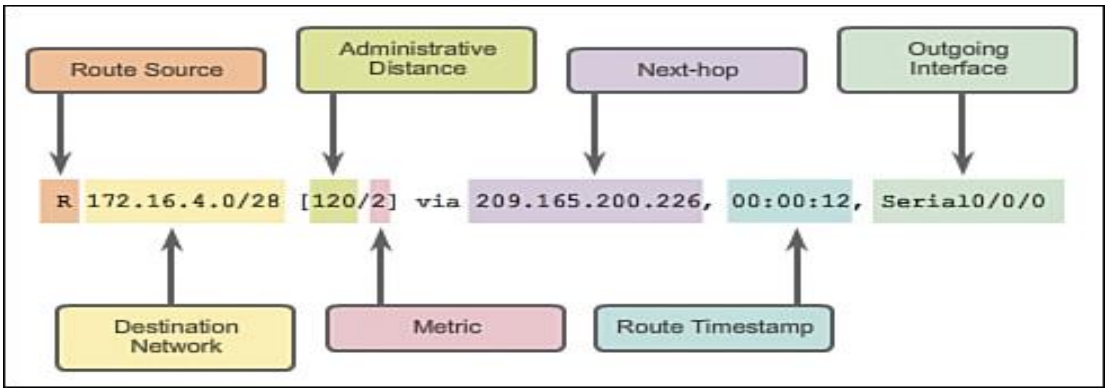
## Components of a Routing Table:




### Routing Prefix & Network Mask:

A subnetwork or subnet is a logical subdivision of an IP network. Expressed in CIDR notation written as the first address of a network, followed by a slash character (/), and ending with the bit-length of the prefix. Example like 172.16.4.0/28. It is Destination Network, Identifies the address of the remote network and /28 is Network Mask.

### Next Hop:

Identifies the IPv4 address of the next router to forward the packet to. Example like 209.165.200.226 in above given table.

### Routing Protocol Code:

It's called Route Source Identifies how the route was learned. Common codes include O (OSPF), D (EIGRP), R (RIP), S* (Static Default), S (Static) and B (BGP). Example like R in above given table.

### Administrative Distance:

Administrative distance is the feature that routers use to select the best path when there are two or more different routes to the same destination from two different routing protocols. Administrative distance defines the reliability of a routing protocol. The administrative number is from 0 to 255. Lowes administrative distance is most preferred.

| Route Source | Default Administrative Distance |
|---|---|
| Connected Interfaces | 0 |
| Static Route | 1 |
| EBGP | 20 |
| IBGP | 200 |
| EIGRP | 90 |
| External EIGRP | 170 |
| OSPF | 110 |
| RIP | 120 |

## Metric:

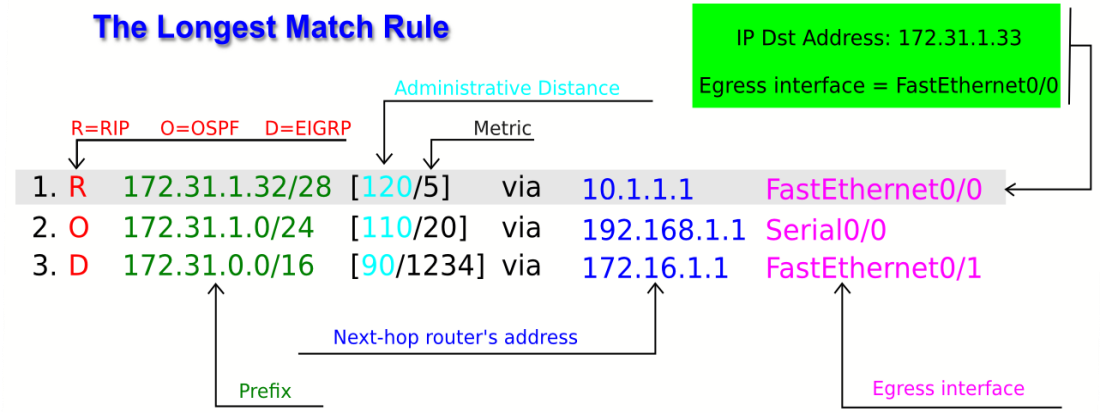
Routers use various metrics and calculations to determine the best route for a packet to reach its final network destination. Each routing protocol uses its own algorithm with varying weights to determine the best possible path. Identifies the value assigned to reach the remote network. Lower values indicate preferred routes. Example like 2 hops in above given table.

## Gateway of Last Resort:

A Gateway of Last Resort or Default gateway is a route used by the router when no other known route exists to transmit the IP packet. Known routes are present in the routing table. Hence, any route not known by the routing table is forwarded to the default route. Use the ip default-gateway command when ip routing is disabled on a Cisco router. Use the ip default-network and ip route 0.0.0.0 0.0.0.0 commands to set the gateway of last resort on Cisco routers that have ip routing enabled.

## Packet Handling & Forwarding Decision:

When an IPv4 packet arrives on a router interface, the router de-encapsulates the Layer 2 frame and examines the Layer 3 IPv4 header. The router identifies the destination IPv4 address, and proceeds through the route lookup process. The router scans the routing table to find a best match for the destination IPv4 address. The best match is the longest match in the table. For example, if the destination IPv4 address is 172.16.0.10 and the entries in the routing table are for 172.16.0.0/12, 172.16.0.0/18, and 172.16.0.0/26, the longest match and the entry used for the packet is 172.16.0.0/26.




## Frame Rewrite:

The frame rewrite procedure by the router is to encapsulates the IP packet with the same source and destination IP address that was sent from the original sending device into a new Layer 2 frame. It changes the source MAC address to the forwarding interface of the local router. The router changes the destination MAC address to the receiving interface of the next hop device. An FCS as part of the trailer is also added. This process continues from hop to hop on Ethernet networks until the packet reaches the destination host.

## Longest Match:

Cisco routers use the longest prefix match rule when determining which of the routes placed into the routing table should be used to forward traffic to a destination network or node. Longer, or more specific routing table entries are preferred over less specific entries, such as summary addresses, when determining which entry to use to route traffic to the intended destination network or node. The longest prefix or most specific route will be used to route traffic to the destination network or node regardless of the administrative distance of the route source, or even the routing protocol metric assigned to the prefix is multiple overlapping prefixes are learned via the same routing protocol.

| Routing Table Entry | Order Used |
|---|---|
| 8.8.8.8/32 | 1st Longest Prefix Match Lookup |
| 8.8.8.0/24 | 2nd Longest Prefix Match Lookup |
| 8.8.0.0/16 | 3rd Longest Prefix Match Lookup |
| 8.0.0.0/8 | 4th Longest Prefix Match Lookup |
| 0.0.0.0/0 | 5th Longest Prefix Match Lookup |