance window

Notify users of potential connectivity disruption

Prepare verification commands

Have backup configuration saved

11.2.2 Post-Deployment Verification

Verify all expected routes appear in routing tables

Test connectivity between all network segments

Monitor router CPU and memory usage

Check for routing loops (traceroute)

Verify external route marking (D EX, O E2)

Document final working configuration

Update network diagrams and documentation

11.2.3 Ongoing Monitoring

- Monitor routing table stability
- Watch for route flapping
- Track router resource usage
- Review logs for routing protocol errors
- Periodically verify redistribution is still functioning

12 Conclusion

12.1 Project Summary

This project successfully implemented mutual redistribution between three routing protocols (EIGRP 11, RIPv2, and OSPF Area 1) across two redistribution routers. Both implementations initially failed due to identical root causes:

1. Overlapping network statements causing protocols to run on wrong interfaces
2. Split-horizon enabled on serial interfaces blocking route propagation

By applying systematic troubleshooting and implementing specific fixes (precise network statements and disabling split-horizon), both redistribution scenarios were successfully resolved.

12.2 Final Network Status

Redistribution	Routes Exchanged	Status
RIPv2 ↔ EIGRP 11	19+ routes each direction	Operational
OSPF ↔ EIGRP 11	29+ routes each direction	Operational

Table 5: Final Redistribution Status

12.3 Success Metrics Achieved

100% route propagation: All routes visible throughout their destination domains

Correct external marking: D EX for redistributed routes in EIGRP, O E2 in OSPF, R in RIP

No routing loops: Clean routing tables with no inconsistencies

End-to-end connectivity: All network segments can communicate

Optimal routing: Routes follow expected paths based on metrics and administrative distances

12.4 Knowledge Transfer

The troubleshooting methodology and solutions documented in this report provide a replicable framework for:

- Implementing mutual redistribution between any routing protocols
- Diagnosing redistribution issues systematically
- Understanding the critical role of split-horizon in redistribution scenarios
- Applying best practices for protocol boundary management

12.5 Future Recommendations

For continued network optimization:

1. Implement route filtering to control which routes are redistributed
2. Consider route summarization to reduce routing table size
3. Monitor router performance and adjust timers if needed
4. Document all changes and maintain current network diagrams
5. Plan for periodic reviews of redistribution configuration

End of Report