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Implementation of Probabilistic Shortest Path Routing Algorithm in Routing Protocol

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Article Info
Volume 82
Page Number: 12854 - 12858
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 24 February 2020*

Abstract:
In Computer networks, data transfer operations are fundamental aspects for networking and routing. Generally routing protocol performs the task between the nodes and sets up a path between the two nodes. It also has the liability of sharing information among the entire network from the source location to the destination location. For this purpose, the route linked between source nodes to destination node is to be found. Here we focus on finding the route between sources to the destination node through shortest path. The significance of this paper is to find the shortest path between two nodes (source node and destination node) in Open Shortest Path First Protocol (OSPF) using probabilistic shortest path routing algorithm which is altogether a new algorithm unlike Dijkstra's shortest path or any other algorithm for finding shortest path. Further, here we implement the proposed algorithm and the Dijkstra's algorithm to find the shortest path using C programming language. Finally, we present some numerical examples to explain the solution procedure.

Keywords: *Routing Protocol, Open shortest path first, shortest path, Dijkstra's algorithm, Distance vector protocol.*

1. INTRODUCTION

The routing protocol essential for establishing communication link between all its nodes in a network and routing protocol is a process to find suitable path for the data to travel from source to destination. The process meets several obstacles while selecting the route, which depends upon the type of network, channel characteristics and the performance metrics. The data sensed by the sensor nodes in a wireless sensor network (WSN) is naturally forwarded to the base station that connects the sensor network with the other networks (including internet) where the data is collected, analyzed and various action is performed as per the requirement.

Shortest path algorithm which helps to find least expensive path on the network is based on the cost function. In this paper we explain the procedure for finding the shortest path between source and destination node in open shortest path first (OSPF) protocol using probabilistic shortest path routing algorithm.

2. ROUTING PROTOCOL

The node is used to exchange information between nodes assigned by routing protocol. The node or vertex of a network also helps in passing information and data packets between the nodes. The nodes keep information about the network directly attached and with the help of routing protocol, it is awake of the entire structure of the network. There are different types of protocol, but we discuss about protocols used in IP network [1]. The IP network is classified into two categories: (i) Interior Gateway Protocol (ii) Exterior Gateway Protocol

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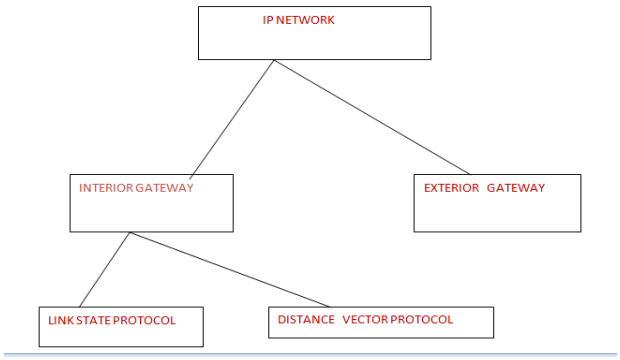

Fig-1 types of IP network

The interior Gateway protocol transfer routing data within a single routing domain. It is classified into Link State Routing protocol and Distance Vector Routing protocol. Link state routing protocol contains the full structure of the network on each router connected to its network. Routing information Protocol (RIP) and Open Shortest Path First (OSPF), Distance Vector Routing protocol, the route information is periodically shared in the entire network, Interior Gateway Routing Protocol (IGRP); exterior Gateway protocol communicates routing information with independent system [2].

3. OPEN SHORTEST PATH FIRST (OSPF)

The most broadly used routing protocols are OSPF and are suitable for large network. The OSPF is a Link State protocol based on cost under a single routing solution that maintains information of every node on the network. Since every node holds the entire net-work structure information, each node can independently find the path to reach the destination by adopting shortest path algorithm namely Dijkstra's algorithm [4]

4. DIJIKSTRA'S ALGORITHM

Graph theory is effectively applied to determine the relationship among the various parameters in a computer network. One of the several graph theory algorithms is Dijkstra's algorithm that is used to determine the shortest path based on cost weight age associated in the given network.

4.1. ALGORITHM

Step 1: Take starting vertex to zero and assign all other vertices distance to infinity.

Step 2: Initial vertex will be send to minimum priority queue based on distance & vertex.

Step 3: The vertex having minimum distance will be removed from the priority queue and update the queue

Step 4: Check whether the current vertex distance with edge weight is less than next vertex distance then send the next distance to the priority queue.

Step 5: Continue step 2 to 4 until the priority queue is empty[3]

4.2 PSEUDOCODE

Take source vertex is S and it should be a weighted graph G= (V, E) & source vertex S ∈ V to all vertex of the given graph

Dist[s] ← 0 for all v ∈ V − {s}

do

{

Dist[v] <-−∞

S ← ∅

Q ←V

} while (Q≠ ∅)

do u-<--minimum distance (Qdist);S < −S ∪ {u}

for all v ∈ neighbors[u]

do if dist[v]> dist[u] +w (u, v)

Replace d[v] <-- d[u] +w (u, v)

return (dist)

Working principle of Dijkstra's Algorithm :

- It can be directed and undirected graphs
- All edges should have positive values.

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- It should be a connected graph.

5. IMPLEMENTATION OF PROBABILISTIC SHORTEST PATH ROUTING ALGORITHM

Given graph G= (V, E) with two nodes (source node and destination node), Calculate the shortest path with help of following steps:

Step-1: Find all possible paths connecting the source and destination node of the given graph G= (V, E)

Step-2: For all possible path calculate probability = (Distance Ratio)

Step-3 After considering over all such paths, Calculate the path for which the probability turns out to be minimum and the corresponding path gives minimum shortest path

5.1 Example: 1

In networking we have sender and receiver, sender will send some frame or message to receiver, but by the time receiver should be receive the message, there are many parts which the message can take, that are the job of this algorithm. It will find the shortest path traversed to carry the message from sender to receiver.

Consider a network structure given in Fig-1, contains the nodes between sender nodes 0 to receiver node 4. We need to examine the shortest. Path, between node 0 to 4, where 0 being the sender and 4 being the Receiver.

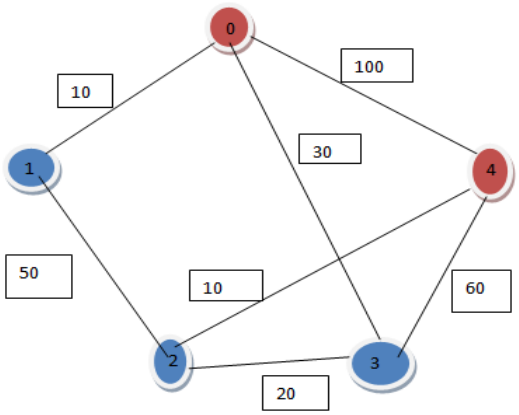

Fig-1

EXPLANATION:

All possible paths associated from node 0 to node 4 are

$P_1 = [0 \rightarrow 4]$

$P_2 = [0 \rightarrow 3 \rightarrow 4]$

$P_3 = [0 \rightarrow 1 \rightarrow 2 \rightarrow 4]$

$P_4 = [0 \rightarrow 3 \rightarrow 2 \rightarrow 4]$,$P_5 = [0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 4]$

Now total distance $D = d(P_1) + d(P_2) + d(P_3) + d(P_4) + d(P_5)$=100+90+70+60+140=460

Distance ratio for $P_1 = d(P_1)$/D =$\frac{100}{460}$ =0.217

Distance ratio for $P_2 = d(P_2)/D$ =$\frac{90}{460}$ =0.196

Distance ratio for $P_3 = d(P_3)/D$=$\frac{70}{460}$ =0.152

Distance ratio for $P_4 = d(P_4)/D$ =$\frac{60}{460}$ =0.13 (MINIMUM)

Distance ratio for $P_5 = d(P_5)/D$ =$\frac{140}{460}$=0.304

So **the Shortest path above network is $P_4 = [0 \rightarrow 3 \rightarrow 2 \rightarrow 4]$**

6. IMPLEMENTATION OF DIJKSTRA'S USING C –PROGRAMMING:

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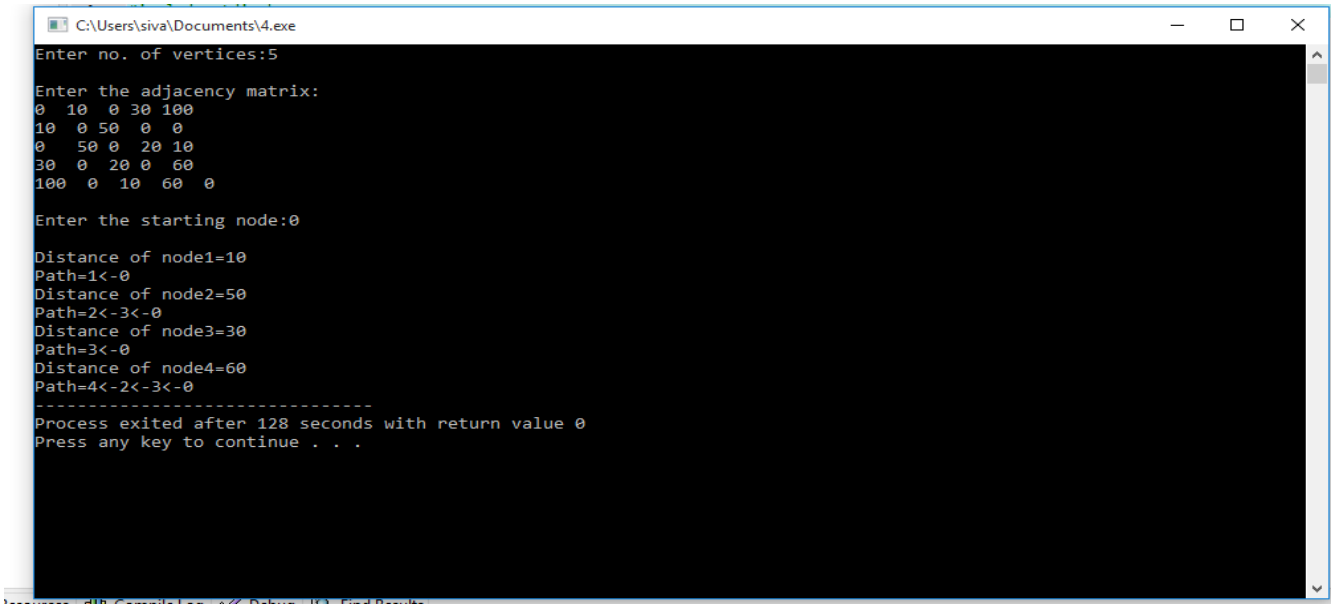

Here calculated path =4 ← 2 ← 3 ← 0 is equal to the shortest path calculated in Probabilistic approach of routing algorithm

7. CONCLUSION:

Open shortest path first is a link state routing protocol that is used for construction of bigger network size. In this paper, we have determined about OSPF protocol. Probabilistic shortest path routing algorithm is one of the best suited algorithms to find the shortest path for the given vertices. In future work we would implement OSPF protocol using NS2 simulator.

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