

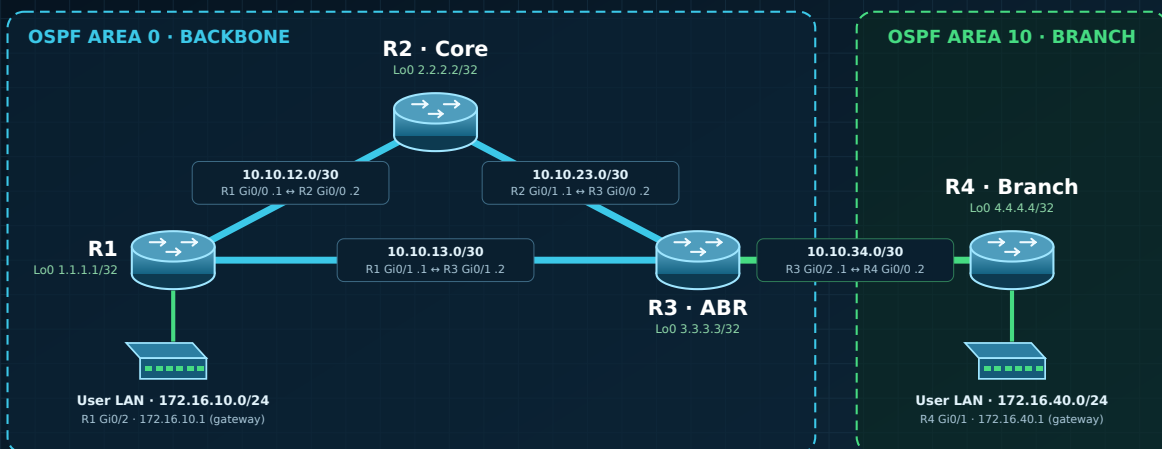
Interior Routing Protocols Ultimate Cheat Sheet

RIP · EIGRP · OSPF · IS-IS | Configuration, Commands, Troubleshooting & Security

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MAG212 CYBER · INTERIOR ROUTING LAB

One physical topology · configure RIP, EIGRP, OSPF or IS-IS separately · areas shown for the OSPF lab



PROTOCOL OVERLAYS · run one protocol at a time

- RIPv2** network 10.0.0.0 on every router; network 172.16.0.0 on R1 and R4; LAN interfaces passive
- EIGRP** AS 100 on all four transit links; DUAL keeps a feasible successor where the feasibility condition holds
- OSPF** Area 0: R1-R2, R2-R3, R1-R3 and R1 LAN · Area 10: R3-R4 and R4 LAN · R3 is the ABR
- IS-IS** R1, R2, R3 in area 49.0001 · R4 in area 49.0002 · R3-R4 forms a Level-2 adjacency only

Illustrative Cisco-inspired stencils, not official Cisco assets · Gi = GigabitEthernet · all addresses are lab examples

One physical topology for four separate labs. Interface names and addresses match section 02; the OSPF areas shown apply to the OSPF lab. Run one routing protocol at a time and avoid mixing them in one routing domain.

Quick reference: protocols compared

Understand the design decision before typing commands.

Protocol	Algorithm	AD (Cisco defaults)	Metric	Transport	Best fit
RIPv2	Bellman-Ford	120	Hop count, max 15	UDP 520	Legacy labs
RIPng	Bellman-Ford	120	Hop count, max 15	UDP 521	Legacy IPv6 labs
EIGRP	DUAL	90 internal / 170 external	Bandwidth + delay by default	IP protocol 88	Cisco-centric enterprise
OSPFv2 / OSPFv3	SPF (Dijkstra)	110	Interface cost	IP protocol 89	Multivendor enterprise
IS-IS	SPF (Dijkstra)	115	Configured link metric	Directly over Layer 2	ISP cores, large-scale fabrics
BGP (context only)	Path-vector decision process	20 eBGP / 200 iBGP	Policy attributes	TCP 179	Between autonomous systems

Remember: administrative distance matters only when a router compares competing routes from different sources to the **same prefix**; it is not a routing-protocol performance score. EIGRP summarized-route AD 5 is platform/context specific and is not the ordinary internal-route AD.

The shared four-router laboratory

Use the same interfaces and addresses for independent protocol labs.

Interfaces on links (R1–R2: R1 G0/0 10.10.12.1/30, R2 G0/0 10.10.12.2/30); (R2–R3: R2 G0/1 10.10.23.1/30, R3 G0/0 10.10.23.2/30); (R1–R3: R1 G0/1 10.10.13.1/30, R3 G0/1 10.10.13.2/30); (R3–R4: R3 G0/2 10.10.34.1/30, R4 G0/0 10.10.34.2/30). R1 G0/2 is 172.16.10.1/24; R4 G0/1 is 172.16.40.1/24. Each router has a /32 loopback matching its diagram label. Assign physical addresses before enabling a routing protocol. Use one protocol at a time in the lab; do not accidentally mix redistribution and overlapping route sources.

RIP: simplest concept, weakest scale

Periodic vectors, hop limits, and loop avoidance.

Cisco IOS/IOS XE sample on R1 (repeat the relevant classful **network** statements on other routers):

```
router rip
version 2
no auto-summary
network 10.0.0.0
network 172.16.0.0
passive-interface GigabitEthernet0/2
```

Here **network 10.0.0.0** selects interfaces in the classful major network; **no auto-summary** preserves advertised subnet masks. Repeat **network 172.16.0.0** only on routers with a 172.16.x.x interface. By default RIPv2 sends updates every 30 seconds to 224.0.0.9. A hop count of 16 indicates unreachable. Prefer a modern IGP over RIP for production.

EIGRP: DUAL and loop-free backups

Feasible successors are backup candidates, not just alternate neighbors.

Cisco classic-mode example on R3:

```
router eigrp 100
  no auto-summary
  network 10.10.23.0 0.0.0.3
  network 10.10.13.0 0.0.0.3
  network 10.10.34.0 0.0.0.3
  passive-interface default
  no passive-interface GigabitEthernet0/0
  no passive-interface GigabitEthernet0/1
  no passive-interface GigabitEthernet0/2
```

DUAL terms: Reported Distance (RD) is the neighbor's advertised metric; Feasible Distance (FD) is the best metric from the local router to that prefix. A feasible successor must satisfy **RD < current successor FD** (feasibility condition). A nonqualifying route could still be usable after recomputation, but is not a guaranteed loop-free backup. `show ip eigrp neighbors` verifies peers, `show ip eigrp topology` verifies the feasible successor and path state. Named EIGRP mode is recommended where supported; wide metrics and authentication syntax differ by platform.

OSPF: backbone, areas and DR/BDR

Multi-area IP routing built around a synchronized link-state database.

Example area plan: R1–R2–R3 links belong to area 0; R3–R4 link and R4 LAN belong to area 10, making R3 an ABR. R1 LAN stays in area 0. R3 sample:

```
router ospf 10
  router-id 3.3.3.3
  passive-interface default
  no passive-interface GigabitEthernet0/0
  no passive-interface GigabitEthernet0/1
  no passive-interface GigabitEthernet0/2
!
interface GigabitEthernet0/0
  ip ospf 10 area 0
  ip ospf network point-to-point
interface GigabitEthernet0/1
  ip ospf 10 area 0
  ip ospf network point-to-point
interface GigabitEthernet0/2
  ip ospf 10 area 10
  ip ospf network point-to-point
```

Point-to-point OSPF links do not elect a DR/BDR; shared broadcast Ethernet does. On a broadcast segment, DR and BDR election is non-preemptive and depends on priority, then router ID. OSPF states: Down → Init → 2-Way → ExStart → Exchange → Loading → Full. Staying 2-Way can be normal between DROTHER neighbors. Check `show ip ospf neighbor`, `show ip ospf interface`, `show ip ospf database`, `show ip route ospf`. Match area, timers, authentication, network type, and subnet; monitor MTU problems in database exchange.

IS-IS: L1, L2 and NET addressing

Link-state routing carried directly at Layer 2.

R1, R2 and R3 share area 49.0001; R4 sits in area 49.0002, so R3 is the area border. An IS-IS router has one area, set in its NET, for the whole process; areas are not assigned per interface. Because R3 and R4 are in different areas, the R3–R4 link can form **only a Level-2 adjacency**, so both routers must run Level 2 (`is-type level-1-2`). Sample R3:

```
router isis MAG212
 net 49.0001.0000.0000.0003.00
 is-type level-1-2
 metric-style wide
 !
 interface GigabitEthernet0/2
  ip router isis MAG212
  isis circuit-type level-2-only
  isis network point-to-point
```

R4 uses `net 49.0002.0000.0000.0004.00` and `is-type level-1-2` so its L2 connection to R3 operates across areas; R4's LAN prefix sits in its Level-1 database and is advertised into Level 2 by default. IS-IS NET is not an interface IP address. Verify `show isis neighbors`, `show isis database`, `show isis topology`, `show clns interface`. Broadcast segments elect a DIS; point-to-point segments do not. IS-IS L2 is an inter-area routing level, not OSPF Area 0.

Routing protocol security

Establish policy boundaries; assume the LAN could be hostile.

1. Enable authentication supported by platform and routing mode (EIGRP HMAC-SHA-256 when available; OSPF authentication options depend on v2/v3 and device; IS-IS authenticated PDUs); avoid publishing shared secrets in the article.
2. Set interfaces toward end-user LANs as passive when applicable; never form dynamic peers with untrusted clients.
3. Apply infrastructure ACLs and routing process filters for expected adjacencies and protocol traffic.
4. Filter inbound/outbound prefixes at redistribution boundaries; avoid accidental default-route leaks and loops.
5. Limit management access with SSH, AAA, logging, NTP, and configuration backups; monitor adjacency churn.
6. Change reference-bandwidth consistently on all OSPF routers if higher link speeds warrant it.
7. Be cautious with `debug`, protocol clears, and authentication changes on live routers—these may disrupt adjacencies.

Troubleshooting decision tree

Go from physical connectivity to peer state to route installation.

- **01 Physical:** `show ip interface brief`, `show interfaces`, verify VLAN, speed, IP/mask, ACL and bidirectional reachability.
- **02 Protocol:** `show ip protocols`; confirm interface enabled and correct process/domain.
- **03 Adjacency:** RIP has no neighbor adjacency; inspect `show ip rip database` and `debug ip rip` carefully. EIGRP: `show ip eigrp neighbors`. OSPF: `show ip ospf neighbor`. IS-IS: `show isis neighbors`.
- **04 Database:** EIGRP `show ip eigrp topology`; OSPF `show ip ospf database`; IS-IS `show isis database`.
- **05 RIB:** `show ip route`, `show ip route <prefix>`; compare AD and route policy, check whether the next hop is reachable.
- **06 Path:** `traceroute <destination>` and check route summarization, redistribution, and return path.
- **Common symptoms:** OSPF EXSTART/EXCHANGE: check MTU/network type; EIGRP neighbors never form: verify AS, K-values, authentication and IP reachability; IS-IS missing L1: inspect NET area values; RIP remote prefixes missing: confirm correct `network` statements, `no auto-summary`, update filters and the 15-hop limit.

Field exam: questions with explained answers

Eight scenario questions, with the answer next to each question.

Q1. Which protocol runs over TCP/179?

BGP. It is included for comparison but is not an IGP.

Q2. A RIP route reaches hop count 16. What happens?

It is considered unreachable.

Q3. What is EIGRP's feasibility condition?

A backup neighbor's reported distance must be strictly lower than the current successor's feasible distance.

Q4. Why are two OSPF neighbors stuck in 2-Way?

Normal for two DROTHER routers on a broadcast segment; abnormal for a point-to-point adjacency that should become Full.

Q5. Why is an OSPF Type-2 LSA absent on a p2p Ethernet link?

No DR is elected in p2p mode, so there is no transit network LSA for that link.

Q6. Can IS-IS Level 1 routers in different areas become L1 neighbors?

No, their area IDs must match for L1.

Q7. Which protocol uses UDP/520 and multicast 224.0.0.9?

RIPv2.

Q8. Two protocols advertise the same exact IPv4 prefix: EIGRP internal AD 90 and OSPF AD 110. Which is installed (assuming valid equal-prefix routes)?

EIGRP internal, because its AD is lower. Longest-prefix match still governs destination forwarding across *different* prefix lengths.

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Legacy-reference corrections and modern notes

Important distinctions when using older quick-reference sheets.

Older quick-reference sheets remain useful for terminology and command families, but some of their entries are era-specific: IPv6 protocol configuration differs across IOS/IOS XE versions; classic EIGRP `no auto-summary` is relevant to older/configuration modes; IS-IS is not an IP protocol number; OSPFv3 uses different LSA naming and addressing and should not be configured by blindly copying OSPFv2 commands. Older RIP and MD5 examples are primarily for legacy operation and lab familiarity. Always validate against your actual IOS XE version and feature set.

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Go deeper

Each protocol has its own full MAG212 CYBER cheat sheet with a dedicated lab, diagrams and troubleshooting: [RIP](#) · [EIGRP](#) · [OSPF](#) · [IS-IS](#) · [BGP](#).

Sources: [RFC 2453 \(RIPv2\)](#) · [RFC 7868 \(EIGRP\)](#) · [RFC 2328 \(OSPFv2\)](#) · [RFC 1195 \(Integrated IS-IS\)](#) · [RFC 4271 \(BGP-4\)](#).

your IOS XE platform.