International Journal For Technological Research In Engineering
Volume 3, Issue 10, June-2016 *ISSN (Online): 2347 - 4718*

OSPF IMPLEMENTATION & APPLCATIONS IN MATLAB

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Abstract: Due to the shortage of RIP protocol, OSPF protocol is used in large network. OSPF is shortened form of Open Shortest Path First. It is a dynamic routing protocol used in Internet Protocol networks. Specifically, it is a link-state routing protocol and falls into the group of interior gateway protocols, operating within a single Autonomous system. It gathers link state information from available routers and constructs a topology map of the network. The topology determines the routing table presented to the Internet Layer which makes routing decisions based solely on the destination IP address found in IP datagram. OSPF was designed to support Variable-length subnet masking (VLSM) or Classless Inter-Domain Routing (CIDR) addressing models. OSPF detects changes in the topology, such as link failures, very quickly and converges on a new loop-free routing structure within seconds. It computes the shortest path tree for each route using a method based on Dijkstra's Algorithm, a shortest path first algorithm. Dijkstra algorithm is a solution to the single-source shortest path problem in graph theory. Works on both directed and undirected graphs. However, all edges must have nonnegative weights. It follows Greedy Approach. There are two types of routing-Link State routing and Distance Vector routing. Dijkstra is based on Link State routing. In Link State routing each router keeps track of its incident links and cost on the link, whether the link is up or down. Each router broadcasts the link state to give every router a complete view of the graph. Each router runs Dijkstra's algorithm to compute the shortest paths and construct the forwarding table. Thus, it chooses the path with min hops and topology changes can be detected with the help the help of beacons this algorithm is based on iterations. The topology of the network can be generated by collecting the OSPF message.

I. INTRODUCTION

A mobile ad hoc network is a collection of wireless nodes that can dynamically be set up anywhere and anytime without using any pre-existing network infrastructure. It is an autonomous system in which mobile hosts connected by wireless links are free to move randomly and often act as routers at the same time. OSPF is a large and complex protocol, and as such we only provide an overview of some properties of the protocol. The purpose of any routing protocol is to efficiently distribute dynamic topological information among its participants to facilitate routing calculations upon which packet forwarding decisions are then based. In a link-state routing protocol such as OSPF, each router is independently responsible for describing the state of its local neighborhood (e.g. links to neighboring networks, routers, and hosts) to the rest of the network. In OSPF, the first step in the exchange of routing information is the creation of adjacencies between neighboring routers. A router first uses a Hello Protocol to discover its neighbors. Once neighbor routers have 'met' via the Hello Protocol, then they go through a database exchange process to synchronize their databases with one another. Only then neighbor routers can become adjacent and exchange routing protocol information. Information about the state of a router's local neighborhood is then assembled into a link-state advertisement (LSA), which is then distributed to every other router by reliable intelligent flooding. The basic flooding process is straightforward: upon receiving an advertisement from a neighbor, a router acknowledges receipt of the advertisement and, if new, forwards the advertisement to all other neighbors. Thus, after a short period of convergence, each router in the network will have an identical topological database of LSAs to be used for routing calculations.

II. OBJECTIVES

1. Study of OSPF protocol and various other routing protocols.
2. To find the open shortest path for directed and undirected graphs.
3. Reduce the calculation complexity and provide a less runtime for calculation.
4. Implementation of OSPF Link State Routing for directed and undirected graph in MATLAB and shortest path is shown in result for both cases.
5. To solve the shortest path problem when no. of nodes are less than no. of edges, which is faced in real life problems Eg. Maps (road, city), computer networks, genetic tree, protein combinations in biology, electrical circuits etc..

III. METHODOLOGY

In Dijkstra's algorithm is an algorithm for finding the shortest paths between nodes in a graph, which may represent, for example, road networks. The algorithm exists in many variants; Dijkstra's original variant found the shortest path between two nodes, but a more common variant fixes a single node as the "source" node and finds shortest paths from the source to all other nodes in the graph, producing a shortest path tree. For a given source node in the graph, the algorithm finds the shortest path between that node and every other. It can also be used for finding the shortest paths from a single node to a single destination node by stopping the algorithm once the shortest path to the destination node has been determined [17]. For example, if the nodes of the graph represent cities and edge path costs represent driving distances between pairs of cities connected by a direct road, Dijkstra's algorithm can be used to find the shortest route between one city and all other cities [18]. As a result, the shortest path algorithm is widely used in network

routing protocols, most notably IS-IS and Open Shortest Path First (OSPF). It is also employed as a subroutine in other algorithms such as Johnson's. Dijkstra's original algorithm does not use a min-priority queue and runs in time O(|V|^2) (where |V| is the number of nodes. This is asymptotically the fastest known single-source shortest-path algorithm for arbitrary directed graphs with unbounded non-negative weights. In some fields, artificial intelligence in particular, Dijkstra's algorithm or a variant of it is known as uniform-cost search and formulated as an instance of the more general idea of best-first search. circuits. [1]

IV. SIMULATION RESULTS

Results for directed and undirected graphs are successfully implemented in MATLAB 2013a with desired results. The OFDM implementation is to store vertices in an array or linked list will produce a running time of O(|V|^2 + |E|). For sparse graphs (with very few edges and many nodes), it can be implemented more efficiently storing the graph in an adjacency. This will produce a running time of O((|E|+|V|) log |V|). Finally, we made sure that it is a correct algorithm (e.g., it always returns the right solution if it is given correct input). With the help of two mathematical results:

Lemma 1: Triangle inequality

If $\delta(u,v)$ is the shortest path length between u and v, $\delta(u,v) \leq \delta(u,x) + \delta(x,v)$

Lemma 2:

The subpath of any shortest path is itself a shortest path.

We can claim that anytime we put a new vertex in network, we can say that we already know the shortest path to it.

V. FUTURE SCOPE

1. Traffic Information Systems are most prominent use
2. Mapping (Map Quest, Google Maps), where multiple ways are available for same destination. (i.e. low nodes high edges).
3. Epidemiology: to model the spread of infectious diseases and design prevention and response strategies. Vertices represent individuals, and edges their possible contacts. It is useful to calculate how a particular individual is connected to others. Knowing the shortest path lengths to other individuals can be a relevant indicator of the potential of a particular individual to infect others.

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