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Identifying Faulty Node and Alternative Path in a Network

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Abstract: ***This Paper describes a good algorithm to find the Faulty node in any given complex Network and provides the alternative path and also tells us the number of faulty node. As the Technological advances increasing number of node day by day in a Network. If a node fails, the system continues to operate with degraded performance until the faulty node is repaired. If the repair operation will take an unacceptable amount of time, it is useful to replace the faulty node with a spare node. However, the appropriate procedures must be followed and precautions must be taken so you do not interrupt I/O operations and compromise the integrity of your data that we have presented in our paper.***

Index Terms- Alternative path, Faulty node, Buffer, Computer

I. INTRODUCTION

Today scenario a computer network is divided into mainly two parts first one is wired computer network and wireless computer network [1]. Wired computer network are those network in which all computer are connected to each other via wire or common wire and wire-less computer network are those in which all computer are connected to each other without a wire. It means that the network may be of any type of the computers or any computer embedded device connected to each other by a LAN cable.

If any one computer or client wants to communicate to each other that's related information in another computer, the information is accessed from that computer by which client is communicating, In case if it is not directly communicate to that computer(in wire-less network). Same case in wired computer network if any node is failed during the communication then the integrity of data communication [2] is lost. So to overcome this type of problem there is a need of alternative path to communicate to that node.

As we know that failed nodes may be decreases the quality of service [3] of the entire network. It is necessary to study the faulty node detection methods in entire network for the following reasons:

1) Enormous low-cost nodes are generally deployed in Uncontrollable and unfriendly environments [4]. Therefore failure in nodes can occur more easily in comparison to other systems.
2) The applications of networks are being widened. So fault detection for nodes having great importance.
3) It is inconvenience and not practically possible to manually examine the nodes are functioning properly or not.
4) As we know that the correct information unobtainable by the control centre because failed nodes may produce incorrect data.

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The node status in entire network can also be categorized into two types: normal and faulty. Faulty node can be "permanent" or "static" [5]. Here "permanent" means failed nodes will remain faulty until and unless they are replaced as shown in figure 1, and here "static" means the faulty node can be repaired. So our work is regarded to static node and provides the alternative path to maintain the data integrity.

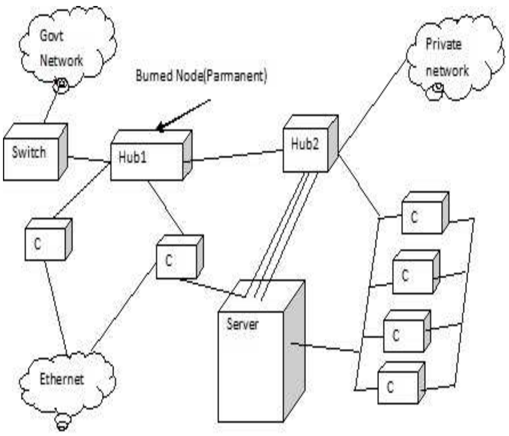


Fig. 1 Permanent and Static Node.

Proposed System:

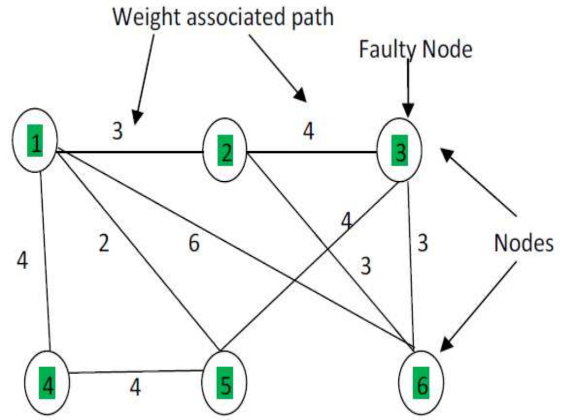


Fig. 2 A computer Network.

Figure 2. Shows the Network of computer in which Number of nodes are connected to each other directly and indirectly to each other. The Adjacency Matrix [6] of given Computer Network:

Nodes

	1	2	3	4	5	6
1	0	3	0	4	2	6
2	3	0	4	0	0	3
3	0	4	0	0	4	3
4	4	0	0	0	4	0
5	2	0	4	4	0	0
6	6	3	3	0	0	0

	1	2	3	4	5	6
1	0	3	0	4	2	6
2	3	0	0	0	0	3
3	0	0	0	0	0	0
4	4	0	0	0	4	0
5	2	0	0	4	0	0
6	6	3	0	0	0	0

Fig. 3 (a) Old Matrix (b) New Matrix

Proposed algorithm:

1. 1st we determine the old matrix for a given node in the network [7] before passing the message.
2. Now we determine the new matrix for a given node in the network after passing the message.
3. Now compute the sum of rows and column of both matrix and store into some buffer for both matrixes separately.
4. Now we compare these sum either row wise or column wise of both matrix.
5. If in step 4 the sum is same then there is no fault and go to step 11 otherwise go to next step.
6. Now we check the row wise or column wise sum of new matrix which contain 0.
7. Loop
8. from i = 1 to size of the row or column
9. If A[i] == 0
10. Then ith will be faulty node.
11. End

Floyd Wars hall's Algorithm:

The Floyd–Warshall algorithm [8] is mainly graph analyzing algorithm for finding shortest roots in a weighted graph and it also find the transitive closure of a given relation R. After the execution, the algorithm will compute the summed weights of the shortest roots between all pairs of vertices, but it will not return the details of the roots themselves. This algorithm is a concept of dynamic programming.

The Floyd–Warshall algorithm analyzes all possible roots through the network graph for each pair of vertices. This algorithm will do this analysis with only $\Theta(|V|^3)$ comparisons in a network graph. This is remarkable considering that there may be up to $\Omega(|V|^2)$ edges in the given graph, and all combination of edges is checked. It does calculate an estimate on the shortest root between two vertices till the estimate is optimal.

Here W (i, j) shows the weight of the edges between vertices *i* and *j*, shortest root (i, j, L) can be define by the following recursive formula: the terminating case is Shortest root (i, j, 0) =w (i, j) and the recursive case is

Shortestroot (i,j,L)=min(Shortestroot (i,j,L-1),shortestroot (I,L,L-1)+Shortestroot (L,j,L-1))

This formula is the heart of the Floyd–Warshall algorithm. The algorithm works by first computing shortestroot (*i*, *j*, d) for all (*i*, *j*) pairs for d = 1, then d = 2, etc. This process continues until d = *n*, and we have found the shortest root for all (*i*, *j*) pairs using any intermediate vertices.

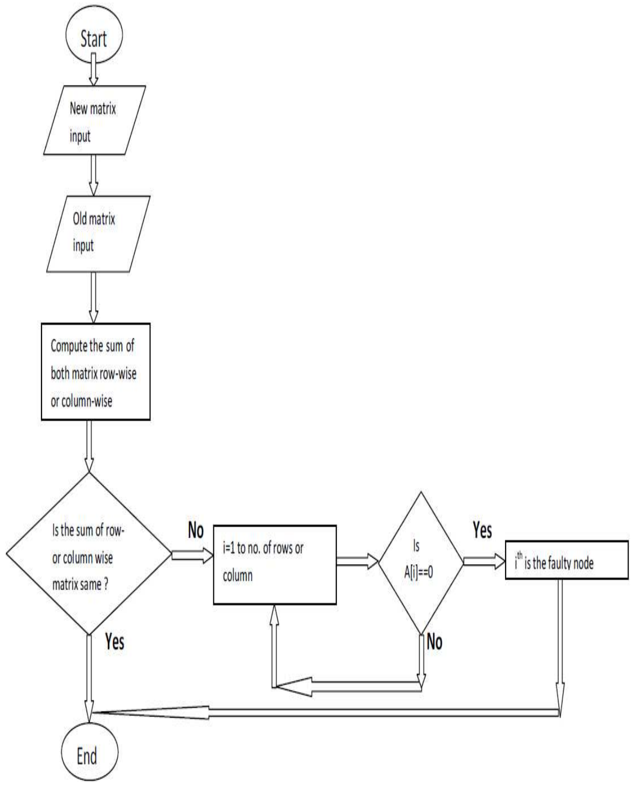


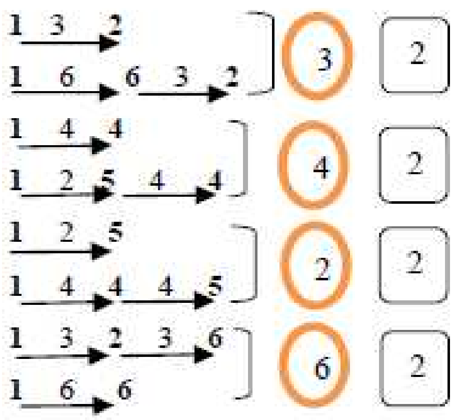
Fig. 4 Flow chart for faulty node

1. /* Here we are assuming that a function Edge_cost (i,j) that return the cost of edge from i to j */
2. /* Here we are assuming that n will be the number of vertex in the network and Edge_cost (i,i) = 0 for self */
3. int root[][]; /* A two-dimensional matrix. At each step in the algorithm, root[i][j] is the shortest root from i to j by using the intermediate vertices (1..L−1). Each root[i][j] is going to initialized in the algorithm with Edge_cost(i,j)value.*/
4. Function FLOYDWARSHALL ()

```
for L = 1 to n
 for i = 1 to n
  for j = 1 to n
   root [i][j] = min (root [i][j], root [i][d]+ root [d][j] );
```

The shortest and Alternative path for all source and Destination:

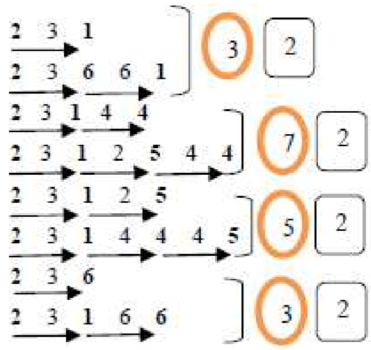
For node: 1



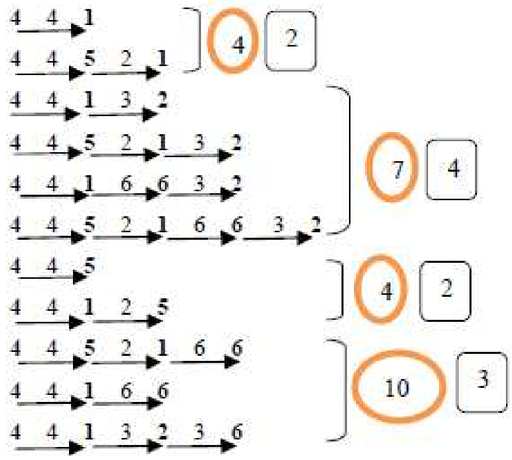
Denotes shortest path from source to destination

Number of alternative path

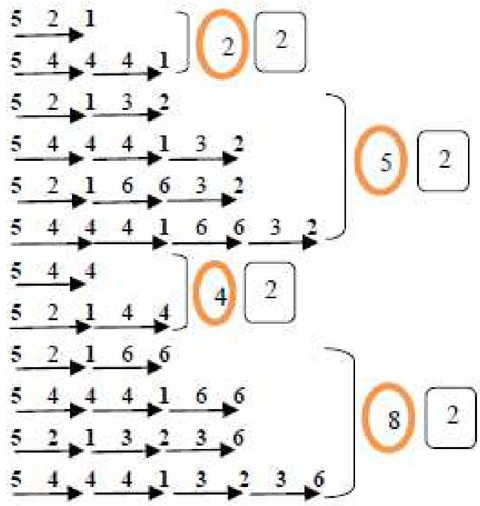
For node: 2



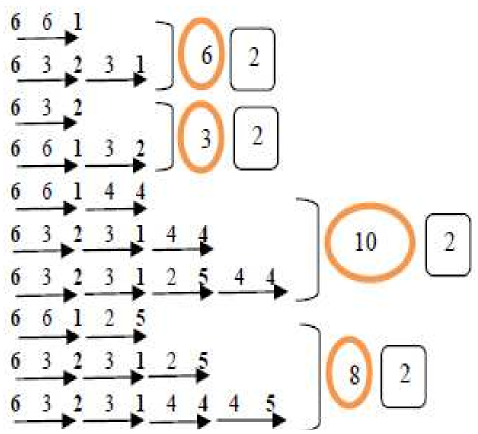
For Node: 4



For node: 5



For node: 6



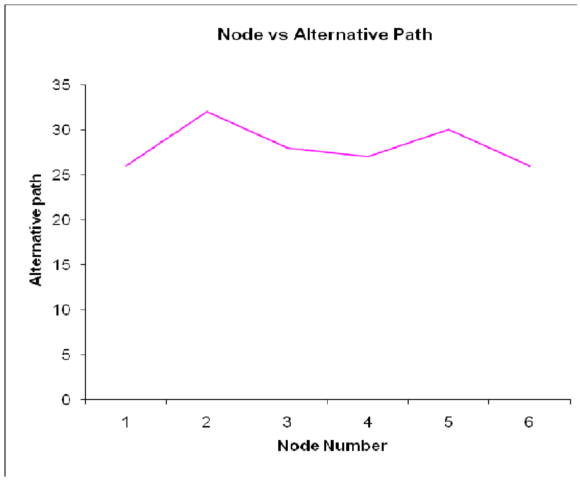
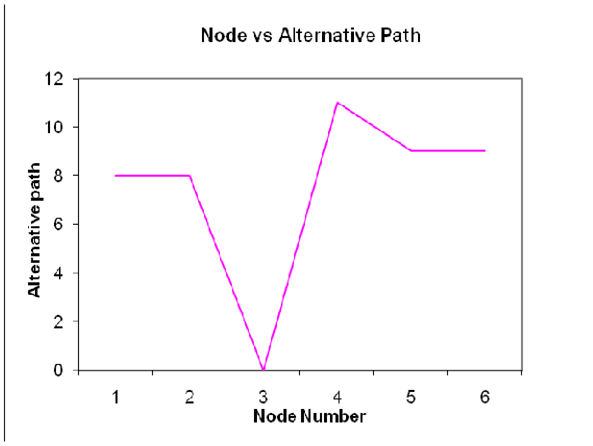


Fig. 5 (a) Alternative Path Vs Node Number without Third as Faulty Node.



(b) Alternative Path Vs Node Number with Third as Faulty Node.

Figure 5(a) describes the alternative path when there is no faulty node in the given network. We are not describing all procedure or solution to find the alternative path [9] between all source and destination because of the limitation of number of pages of this paper.

Although we have given the all possible paths between all source and six as destination node, when third node is a faulty node as shown in figure 5(b).

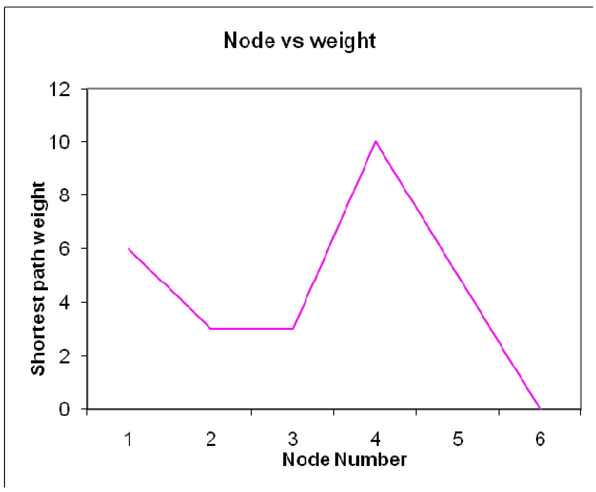
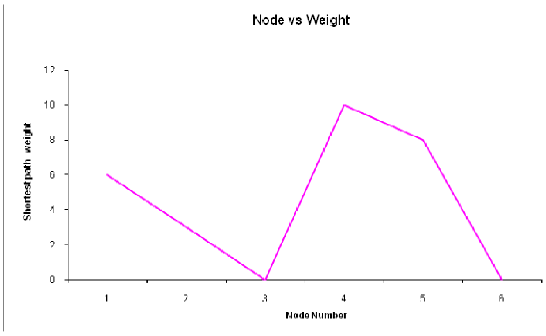


Fig. 6 (a) Shortest Path between All Sources and Six as Destination Node without Faulty Node.



(b) Shortest Path between All Sources and Six as Destination Node with Faulty Node.

Fig 6 (a) and (b) shows the shortest path with or without faulty node respectively in the given network as shown in figure 2. Due to faulty node in a network as shown in figure 2 the network may hang [10] if there is no any alternative path available as well as the packet or data may choose longer path to reach their destination. Due to this we are providing an alternative shortest path for sending a packet or data to reach their destination. Therefore the network hanging problem is get reduced.

Conclusion: Whenever a fault occurs in the Computer Network, the network may hang and there is a delay or failure of packet or data sent their destination. We proposed the solution to over come this problem by providing the alternative shortest path. The further enhancement can be done by providing security to send the information on alternative shortest path for fastest communication on available alternative path. We can do automation also of this proposed model.

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