

# OSPF V2



For Use with RouterOSv6

Link State Routing Protocol
Uses Dijkstra's SPF Algorithm (Shortest Path First)
Uses IP Protocol #89
Primary RFC = RFC 2328 (IPv4)
IP headers are set to a TTL of 1 to ensure only 1 hop
Default cost of all links is 10

OSPF Router Types	Notes
ASBR (Autonomous System Border Router)	Sits on the edge of the OSPF network. That may or may not be the edge of the physical network. Re-distributing routes will cause the router to become an ASBR.
ABR (Area Border Router)	This router will participate in at least 2 areas.
BR (Backbone Router)	Any router that is part of the Backbone area only is a BR.
IR (Internal Router)	Any router that is not an ASBR, ABR, or BR is simply an IR.

## Area Types

Area Type	Explanation
Backbone	Responsible for sharing all routes and the default route to other areas. Must be continuous. Can be linked with virtual links.
Default	Normal OSPF area. Does not share the default route to other areas.
Stub	Usually used to reduce CPU load or minimize the impact of interface flapping. AS-external-LSAs (Type 5) are replaced with the default route. The setting "Inject Summary LSAs" will flood Summary-LSAs into the Stub area. This setting is applicable only for stub areas on ABRs.
NSSA	Similar to a stub area, but an NSSA area also contains an ASBR. An NSSA generates LSA Type 7 messages which are converted to LSA type 5 messages by the ABR and shared with the rest of the OSPF network.

## Redistribution Settings

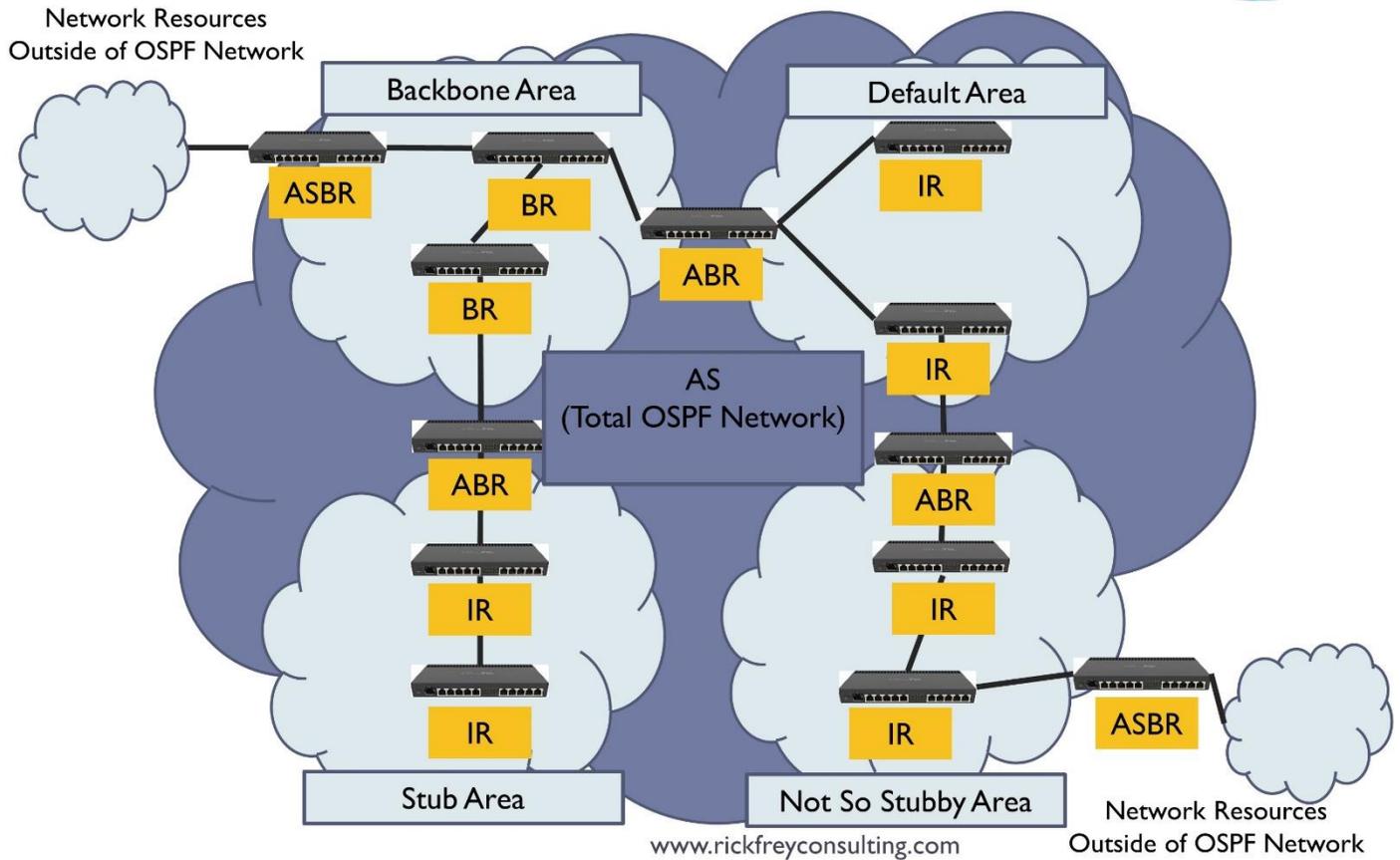
Type 1	Sum of internal and external metrics. Internal metrics are defined by the cost of the interface. External metrics are defined by the metric value (found in the Instance settings).
Type 2	Use external metrics only. Internal costs are "trivial" and not evaluated.

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## Router / Area Types

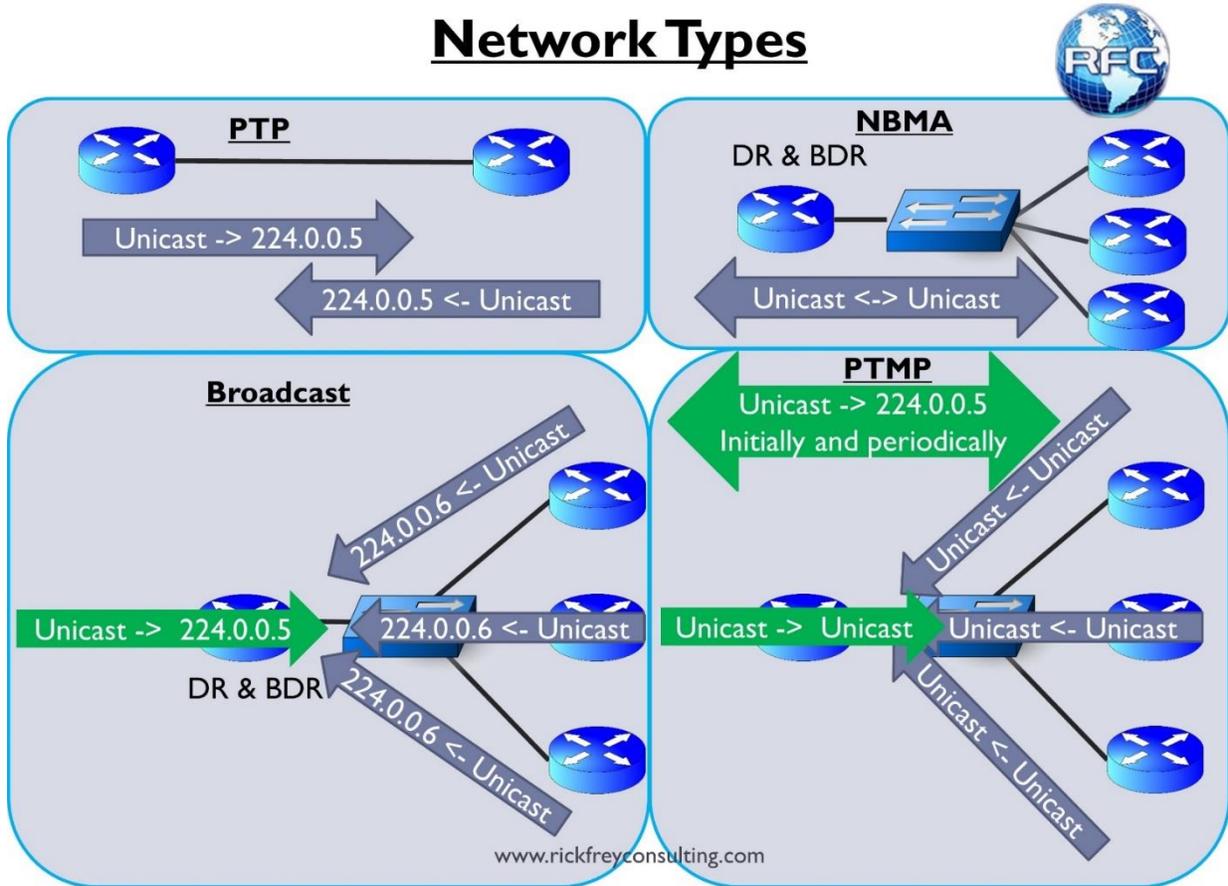


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## Network Types



OSPF Network Types				
	Broadcast	NBMA	PTP	PTMP
DR Election	Yes	Yes	No	No
Neighbor Discovery	Yes	No	Yes	Yes
Topology	PTP or PTMP	PTP or PTMP	PTP	PTP or PTMP

OSPF Address Types					
	General Meaning	Broadcast	NBMA	PTP	PTMP
224.0.0.5	All SPF Routers	Yes	N/A	Yes	Yes
224.0.0.6	All DRs & BDRs	Yes	N/A	No	No

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Adjacency States		
Step #	State Name	Explanation
1	Down	This is the initial state of a neighbor conversation. It indicates that there has been no recent information received from the neighbor. On NBMA networks, Hello packets may still be sent to "Down" neighbors, although at a reduced frequency.
2	Attempt	This state is only valid for neighbors attached to NBMA networks. It indicates that no recent information has been received from the neighbor, but that a more concerted effort should be made to contact the neighbor. This is done by sending the neighbor Hello packets at intervals of Hello-Interval.
3	Init	In this state, a Hello packet has recently been seen from the neighbor. However, bidirectional communication has not yet been established with the neighbor (i.e., the router itself did not appear in the neighbor's Hello packet). All neighbors in this state (or higher) are listed in the Hello packets sent from the associated interface.
4	2-way	In this state, communication between the two routers is bidirectional. This has been assured by the operation of the Hello Protocol. This is the most advanced state short of beginning adjacency establishment. The (Backup)Designated Router is selected from the set of neighbors in state 2-Way or greater.
5	Exstart	This is the first step in creating an adjacency between the two neighboring routers. The goal of this step is to decide which router is the master, and to decide upon the initial DD sequence number. Neighbor conversations in this state or greater are called adjacencies.
6	Exchange	In this state the router is describing its entire link state database by sending Database Description packets to the neighbor. Each Database Description Packet has a DD sequence number and is explicitly acknowledged. Only one Database Description Packet is allowed outstanding at any one time. In this state, Link State Request Packets may also be sent asking for the neighbor's more recent LSAs. All adjacencies in Exchange state or greater are used by the flooding procedure. In fact, these adjacencies are fully capable of transmitting and receiving all types of OSPF routing protocol packets.
7	Loading	In this state, Link State Request packets are sent to the neighbor asking for the more recent LSAs that have been discovered (but not yet received) in the Exchange state.
8	Full	In this state, the neighboring routers are fully adjacent. These adjacencies will now appear in router-LSAs and network-LSAs.

Neighboring

Adjacency

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OSPF Packet Types		
Type	Packet Name	Protocol function
1	Hello	Discover/ Maintain Neighbors
2	Database Description	Summarize Database Contents
3	Link State Request	Database Download
4	Link State Update	Database Update
5	Link State Acknowledgment	Flooding Acknowledgement

LSA Types (Link State Advertisement)		
LSA Type	LSA Name	LSA Description
1	Router-LSAs	Originated by all routers. This LSA describes the collected states of the router's interfaces to an area. Flooded throughout single area only.
2	Network-LSAs	Originated for broadcast and NBMA networks by the Designated Router. This LSA contains the list of routers connected to the network. Flooded throughout a single area only.
3,4	Summary-LSAs	Originated by area border routers and flooded throughout the LSA's associated area. Each summary-LSA describes a route to a destination outside the area, yet still inside the AS (i.e., an inter-area route). Type 3 summary-LSAs describe routes to networks. Type 4 summary-LSAs describe routes to AS boundary routers.
5	AS-external-LSAs	Originated by AS boundary routers, and flooded through-out the AS. Each AS-external-LSA describes a route to a destination in another Autonomous System. Default routes for the AS can also be described by AS-external-LSAs. Not flooded into stub areas.
6	Multicast extensions to OSPF	N/A
7	NSSA LSA	Routers in a Not-so-stubby-area (NSSA) do not receive external LSAs from Area Border Routers but are allowed to send external routing information for redistribution. They use type 7 LSAs to tell the ABRs about these external routes, which the Area Border Router then translates to type 5 external LSAs and floods as normal to the rest of the OSPF network.
8	A link-local only LSA for OSPFv3	N/A
9	Opaque-LSAs	Sends link information to MPLS for RSVP-TE.
10,11	Opaque-LSA Types Not used in ROS	N/A

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Interface Settings		
Setting	Value	Explanation
Cost	Integer 1-65535	All interfaces have a cost of 10 by default. Cost is learned by all other routers in the OSPF network.
Priority	Integer 0-255	Metric for determining the likelihood of being elected the DR while using the Broadcast or NBMA Network Types.
Authentication	None, Simple, MD5	All OSPF message are authenticated. None means leave those fields blank, simple uses a plain text password, MD5 uses a MD5 hash.
Authentication Key	String	Password
Authentication Key ID	Integer 0-9999999999999999 Up to 16 Characters	Key id is used to calculate message digest (used only when MD5 authentication is enabled). Value should match on all OSPF routers from the same region.
Instance ID	Integer 0-255	Print display number found in the CLI.
Passive	Yes/No Check/Unchecked	Toggles the interface to stop sending or receiving Hello packets.
Use BFD	Yes/No Check/Unchecked	Toggles the interface to use Bidirectional Forwarding Detection.
Hello Interval	Integer 1-65535 Seconds	The length of time, in seconds, between the Hello packets that the router sends on the interface. Advertised in Hello packets sent out this interface.
Router Dead Interval	Integer 1-65535 Seconds	The number of seconds before the router's neighbors will declare it down when they stop hearing the router's Hello Packets. Advertised in Hello packets sent out this interface.
Transmit Delay	Integer 1-65535 Seconds	The estimated number of seconds it takes to transmit a Link State Update Packet over this interface. LSAs contained in the Link State Update packet will have their age incremented by this amount before transmission. This value should take into account transmission and propagation delays; it must be greater than zero.
Retransmit Interval	Integer 1-65535 Seconds	Time between retransmitting lost link state advertisements. When a router sends a link state advertisement (LSA) to its neighbor, it keeps the LSA until it receives back the acknowledgment. If it receives no acknowledgment in time, it will retransmit the LSA.

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Instance Settings		
Setting	Value	Explanation
Name	String	Administrative Name
Router ID	IP Address	The OSPF Router ID. If not specified OSPF will use the lowest IP address configured on an active interface that is being used. This is often set to the same IP address as the OSPF Loopback, when used.
Redistribute Default Route	Always Type 1 Always Type 2 If Installed Type 1 If Installed Type 2	Whether or not to distribute the default route from the main routing table.
Redistribute Connected Routes	As Type 1 As Type 2	Whether or not to distribute the connected routes from the main routing table.
Redistribute Static Routes	As Type 1 As Type 2	Whether or not to distribute the static routes from the main routing table.
Redistribute RIP Routes	As Type 1 As Type 2	Whether or not to distribute the RIP routes from the main routing table.
Redistribute BGP Routes	As Type 1 As Type 2	Whether or not to distribute the BGP routes from the main routing table.
Redistribute Other OSPF Routes	As Type 1 As Type 2	Whether or not to distribute the routes from other OSPF instances.
In filter	String	Name of routing filter chain used for incoming prefixes.
Out Filter	String	Name of routing filter chain used for outgoing prefixes.
Routing Table	String	The routing table OSPF will run on. The main routing table is used by default.
Use DN	Yes/No Checked/Unchecked	Whether or not to use the Down-bit. The DN bit is used to prevent loops. Can be helpful when using OSPF as a PE-CE protocol as well as some BGP/MPLS configs. A DN value of 1 is checked and 0 is unchecked. (RFC 4577)
Default Route Metric	Integer 1-16,777,214	The metric this route will be introduced to OSPF as. This metric + each hop cost = cost shown in Routing -> OSPF -> Routes.
Connected Routes Metric	Integer 1-16,777,214	The metric this route will be introduced to OSPF as. This metric + each hop cost = cost shown in Routing -> OSPF -> Routes.

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Static Routes Metric	Integer 1-16,777,214	The metric this route will be introduced to OSPF as. This metric + each hop cost = cost shown in Routing -> OSPF -> Routes.
RIP Routes Metric	Integer 1-16,777,214	The metric this route will be introduced to OSPF as. This metric + each hop cost = cost shown in Routing -> OSPF -> Routes.
BGP Routes Metric	Integer 1-16,777,214	The metric this route will be introduced to OSPF as. This metric + each hop cost = cost shown in Routing -> OSPF -> Routes.
Other OSPF Routes Metric	Integer 1-16,777,214	The metric this route will be introduced to OSPF as. This metric + each hop cost = cost shown in Routing -> OSPF -> Routes.
MPLS TE Area	String	The area used for MPLS TE. Opaque LSAs are generated in this area. Only one OSPF instance can choose this area.
MPLS TE Router ID	Converts to IP Address	The Loopback interface from which to take the IP address used as the Router ID in MPLS TE. The OSPF Router ID, the LSR ID, and the MPLS TE Router ID will usually be the same.
Running	Read Only	Shows whether or not OSPF is running.
Effective Router ID	Read Only	Router_ID chosen by OSPF.
Dijkstra's	Read Only	Shows how many times the Dijkstra's algorithm was executed.
Db. Exchanges	Read Only	Number of database exchanges currently going on.
External Imports	Read Only	How many external routes were imported into OSPF from this router.
Domain ID	Hex	MPLS related parameter. Identifies OSPF domain of the instance. This value is attached to OSPF routes redistributed in BGP as VPNv4 routes as BGP extended community attribute, and used when BGP VPNv4 routes are redistributed back to OSPF to determine whether to generate inter-area or AS-external LSA for that route. By default Null domain-id is used, as described in RFC 4577. CLI Only.
Domain Tag	Integer 0-4294967295	If set, then used in route redistribution (as route-tag in all external LSAs generated by this router), and in route calculation (all external LSAs having this route tag are ignored). Needed for interoperability with older Cisco systems. By default not set. CLI Only.

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Networks Settings		
Setting	Value	Explanation
Network	IP Prefix	The network prefix associated with the area. OSPF will be enabled on all interfaces that has at least one address falling within this range. Note that the network prefix of the address is used for this check (i.e. not the local address). For point-to-point interfaces this means the address of the remote endpoint.
Area	String	The OSPF area associated with this network.

Area Settings		
Setting	Value	Explanation
Area Name	String	Administrative name of area.
Instance	String	The instance the area belongs to.
Area ID	Integer in dot.decimal format	OSPF area identifier. If the router has networks in more than one area, then an area with area-id=0.0.0.0 (the backbone) must always be present. The backbone always contains all area border routers. The backbone is responsible for distributing routing information between non-backbone areas. The backbone must be contiguous, i.e. there must be no disconnected segments. However, area border routers do not need to be physically connected to the backbone - connection to it may be simulated using a virtual link. Its recommended that networks with less than 50 routers just use the backbone area.
Type	Default, Stub, NSSA	Whether to make the area a default area, a stub area, or a not so stubby area.
Translator Role	translate-always, translate-candidate, translate-never	Parameter indicates which ABR will be used as translator from type7 LSAs to type5 LSAs. Applicable only if area type is NSSA. -translate-always - router will be always used as translator -translate-never - router will never be used as translator -translate-candidate - sop elects one of candidate routers to be a translator
Inject Summary LSAs	Yes/No Checked/Unchecked	Specifies whether to flood summary LSAs in this stub area. Applicable only for stub areas on ABRs.
Default Cost	Integer 1-65535	Specifies the cost for the default route originated by this stub area ABR. Applicable only for stub areas on ABRs (applied on type-3 default routes).
Interfaces	Read Only	How many total interfaces apply to this area.
Active Interfaces	Read Only	How many active interfaces apply to this area.
Neighbors	Read Only	How many total neighbors OSPF sees connecting to this area.
Adjacent Neighbors	Read Only	How many neighbors have formed and adjacency to this area.

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Area Ranges Settings		
Setting	Value	Explanation
Area	String	The OSPF area associated with this range.
Range	IP Prefix	The network prefix of this range. Prefix ranges are used to aggregate routing information on area boundaries. By default, the ABR creates a summary LSA for each route in a specific area and advertises it in the adjacent areas. Using ranges allows you to create only one summary LSA for multiple routes and send only the single advertisement into adjacent areas.
Cost	Integer 1-65535	The cost of the summary LSA this range will create. By default, it will use the largest cost of all routes used within this range.
Advertise	Yes/No Checked/Unchecked	Whether or not to create the summary LSA and advertise it into adjacent areas.

Virtual Link Settings		
Setting	Value	Explanation
Neighbor ID	IP Address	Specifies the Router ID of the OSPF router this router will connect to.
Transit Area	String	One side of the virtual link must be in the backbone area. The transit area is the area that is in-between the non-adjacent area and the backbone. There can only be transit area per virtual link.
Authentication	None, Simple, MD5	Specifies the authentication method for OSPF messages. -None - No authentication is used -Simple - Password is sent in plain text -MD5 - Password is sent using MD5
Authentication Key	String	The password used to authenticate the OSPF messages.
Authentication Key ID	Integer 0-9999999999999999 Up to 16 Characters	Key ID used by MD5 Authentication.
Instance ID	Integer 0-255	The CLI print display number of the instance this virtual link belongs to.
Use BFD	Yes/No Checked/Unchecked	Whether or not this link should use Bidirectional Forwarding Detection.

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NBMA Neighbor Settings		
Setting	Value	Explanation
Instance	String	The OSPF instance the parent interface is participating in.
Address	IP Address	The link address of the neighbor.
Poll Interval	Time	How often to send message to neighbors which are in a down state.
Priority	Integer 0-255	Assumed priority value of neighbors which are in a down state. Default is 0, which means they not be apart of the DR/BDR election process.

Sham Link Settings		
Setting	Value	Explanation
SRC Address	IP Address	This router's loopback address.
DST Address	IP Address	The remote router's loopback address.
Cost	Integer 1-65535	Cost of the link.
Area	String	The area that shares an OSPF backdoor link.