OSPF Area Types

# CCNP Lab 2

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# Background

In OSPF, each device maintains a link-state database of the network through routing updates, which can result in a heavy load in large networks. One solution is to implement multi-area OSPF, in which an autonomous system can be split into multiple areas to reduce overhead traffic on the network and shrink the database on each device. In particular scenarios, the load from OSPF can be reduced further by blocking unnecessary information in the area. For example, an area connected only to area 0 via a single router would not need any updates regarding other areas or external processes, as all traffic to outside the area would have to travel through that single router regardless of destination. There are five area variations within multi-area OSPF, with each type designed for a different situation and blocking different link state advertisements.

In addition, there are six primary link state advertisement (LSA) types used in OSPF to communicate between devices, which are briefly summarized below:

* Type 1 (Router) – used by routers to announce its presence and list links within the area
* Type 2 (Network) – used by DRs to list routers joined by a broadcast segment within the area
* Type 3 (Summary) – used by ABRs to send summarized information to other areas
* Type 4 (ASBR Summary) – used by ASBRs to announce its presence across areas
* Type 5 (ASBR External) – used by ASBRs to send information from external routing processes across areas
* Type 7 (NSSA External) – used as a replacement for type 5 LSAs within a not-so-stubby area; type 7 LSAs are translated into type 5 LSAs when sent across areas

# Operation Differences

The five area types within OSPF are normal, stubby, totally stubby, not-so-stubby, and totally not-so-stubby areas; each differs slightly in operation and purpose.

Normal areas are the default areas for multi-area OSPF. They utilize type 1-5 LSAs and each device within the area keeps track of all routing information, be it external, inter-area, or intra-area. Because of this, normal areas will work in all network topologies, though it will be the least efficient solution possible. All other types of OSPF areas can be considered modifications of normal areas which reduce the load most efficiently according to the specific network configuration and topology.

Stubby areas assume that the area is not connected to external autonomous systems, which commonly occurs within OSPF configurations. Based on this assumption, all traffic to external destinations must first enter another area within OSPF, meaning that there is no need for external routing information within the area. Because of this, stubby areas can block type 4 and 5 LSAs, which serve to communicate information from external processes.

Totally stubby areas act as stubby areas with the additional assertion that there is only one exit point to other areas. Since all traffic to outside the area must exit through that point, a default route would suffice for all traffic leaving the area and totally stubby areas can block type 3 LSAs, which are used to send inter-area routes.

Not-so-stubby areas act similarly to stubby areas with the exception that redistribution of external routes are permitted within an area. NSSAs can be implemented in stub network areas that also connect to an external process. In order to work around the restriction that type 5 LSAs are not allowed, NSSA ASBRs generate type 7 LSAs that act as a substitute. NSSAs are common in actual OSPF implementations, as they have additional flexibility while maintaining the benefits of stubby area implementations.

Totally not-so-stubby areas have the same restrictions as not-so-stubby areas, but also presume that the area has one exit point. Essentially a crossover between totally stubby areas and not-so-stubby areas, totally not-so-stubby areas block type 3, 4, and 5 LSAs and use type 7 LSAs. Note that this type of OSPF area is not commonly used.

The similarities and differences between the area types are summarized in the following table:

|  |  |  |
| --- | --- | --- |
|  | **No connection to external autonomous systems (type 4/5 LSAs blocked)** | **Has connections to external systems (uses type 7 LSAs in place of blocked type 5 LSAs)** |
| **Multiple exit points to other areas (cannot use a default route)** | Stubby Area | Not-So-Stubby Area |
| **One exit point to other areas (type 3 LSAs blocked, uses default route instead)** | Totally Stubby Area | Totally Not-So-Stubby Area |

Note that normal areas do not fall under any of the categories listed in the table as no assumptions are made regarding the particular area.

# Link State Advertisement/Packet Differences

Each type of area permits and blocks a unique combination of LSA types based upon its design.

Type 3 LSAs are used in all areas except totally stubby areas and totally NSSAs, which assume that the area has one exit point. Because all traffic must exit through one point, the area uses a single default route instead of several inter-area routes.

Type 4 and 5 LSAs, used to communicate external routing information, are allowed in normal OSPF areas but are blocked for all other types, which presume that external routes are not necessary.

Type 7 LSAs are only utilized in NSSAs and totally NSSAs as a substitute for type 5 LSAs, which are blocked in such areas; like type 5 LSAs, they serve to communicate external routing information. Type 7 LSAs are not used by default or in any of the other types of OSPF areas. When sent across areas, type 7 LSAs will be translated into type 5 LSAs by the ABRs.

The table below summarizes which combinations of certain LSAs are allowed for each type of OSPF area (note that all five types use type 1 and 2 LSAs):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Normal** | **Stubby** | **Totally Stubby** | **NSSA** | **Totally NSSA** |
| **Type 3** | Yes | Yes | No | Yes | No |
| **Type 4/5** | Yes | No | No | No | No |
| **Type 7** | No | No | No | Yes | Yes |

In an OSPF network, packet-sniffing programs are able to detect the packets being sent between devices, specifically link state advertisement packets. Each LSA packet contains a “LS Type” field, which determines the type of the LSA packet sent. Since each type of area allows a different combination of LSA types, the area type can be determined by the presence or absence of certain LSA packet types within the network; in particular, the five OSPF area variations differ in permitting and blocking type 3, 4, 5, and 7 LSAs. Because of this, it is not difficult to deduce the particular type of OSPF area of a network given enough time capturing packets.