Shortest Path and Widest Path

Shortest path algorithms are applicable to IP networks
And
widest path algorithms are useful for **telephone network dynamic call routing and quality-of-service-based routing.**

two classes of routing algorithms:

shortest path routing --> use a **additive concav**e property --> the overall distance of a path by adding a cost of a link to the cost of the next link along a path until all links for the path are considered.

widest path routing--> uses a **non-additive concave** property

Centralized environment --- BellmanÐFord algorithm
Distributed Environment --- Distance vector approach

They appear in network routing in many ways and have played crit-ical roles in the development of routing protocols.

Basics:

In general, a communication network is made up o**f nodes and links.**

Depending on the type of the network, nodes have different names.

In an IP network, a node is called a ***router*** while in the telephone network a node is either an *end (central)* ***office*** **or a** ***toll switch*****.**

In an optical network, a node is an ***optical or electro-optical switch*****.**

A link connects two nodes; a **lin**k connecting two routers in an IP network is sometimes called an ***IP trunk*** **or simply an IP link,**

The end of a link outgoing from a router is called an ***interface*****.**

A link in a telephone network is called a ***trunkgroup*****,** or an ***intermachine trunk*** *(IMT)*, and sometimes simply a *trunk*.

few general terms.

A communication network traffic flows from a ***start*** **node to an** ***end*** **node;**

the start node as the *source* node (where traffic originates) and the end node as the *destination* node. Important requirement of a communication network is a **flow or route** from a source to the destination.**routing algorithm is used to determine the route.**

Route is a path from the source node to the destination node.

Goal of the routing algorithm is to provide an **efficient and fair route** from the source to the destination.

Provides good and acceptable service

A route can certainly be set up manually; such a **route is known as a *static route*.**

Communication network can be

--> user oriented(provides good and quick service)

--> network oriented(provides efficient and fair routing)(focuses on network capacity)

Consider now the network shown in Figure . Suppose that we have trafÞc that enters node 1 destined for node 6; in this case, node 1 is the source node and node 6 is the destination node. We may also have trafÞc from node 2 to node 5; for this case, the source node will be node 2 and the destination node will be node 5; and so on.

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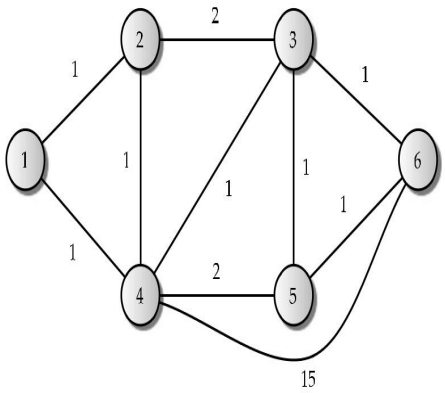

the *BellmanÐFord algorithm* and *DijkstraÕs algorithm*,

can be classified as falling under user-oriented in terms of the above broad categories.

They are both called shortest path routing algorithms

, the goal of an is to find the shortest path from a source node to a destination node.

A simple way to understand a shortest path is from road networks where shortest can be defined in terms of distance,time

Instead of worrying about the unit of measurement, it is better to have an algorithm that works *independent* of the measuring unit and considers a generic measure for distance for each link in a network.

In communication networks, a generic term to refer to a distance measure without assigning any measure units is called *cost*, *link cost*, *distance cost*, or *link metric*.

Consider again Figure 2.1. We have assigned a value with each link, e.g., link 4-6 has the value 15; we will say that the link cost, or distance cost, or link metric of link 4-6 is 15.

No measuring units are used; for example, in road networks, it could be in miles, kilometers, or minutes.

By simple inspection, it is not hard to see that the shortest path between nodes 1 and 6 is the path 1-4-3-6 with a total minimum cost of 3. It may be noted that the shortest path in this case did not include the link 4-6, although from the viewpoint of the number of nodes visited, it would look like the path 1-4-6 is the shortest path between nodes 1 and 6. In fact, this would be the case if the link cost was measured in terms of nodes visited, or *hops*.

the relation between a network and a *graph*. A net-work can be expressed as a graph by mapping each node to a unique vertex in the graph where links between network nodes are represented by edges connecting the corresponding vertices.

Each edge can carry one or more weights; such weights may depict cost, delay, band-width, and so on.