

# Day 10: IPv4 Header

## CCNA 200-301 Study Guide: The IPv4 Header and Layer 3 Operations

### 1.0 The Role of the Network Layer (Layer 3)

The primary role of the Network Layer is to provide logical addressing and path determination to move data between different networks.

- PDU: The Protocol Data Unit at Layer 3 is the Packet.
- Exam Weight: This falls under the IP Connectivity domain, representing 25% of the CCNA exam score.
- Focus: Understanding how routers interpret routing tables, make forwarding decisions, and establish connectivity.

### 2.0 Analyzing the IP Routing Table (Exam Obj. 3.1)

The routing table is a router's primary map of the network. Each entry provides the instructions needed to forward a packet toward its final destination.

# Components of a Routing Table Entry

Component	Code/Ref	Function
Protocol Code	3.1.a	Identifies how the route was learned (e.g., C: Connected, S: Static, O: OSPF, D: EIGRP).
Prefix	3.1.b	The destination network address.
Network Mask	3.1.c	Defines the size of the network (e.g., /24). Used for "longest match" decisions.
Next Hop	3.1.d	The IP of the next router or the local exit interface.
Admin Distance	3.1.e	The "trustworthiness" of the route source (Lower is better).
Metric	3.1.f	The "cost" calculated by the routing protocol (Lower is better).
Gateway of Last Resort	3.1.g	The Default Route used when no specific match exists.

## 3.0 Static Route Types (Exam Obj. 3.3)

Static routes are manually configured and are resource-efficient. You must be able to configure and verify these four types:

1. Default Route: The "Gateway of Last Resort" (usually 0.0.0.0/0). Points to the ISP.
2. Network Route: A path to a specific destination subnet (e.g., 192.168.10.0/24).
3. Host Route: A route to a single IP address using a /32 mask (IPv4) or /128 (IPv6).
4. Floating Static Route: A backup route with a higher Administrative Distance (AD) than the primary dynamic route. It only appears in the routing table if the primary fails.

## 4.0 Core Layer 3 Operational Concepts

# 4.1 The Router's Forwarding Decision Logic (Exam Obj. 3.2)

When a router receives a packet, it uses a strict three-step hierarchical logic to find the "best path":

1. Longest Prefix Match: The router prefers the most specific route. A match for  $/26$  always beats a match for  $/24$ .
2. Administrative Distance (AD): If the prefix lengths are identical, the router chooses the source with the lowest AD.
  - Connected: 0
  - Static: 1
  - OSPF: 110
3. Routing Protocol Metric: If the AD is also identical (same protocol), the path with the lowest calculated cost (metric) is chosen.

# 4.2 First Hop Redundancy (FHRP) (Exam Obj. 3.5)

The purpose of FHRP is to eliminate the single point of failure inherent in having only one default gateway.

- Mechanism: Multiple physical routers act as a single Virtual Router.
- Benefit: If the active physical router fails, a standby router takes over the virtual IP address seamlessly, ensuring continuous connectivity for end hosts without manual configuration changes.

# 5.0 CCNA Exam Quick Reference Summary

- IP Connectivity: Domain 3; 25% of the exam.
- Selection Hierarchy: Longest Match  $\rightarrow$  AD  $\rightarrow$  Metric.
- OSPFv2: Requires knowledge of neighbor adjacencies and DR/BDR selection.
- Static Routing: Know how to configure and verify Network, Host, and Floating routes.
- FHRP: Understand its role in providing a resilient default gateway.

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