

# Realization of Virtual-Link on a Network

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**Abstract:** A network is group of computers and other devices running on suitable protocols enabling data and multimedia communication. Multimedia includes image, audio, video and text. Router is a part of the network and is responsible for forwarding the packets. A routing protocol specifies how routers communicate with each other. Open Shortest Path First (OSPF) is a dynamic routing protocol and uses Dijkstra shortest path first algorithm to determine the shortest path. OSPF employs a hierarchical network design using areas. Area 0 is the backbone area. All other areas that is area n, where n=1,2,3.... are (must be) directly connected to the backbone. But in several cases the non-backbone area cannot be directly connected to area 0. In this paper we present to you the configuration of virtual-links to logically connect separated areas to area 0.

**Keywords:** Data Communication, Multimedia Communication, Open Shortest Path First (OSPF), Hierarchical Network Design, Virtual-Links to Logically Connect Separated Areas to Area 0, Autonomous Systems (AS)

## I. INTRODUCTION

Open Shortest Path First protocol is an intra-domain routing protocol based on link state routing. OSPF protocol supports area to handle routing efficiently and in a timely manner. An autonomous system can be divided into many areas. All networks inside an area must be connected. Area 0 is called the backbone area. Area n where n=1,2,3.... are called non-backbone areas. An area is a collection of networks, hosts, routers and other network components. All non-backbone areas must be connected to the backbone area. The router between two areas is called an Area Border Router (ABR). A router between two Autonomous Systems (AS) is called an Autonomous System Border Router (ASBR). Figure 1 shows the hierarchical network design of an OSPF network with area 0 as the backbone area.

## II. FEASIBILITY STUDY

Feasibility is a signified process carried out over various aspects of a commercial project. In the realization of virtual-link, GNS 3 tool is used to simulate the network and check for connectivity. The simulated routers have been observed to exchange data with the other routers without any discrepancies. Hierarchical network consisting of areas with unique area identification number could be flooded with LSA packets. [1]

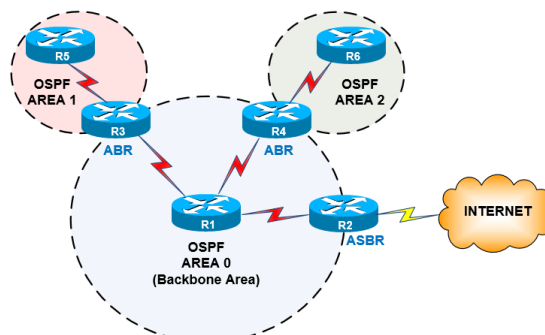


Figure 1 shows the hierarchical network design of an OSPF network with area 0 as the backbone area.

## III. SOFTWARE REQUIREMENTS SPECIFICATION

### A. Functional Requirements

Functional requirements define the functionality of a system to be developed. It also reflects each functionality of the user in the system. The functional requirements of the proposed system are

- Selection of proper routers and other networks best suited for the situation.
- Providing proper addressing scheme for the packets to traverse through the network.
- Use of proper dynamic or static routing protocols to guide the packets in the network.
- Proper OSPF area identification scheme.

## B. Non-functional Requirements

Non-functional requirements play the behaviour and performance of the system at its critical stages

- Scalability

Provisions will be made to accommodate more routers or network elements to avoid early saturation in the network.

- Security

The system will provide secured transfer of data between nodes within the AS

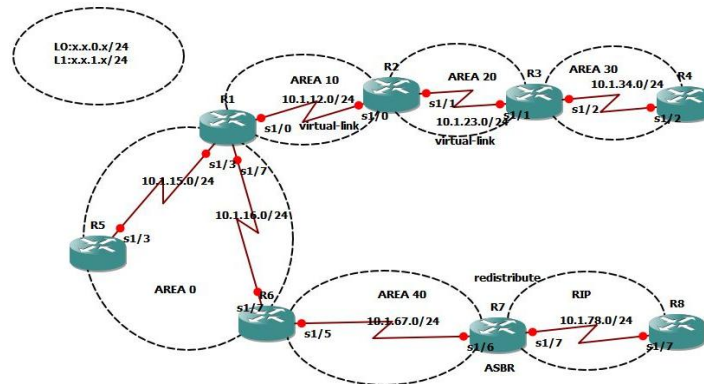


Figure 2 shows virtual-link, a tunnel between area 20 and area 0.

## IV. PROBLEM STATEMENT AND SOLUTION

OSPF is a hierarchical system that separates an Autonomous System (AS) into individual areas. It consists of [2]

- Backbone area= area 0.
- Non backbone areas= area n, where n=1,2,3.. and n!=0.
- Transient area= which is a non-backbone area.

All areas must be connected to the backbone area or area 0. In normal OSPF operations this may not be possible. There are circumstances preventing direct connection of other areas to area 0. A general solution to this problem is the configuration of virtual-link between the areas [3], logically connecting separated areas to area 0. Figure 2 shows virtual-link, a tunnel between area 20 and area 0.

## V. SIMULATION AND RESULTS

In this paper efforts were put in to build a network and configure OSPF on it. OSPF network being a hierarchical network consists of areas and virtual-links. Figure 3 and 4 shows the configuration of virtual-link. Figure 5 shows the results when R1 tried to ping R3. The success rate was 100%, as all the 5 ICMP echo packets returned with a TTL value of 2 seconds.

```

R1
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#ro
R1(config)#router
R1(config)#router ospf 1000
R1(config)#router ospf 1000
R1(config-router)#net
R1(config-router)#network
*Jul 25 00:12:00.923: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1, changed state to down
R1(config-router)#network 10.0.0.0 0.255.255.255 area1
^
% Invalid input detected at '^' marker.
R1(config-router)#network 10.0.0.0 0.255.255.255 area1
^
% Invalid input detected at '^' marker.
R1(config-router)#network 10.0.0.0 0.255.255.255 area 1?
<0-4294967295> A.B.C.D
R1(config-router)#network 10.0.0.0 0.255.255.255 area 1
R1(config-router)#network 9.0.0.0 0.255.255.255 area 0
R1(config-router)#area 1 virtual-link 2.2.2.2
R1(config-router)#
  
```

Figure 3 shows the configuration of virtual-link.

