

Principles of Building OSPF Topology and Computing Path Selection Algorithm

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Abstract—Modern transportation corridors are fundamental for the swift movement of goods along short routes. Digital systems and IP technologies play crucial roles in shaping processes along these corridors. With the application of digital systems, these corridors operate more efficiently and swiftly. IP technologies facilitate rapid and secure information transmission within transportation corridors, ensuring faster, safer, and more efficient processes in the transportation sector. During accidents, natural disasters, smuggling, and other undesirable events on road infrastructures, IP technologies are extensively utilized. IP cameras feed Artificial Intelligence by means of Facial Recognition, license plate reading, determination of vehicle color and model, etc., by sending information to the Central Management System. The proposal for transmitting acquired information follows the router convergence topology of Open Shortest Path First, a digital network protocol used for finding the shortest path based on disseminated information, comparable to navigation instruments guiding us to our desired destination via the shortest route. OSPF features include initiating routing updates upon changes in network topology, ensuring rapid dissemination of network changes, and supporting classless routing by including subnet masks in updates.

Keywords—Transportation Corridors, Digital Systems, IP Technologies, Information Transmission, Artificial Intelligence, Facial Recognition, License Plate Reading, Central Management System, Open Shortest Path First (OSPF), Network Topology

I. INTRODUCTION

Modern transport corridors are the basis of short-route goods and fast processes. The role of digital systems in the transport corridor and the importance of IP technologies are the basis of the processes along the transport corridor route. These corridors work more efficiently and quickly with the introduction of digital systems. IP technologies enable fast and secure transmission of information in transport corridors. The application of these technologies is essential for digital development to provide faster, safer, and more efficient processes in the field of transport [1].

IP technologies are widely used when there are accidents, natural disasters, smuggling, and other unpleasant events in the road infrastructure. IP cameras use artificial intelligence to perform facial recognition, license plate reading, determine the color and model of the car, and send the data to the central control system. The process of forwarding the received information follows the OSPF topology of the routers so that the packets reach their destination sequentially [2].

What is the OSPF protocol used for routing between routers in the network. OSPF (Open Shortest Path First) is a routing protocol that works as a digital network protocol and is used to find the shortest path based on broadcast data. We can compare the OSPF algorithm to navigation devices that take us to the place we want to go by the shortest route [3]. Link State routing protocols know the entire network map. Also, fast network integration is ensured by sending Triggered Updates when there are any changes on the network [1].

In a network using OSPF, Routers send link status notifications to each other when a change occurs, for example, when a new Router is added to the network environment or when a Router malfunctions [4]. In case of any change in the network, the Router affected by the change sends updated LSA packets to the network environment. Other Routers update the network topology with the LSA packets they receive. It also refreshes SPF trees and updates routing tables [4].

This protocol uses the Dijkstra algorithm and sends updates every 30 minutes. It also supports IPv4 and IPv6 like EIGRP. It uses a value called Area and divides large networks into areas, reducing the size of the routing table and the complexity of the network [3]. OSPF main features are:

- When there is a change in the network topology, routing updates are triggered and the SPF algorithm kicks in to determine the best route.
- Network change propagates to other routers very quickly, i.e., ensures fast convergence.
- Supports classless routing, meaning it sends the subnet mask along with the network address on updates.

Backbone Router Area should be 0 and all other Areas should be connected to this area.

When you examine the image above, you can see that Router R1 is in Area0 and is a Backbone Router. And therefore, you can communicate with Routers connected to different Areas.

1) *How OSPF dynamic routing works:* [2]. When the router is started, it selects the Router ID or the administrator sets its value manually. The protocol searches for other routers - connected neighbors, and sends them hello packets containing information about neighbors and channel status. In response, if a router receives a packet through an OSPF-enabled interface, it establishes a "neighborhood" relationship with it. If it does not

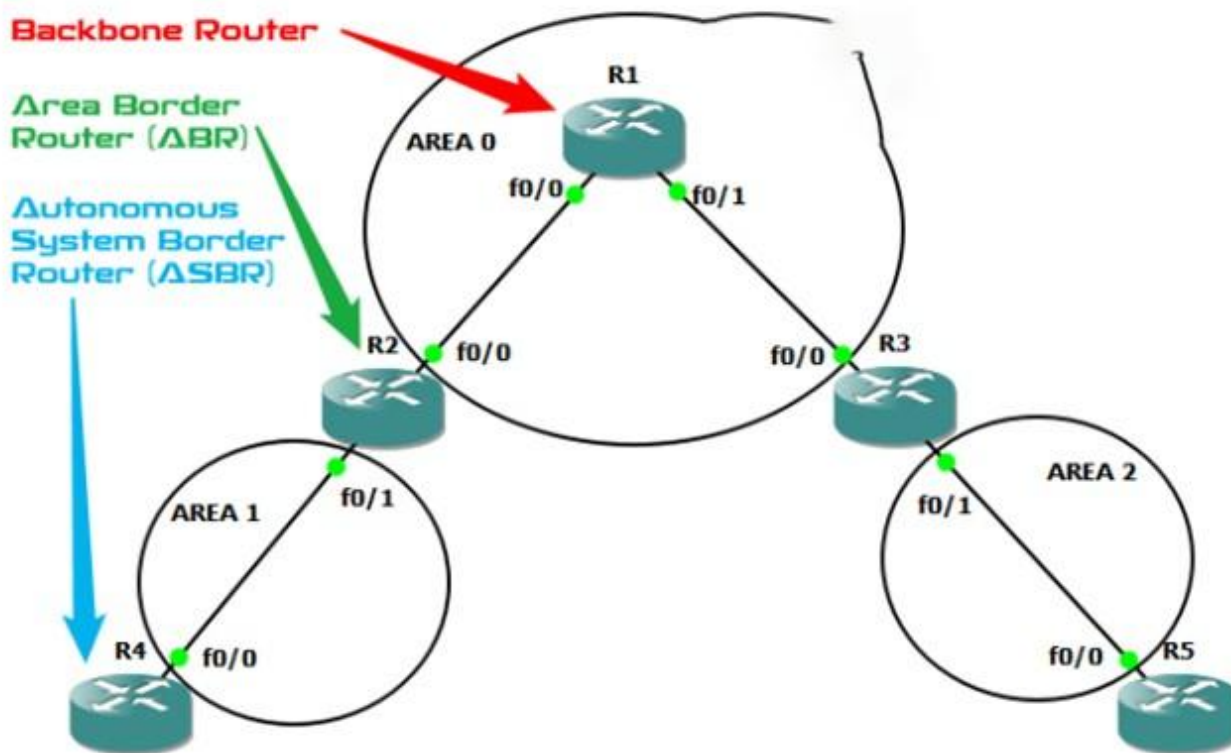


Fig. 1: Backbone Router Area

receive it, the router considers the device "dead" - it does not send traffic to it and rebuilds the routes. After routers become friends, they exchange LSA messages about connected and available networks, neighbor router, and cost. This information is needed to build a network map (topology) - useful for calculating the shortest traffic path. The map is the same on all routers.

Routers synchronize a common LSDB where they store LSAs. A network can have hundreds or thousands of routers. Sending LSA messages from each device to each has to close the channels. To prevent this from happening, DR is responsible for sending messages: through it, information about changes in the network is sent to all routers - for example, when a router crashes. If the DR is not registered first, then the router with the largest IP address becomes it. Then, the SPF algorithm is run, which calculates the optimal route to each network. The process is similar to building a tree where the root is the router and the branches are paths to existing networks. A common routing table will store the best paths to each network [3].

OSPF is a common protocol for managing digital topologies of large networks. When routers in a network are configured with the OSPF feature, they share links with each other and use these links to learn information about all routers and network segments in the network. This data is stored in the OSPF database, and this data forms the OSPF topology [1]. The OSPF algorithm is based on Dijkstra's algorithm. This algorithm

calculates the shortest path from one point to all other points. When implementing OSPF, each router calculates the shortest paths from itself to all other routers and stores this information in the OSPF database [2]. Therefore, OSPF provides the most optimal routes between all routers. The OSPF algorithm uses a value called a metric to calculate the optimal path for each router. This metric is usually calculated based on the speed of the connection between the routers, the overhead line failure, or other parameters [4].

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