Mathematical Modeling on Network Fractional Routing Through Systems of Linear Equations

P.Vanitha Muthu[1], S.Asokan[2]

[1]*Assistant Professor and Head, Department of Computer Science and Engineering*
Government College of Engineering, Srirangam - 620012, Tiruchirappalli, Tamilnadu, India
asokajay2006@gmail.com

[2]*Professor and Head, Department of Mathematics*
Christhu Raj College, Tiruchirappalli - 620 012, Tamilnadu, India.
asokajay2006@gmail.com

Abstract* – A Linear Equations is one of the most important optimization techniques to help decision making in Network. A Linear Equation problem calls for optimizing linear functions of variables called objective function. The objective function minimizes the total overflow from source node to sink node. We will prove fractional Routing Capacity for some solvable network using Linear Equations.

***Keywords* - capacity, flow, fractional routing, Linear Equations.**

I. INTRODUCTION

The maximum flow of problem can be solved by Linear Equation. All the values are non-negative. Network Fractional routing has been proved to be on Effective Technology in Solving Network Information Flow problem. For each source node the message it requires is a subset of messages from source node. The intermediate nodes cannot only identical and forward messages they receive from in-degree but also use mathematical functions to compute these messages before forwarding them. We can find a set of Linear Equation through Gramer's rule. Linear information Theory has applied to Network Security.

II. RELATED WORK

Consider the Capacity Diagram,

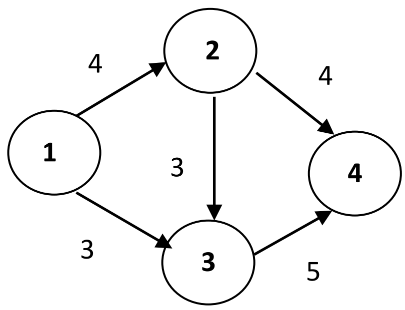

Fig. 1. Capacity Diagram

(i) Select the Path 1

$$1 \xrightarrow{4} 2 \xrightarrow{4} 4$$

Max Flow = max (1->2, 2->4)

= max (4, 4)

= 4

(ii) Select the Path 2

$$1 \xrightarrow{5} 2 \xrightarrow{4} 3 \xrightarrow{3} 4$$

Max Flow = max (1->2, 2->3, 3->4)

= max (4, 3, 5)

= 5

(iii) Select the Path 3

$$1 \xrightarrow{3} 3 \xrightarrow{5} 4$$

Max Flow = max (1->3, 3->4)

= max (3, 5)

= 5

III. PROPOSED ALGORITHM

Step 1: Select the path from Source Node to Sink Node with positive flow using Linear Equations.

Step 2: Find the Maximum Flow using the Capacity of the edges

Step 3: Find the determinant values, if the determinant values not equal to zero then find the flow values From source node to sink node.

Step 4: Consider every Path accepted by a Minimum value.

Step 5: Finally, the Network Fractional Routing = Flow / Capacity.

IV. FRACTIONAL ROUTING EXAMPLE

Consider the Flow Diagram,

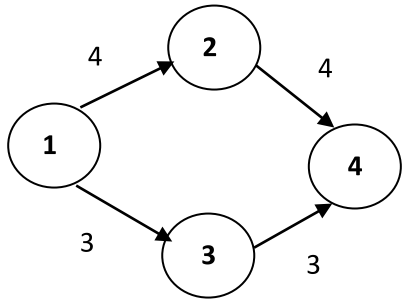

Fig. 2. Flow Diagram

The Equations are

$$4x1 + 4x2 = 8$$
$$3x1 + 5x2 = 8$$

AX = B

$$X = \begin{pmatrix} x1 \\ x2 \end{pmatrix}$$

Let $A = \begin{bmatrix} 4 & 4 \\ 3 & 5 \end{bmatrix}$

$B = \begin{bmatrix} 8 \\ 8 \end{bmatrix}$

AX = B

$$\begin{bmatrix} 4 & 4 \\ 3 & 5 \end{bmatrix} \begin{pmatrix} x1 \\ x2 \end{pmatrix} = \begin{bmatrix} 8 \\ 8 \end{bmatrix}$$

$$\Delta = \begin{vmatrix} 4 & 4 \\ 3 & 5 \end{vmatrix}$$

$= 20 - 12$

$= 8 \neq 0$

Find Δx

$$\Delta x = \begin{vmatrix} 8 & 4 \\ 8 & 5 \end{vmatrix}$$

$= 40 – 32$

$\Delta x = 8$

Find Δy

$$\Delta y = \begin{vmatrix} 4 & 8 \\ 3 & 8 \end{vmatrix}$$

$= 32 - 24$

$\Delta y = 8$

Find x

$$X = \frac{\Delta x}{\Delta}$$

$$X = \frac{8}{8}$$

$X = 1$

Find y

$$y = \frac{\Delta y}{\Delta}$$

$$y = \frac{8}{8}$$

$y = 1$

Let x =1 and y = 1

$4x1 + 4x2 = 8$
$4(1) + 4(1) = 8$
$8 = 8$

Let $3x1 + 5x2 = 8$
$3(1) + 5(1) = 8$
$8 = 8$

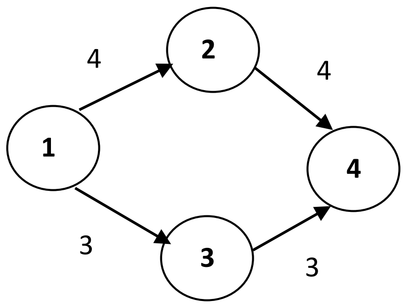

Fig.3. Linear Equation Diagram

Fractional Routing = Flow / Capacity

$$X1 = \frac{4}{4}$$

$X1 = 1$

$$X2 = \frac{4}{4}$$

$X2 = 1$

Similarly,

$$X1 = \frac{3}{3}$$

$X1 = 1$

$$X2 = \frac{5}{5}$$

$X2 = 1$

The value of the Maximum Flow is equal to the total outflow from source node or the total inflow from the sink node.

The Maximum Flow = 4 + 3 = 7

V. RESULT AND DISCUSSION

Fractional Routing = Flow / Capacity

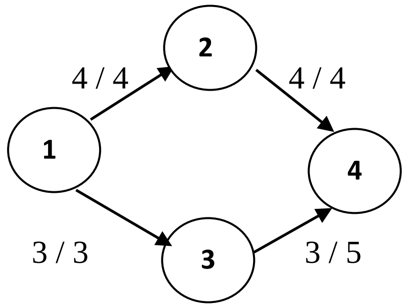

Fig.4. Fractional Routing Diagram using Linear Equation

The interval lies between 0 and 1.

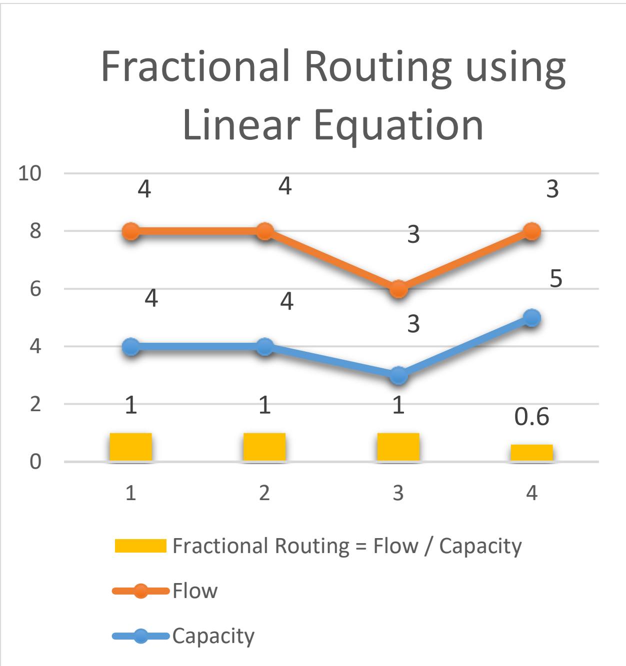

Fig.4. Network Fractional Routing

The Network Fractional Routing value lies between 0 and 1. The Linear Equation is used to determine the routing capacity of a Network. The coding capacity of a network is always greater than or equal to the linear coding capacity. The determinant of elementary matrix is not zero.

VI. CONCLUSION

The Linear Equation minimizes the total outflow from source node or the total inflow to sink node. The flow in a Network assigns a flow to each directed edge which does not exceed the capacity of the edge. The sum of the capacities into sink cannot always be obtained by a flow. A set of nodes which are satisfied by any minimal Fractional routing solution is formulated. If a Network is linearly solvable then the linear coding capacity is greater than or equal to one.

VII. FUTURE WORK

The Linear Equation is a mathematical technique of optimization using state elimination. Every solvable multicast network has a scalar linear solution over a sufficiently large finite field alphabet. The routing capacity of every network is balanced nondegenerate network is reachable. We will briefly describe some of the algorithm for solving Cayley-Hamilton Theorem.

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