Administrative distance

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[Jump to navigation](https://en.wikipedia.org/wiki/Administrative_distance#mw-head)[Jump to search](https://en.wikipedia.org/wiki/Administrative_distance#searchInput)

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|  | It has been suggested that this article be [merged](https://en.wikipedia.org/wiki/Wikipedia:Merging) with [*Metrics (networking)*](https://en.wikipedia.org/wiki/Metrics_(networking)). ([Discuss](https://en.wikipedia.org/wiki/Talk:Administrative_distance))*Proposed since July 2020.* |

**Administrative distance (AD)** or **route preference**[[1]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-1) is a number of [arbitrary unit](https://en.wikipedia.org/wiki/Arbitrary_unit) assigned to [dynamic routes](https://en.wikipedia.org/wiki/Dynamic_route), [static routes](https://en.wikipedia.org/wiki/Static_route) and directly-connected routes. The value is used in [routers](https://en.wikipedia.org/wiki/Router_(computing)) to rank [routes](https://en.wikipedia.org/wiki/Routing) from most preferred (low AD value) to least preferred (high AD value).[[2]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-Understanding_Route_Redistribution-2)[[3]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-cisco-3) When multiple paths to the same destination are available in its [routing table](https://en.wikipedia.org/wiki/Routing_table), the router uses the route with the lowest administrative distance.

Router vendors typically design their routers to assign a default administrative distance to each kind of route. For example, Cisco routers, routes issued by [OSPF](https://en.wikipedia.org/wiki/OSPF) have a lower default administrative distance than routes issued by the [Routing Information Protocol](https://en.wikipedia.org/wiki/Routing_Information_Protocol). By default, OSPF has a default administrative distance of 110 and RIP has a default administrative distance of 120. Administrative distance values can, however, usually be adjusted manually by a [network administrator](https://en.wikipedia.org/wiki/Network_administrator).[[2]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-Understanding_Route_Redistribution-2)



**Contents**

* [1Overview](https://en.wikipedia.org/wiki/Administrative_distance#Overview)
* [2Default administrative distances](https://en.wikipedia.org/wiki/Administrative_distance#Default_administrative_distances)
  + [2.1Cisco](https://en.wikipedia.org/wiki/Administrative_distance#Cisco)
  + [2.2Juniper](https://en.wikipedia.org/wiki/Administrative_distance#Juniper)
* [3Configuration](https://en.wikipedia.org/wiki/Administrative_distance#Configuration)
  + [3.1Cisco IOS](https://en.wikipedia.org/wiki/Administrative_distance#Cisco_IOS)
* [4References](https://en.wikipedia.org/wiki/Administrative_distance#References)
* [5External links](https://en.wikipedia.org/wiki/Administrative_distance#External_links)

Overview[[edit](https://en.wikipedia.org/w/index.php?title=Administrative_distance&action=edit&section=1)]

The administrative distance (AD) value is assigned by the [router](https://en.wikipedia.org/wiki/Router_(computing)) on a per-protocol basis. Routers, by design, should not install multiple routes into the routing table as this has the potential to cause routing loops.[[2]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-Understanding_Route_Redistribution-2) While a router may run multiple [routing protocols](https://en.wikipedia.org/wiki/Routing_protocol) on the same device, it is necessary for the router to implement a process to ensure that multiple routes, pointing to the same destination do not simultaneously exist in the routing table. Each process running on a router advertises its administrative distance value to the local router. The router uses this value to determine which route should be used. Once a route has been selected, the routing information database is updated. If two routes have the same administrative distance, the router uses its vendor-specific algorithm to determine which route should be installed.[[2]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-Understanding_Route_Redistribution-2) [Cisco](https://en.wikipedia.org/wiki/Cisco) routers simply ignore the values and fall back to the default values, which are never the same.[[4]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-ReferenceA-4)

The router will usually compare administrative distances to determine which protocol has the lowest value. The router prefers protocols that have a lower assigned administrative distance. For example, OSPF has a default distance of 110, so it is preferred by the router process, over RIP, which has a default distance of 120. The administrator can arbitrarily reconfigure the administrative distances, which affects the ranking of the preferred routes by the routing process. On Cisco routers, [static routes](https://en.wikipedia.org/wiki/Static_routing) have an administrative distance of 1, making them preferred over routes issued by a [dynamic routing protocol](https://en.wikipedia.org/wiki/Dynamic_routing). The administrative distance is a value that is always only referenced by the local router itself. The administrative distance is not advertised on the network.[[2]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-Understanding_Route_Redistribution-2)

Default administrative distances[[edit](https://en.wikipedia.org/w/index.php?title=Administrative_distance&action=edit&section=2)]

**Cisco**[[edit](https://en.wikipedia.org/w/index.php?title=Administrative_distance&action=edit&section=3)]

The following table lists the default administrative distances for various routing protocols used on [Cisco](https://en.wikipedia.org/wiki/Cisco_Systems) routers.[[3]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-cisco-3)

|  |  |
| --- | --- |
| **Routing Protocol** | **Administrative distance** |
| Directly connected interface | 0[[a]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-5)[[5]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-Cisco_AD-6) |
| Static route out an interface | 1[[b]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-7) |
| Static route to next-hop address | 1 |
| DMNR - Dynamic Mobile Network Routing | 3 |
| [EIGRP](https://en.wikipedia.org/wiki/EIGRP) summary route | 5 |
| External [BGP](https://en.wikipedia.org/wiki/BGP) | 20 |
| Internal [EIGRP](https://en.wikipedia.org/wiki/EIGRP) | 90 |
| [IGRP](https://en.wikipedia.org/wiki/IGRP) | 100 |
| [OSPF](https://en.wikipedia.org/wiki/OSPF) | 110 |
| [IS-IS](https://en.wikipedia.org/wiki/IS-IS) | 115 |
| [Routing Information Protocol](https://en.wikipedia.org/wiki/Routing_Information_Protocol) (RIP) | 120 |
| [Exterior Gateway Protocol](https://en.wikipedia.org/wiki/Exterior_Gateway_Protocol) (EGP) | 140 |
| [On Demand Routing](https://en.wikipedia.org/wiki/On_Demand_Routing) (ODR) | 160 |
| External [EIGRP](https://en.wikipedia.org/wiki/EIGRP) | 170 |
| Internal [BGP](https://en.wikipedia.org/wiki/BGP) | 200 |
| [Next Hop Resolution Protocol](https://en.wikipedia.org/wiki/Next_Hop_Resolution_Protocol) (NHRP) | 250[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] |
| Default static route learned via DHCP | 254[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] |
| Unknown and unused | 255[[c]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-8) |

**Notes**

* 1. [**^**](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-5) Only the interface itself has an administrative distance of 0, since a route cannot have a distance of less than 1.
  2. [**^**](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-7) Since [IOS](https://en.wikipedia.org/wiki/Cisco_IOS) 12.2, the administrative distance of a static route with an exit interface is 1. Prior to the release of 12.2 it was in fact 0.
  3. [**^**](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-8) An administrative distance of 255 will cause the router to remove the route from the routing table and not use it.

**Juniper**[[edit](https://en.wikipedia.org/w/index.php?title=Administrative_distance&action=edit&section=4)]

The following table lists the default administrative distances for various routing protocols used on Juniper routers.[[6]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-Juniper_AD-9)

|  |  |
| --- | --- |
| **Routing Protocol** | **Administrative distance** |
| Directly connected interface | 0 |
| Static routes | 5 |
| OSPF internal routes | 10 |
| IS-IS Level 1 Internal | 15 |
| IS-IS Level 2 Internal | 18 |
| [RIP](https://en.wikipedia.org/wiki/RIP) | 100 |
| Aggregate (route summary) | 130 |
| OSPF external routes | 150 |
| IS-IS Level 1 External | 160 |
| IS-IS Level 2 External | 165 |
| BGP | 170 |

**Notes**

Configuration[[edit](https://en.wikipedia.org/w/index.php?title=Administrative_distance&action=edit&section=5)]

**Cisco IOS**[[edit](https://en.wikipedia.org/w/index.php?title=Administrative_distance&action=edit&section=6)]

The [network administrator](https://en.wikipedia.org/wiki/Network_administrator) may modify the administrative distance to change the desired ranking of router protocols. This may be necessary in cases where [routing redistribution](https://en.wikipedia.org/w/index.php?title=Routing_redistribution&action=edit&redlink=1) has to be used, otherwise, routing loops could occur.[[3]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-cisco-3) The Cisco Internetwork Operating System enables network administrators to modify the distance by changing the distance value in sub-router configuration mode. In the example below, RIP's administrative distance is changed to 89 so that it used in preference to OSPF.[[3]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-cisco-3)

R1> **enable**

R1# **configure terminal**

R1(config)# **router rip**

R1(config-router)# **distance 89**

Manually configuring the administrative distance is also required when configuring a floating static route. Floating static routes are used to provide an alternate path when a primary link fails. In order for static routes to be configured as a backup, the static route's administrative distance would need to be adjusted. Otherwise, it will take precedence over all routing protocols and routes issued from a routing protocol will not be inserted into the routing table.[[3]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-cisco-3) The example below shows how to configure the administrative distance to 254 to specify that it should only be used as a last resort.

R1(config)# **ip route 10.0.0.0 255.0.0.0 backupLink 1 254**

In the event that two routing protocols are configured with the same administrative distance, the [Cisco](https://en.wikipedia.org/wiki/Cisco_Systems) router will ignore the configured values and instead use the default values.[[4]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-ReferenceA-4)

Verifying the configuration of the administrative distance is done on Cisco equipment using the *show ip route* command in [privileged exec mode](https://en.wikipedia.org/w/index.php?title=Privileged_exec_mode&action=edit&redlink=1) on the console of the [Cisco](https://en.wikipedia.org/wiki/Cisco_Systems) router.[[7]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-10)[[8]](https://en.wikipedia.org/wiki/Administrative_distance#cite_note-11) In the example shown below, the administrative distance is 1. The letter "S" indicates that the route is a [static route](https://en.wikipedia.org/wiki/Static_route) that has, for all intents and purposes, been added manually to the router process by the administrator and installed into the routing table.

Router# **enable**

Router# **configure terminal**

Router(config)# **ip route 1.1.1.0 255.255.255.0 fastEthernet 0/0**

Router(config)# **do show ip route**

The *do show ip route* command will display the following, confirming that a [static route](https://en.wikipedia.org/wiki/Static_routing) has an administrative distance of 1.

***S 1.1.1.0/0 [1/0] via 172.31.0.1***

References[[edit](https://en.wikipedia.org/w/index.php?title=Administrative_distance&action=edit&section=7)]

* 1. [**^**](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-1) [*"Route Preferences"*](https://www.juniper.net/documentation/software/cable/junosg30/swconfig30-interfaces/html/protocols-overview4.html)*. Juniper Networks. Retrieved 2018-06-18.*
  2. ^ [Jump up to:***a***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-Understanding_Route_Redistribution_2-0) [***b***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-Understanding_Route_Redistribution_2-1) [***c***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-Understanding_Route_Redistribution_2-2) [***d***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-Understanding_Route_Redistribution_2-3) [***e***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-Understanding_Route_Redistribution_2-4) *Franck Le; Geoffrey G. Xie; Hui Zhang,*[*Understanding Route Redistribution*](https://www.cs.cmu.edu/~4D/papers/rr-icnp07.pdf)*(PDF)*
  3. ^ [Jump up to:***a***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-cisco_3-0) [***b***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-cisco_3-1) [***c***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-cisco_3-2) [***d***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-cisco_3-3) [***e***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-cisco_3-4) Cisco Systems (2013), [What is Administrative Distance?](http://www.cisco.com/en/US/tech/tk365/technologies_tech_note09186a0080094195.shtml), retrieved 14 September 2013
  4. ^ [Jump up to:***a***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-ReferenceA_4-0) [***b***](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-ReferenceA_4-1) Cisco Systems(n.d.), Information About Routing, Cisco Systems Inc, retrieved 16 September 2013
  5. [**^**](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-Cisco_AD_6-0) *Cisco,*[*Default AD*](http://www.cisco.com/c/en/us/support/docs/ip/border-gateway-protocol-bgp/15986-admin-distance.html#topic2)
  6. [**^**](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-Juniper_AD_9-0) *Juniper,*[*Default AD*](https://www.juniper.net/documentation/en_US/junos/topics/reference/general/routing-protocols-default-route-preference-values.html)
  7. [**^**](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-10) Cisco Systems (n.d), [Configuring Static Routing](http://www.cisco.com/en/US/docs/switches/datacenter/sw/5_x/nx-os/unicast/configuration/guide/l3_route.html), Cisco Systems Inc., retrieved 14 September 2013
  8. [**^**](https://en.wikipedia.org/wiki/Administrative_distance#cite_ref-11) Cisco Systems (n.d), [Show Commands](http://www.cisco.com/en/US/docs/switches/datacenter/sw/6_x/nx-os/unicast/command/reference/l3_cmds_show.html#wp1688356), Cisco Systems Inc., retrieved 14 September 2013

External links[[edit](https://en.wikipedia.org/w/index.php?title=Administrative_distance&action=edit&section=8)]

* [Cisco - What is Administrative Distance? (Ref. Mr. Praveen Suvarna Mundkur)](http://www.cisco.com/en/US/tech/tk365/technologies_tech_note09186a0080094195.shtml)