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Survey on Fast IP Network Recovery

Manoj Baingne#1, K. Palanivel*2

#Department of Computer Science, Pondicherry University, Puducherry -605014, India
*Computer Centre, Pondicherry University, Puducherry -605014, India

Abstract- Internet is playing very important role nowadays for satisfying people with various services related to different areas. It is a very versatile facility which can help you in completing many tasks easily and conveniently with few clicks, the slow convergence of routing protocols after a link or node fail in the network becomes a growing problem. Because of faulty interfaces in network, transient failure occurs unfortunately. In this paper, surveys of the different IP recovery schemes are described. With these approaches, when no more than one link failure notification is suppressed, a packet is guaranteed to be forwarded along a loop-free path to its destination if such a path exists. In these techniques, for forwarding the data after getting link or node failure, alternate path used from detecting node to destination. This alternate path is preconfigured so it takes less time to recover the faults. But whole data travels through that particular alternate path so it may be cause a congestion problem. To overcome this congestion problem we proposed a load balancing solution for increasing packet delivery.

1) INTRODUCTION-

In present days internet is one of the strong medium for communication. The demands on internet are automatically increasing for its reliability. Internet is increasingly being used for many applications and services like conferencing, banking, call centres, e-governance etc. If any link breaks or any node get down in network, it affects hundreds of thousands of phone conversations or TCP connections. In this paper, the introduction section gives the basic idea about rerouting purpose. The literature survey section deals about the different methods used for fast IP recovery after single node or link failure. The parameter for analysis section gives the parameters for comparison of different approaches used. The comparison section describes the comparison table and tries to find the best for rerouting based on parameters for analysis. Next section gives the solution for congestion problem after IP recovery and last section describes the conclusion which suggests that any of the single schemes is not capable of 100% efficiency.

2) LITERATURE SURVEY-

In [1], Amund Kvalbein, Audun Fosselie Hansen, Tarik ˇ Ciˇ cic ´, Stein Gjessing, and Olav Lysne proposed multiple routing configurations for fast IP recovery. MCR uses the link weight and network graph for backup configuration. It uses shortest path hop-by-hop routing. When router detects failure of neighbour, it does not broadcast this information to network. Instead, packets normally forwarded to failed link are mark as belonging to backup configuration and use an alternative path toward the destination for sending. If there is no failure then packets will send via normal configuration. This configuration describes three types of links, w_0, w_{max} and w_∞. Link w_0 is weight of link in normal configuration. w_{max} is sufficiently high weight of link is called restricted link which connects two isolated nodes or one isolated node with normal node. w_∞ is isolated link with ∞ weight. Node is isolated if it attached at least one restricted link. For node to be reachable we cannot isolate all links attached to it in same configuration. There is no traffic over restricted link and isolated link. This approach uses backup configurations. Different configuration developed to make isolate all nodes present in the network. If any packet send from source to destination, it reaches on node u (next node is v link with u) and find link failure, then node u is called detecting node responsible for finding backup configuration where the failed component is isolated. The detecting node marks it as belonging packet and forwards it to destination with alternate path got by new configuration. All remaining nodes identify it with selected backup configuration and forward to destination.

In [2], Paolo NarvAez, Kai-Yeung Siu' , Hong-Yi Tzeng proposed local restoration algorithm for link state routing protocols. By this algorithm if any link breaks down then this new update information need to send only the nodes which are in the new restoration path. In link state database of each router, vector V represents the cost of the links. i^{th} element of the vector is referred as i-1 order matric. During initialization, original link cost is given to zero- order matric and all other metric sets to zero. On time of the execution, vector metric of the link can downgraded, link set to be zero of zero order metric and all remaining metrics shifted by ($v_i \leftarrow v_{i-1}$). Working of this algorithm is, if link L breaks between nodes X and Y, then in node X link state database is modified that the link is down and SPF engine computes the entire path to reach node Y. Vector metrics of all the links in that path downgraded. SPF engine recalculates all the next-hops using the vector metric as modified in last step. These next-hops are used in X's routing table. A special packet sent along the path. After receiving the special packet in node S_i , if S_i =Y then stop otherwise repeat above steps. This algorithm solves the routing loop problem by forcing the packet to leave restoration path at right time.

In [3] Z. Zhong, S. Nelakuditi, Y. Yu, S. Lee, J. Wang, and C.-N. Chuah proposed failure inference based fast rerouting approach (FIFR) approach for fast rerouting. This approach provides high service availability and minimal routing overhead. $FIFR_N$ inherits all the nice features of $FIFR_L$ which described in its previous work. $FIFR_N$ can handle 86.6% of all types of failures. Node whose failure makes a packet arrive at node along the reverse shortest path from that node to destination is called KEYNODE. And failure link is not the part of shortest path. This approach gave algorithm for KEYNODE, if it found packet uses reverse shortest path from that node. This path may slight longer than previous path. In FIFR a packet from source to destination forwarded along the usual shortest path till it were to reach the failed node. FIFR also proved that any node s_i adjacent to failed node there is no loop from s_i to destination in case of failed node belongs to the next node of s_i to destination. The packet at most traverses all the adjacent node of failed node then it forwarded to destination by s_n where s_n is last adjacent node of visited by the packet. It guarantees loop free forwarding of packet to its destination if there exist a path to it without failed node.

In [4], JozefPapan, Pavel Segec, Peter Paluch proposed Multicast in IP Fast Reroute technique in which time required for fault recovery has reduced. In the existing approaches it took time for recovery after getting failure of node or link. But in the Multicast in IP Fast Reroute, if sender S wants to send the data to destination D, it sends data via original shortest path from source to destination but same time one copy of data forward to Rendezvous point (RP). RP and destination D should be member of multicast group of sender S. This RP forward this data towards destination via different path which is not the part of original route. Destination is the member of multicast group so it recognizes that the redundant packet is coming. If any failure occurs, still destination is getting the data.

In [5], D. Katz, D. Ward and Juniper Networks, proposed the Bidirectional Forwarding Detection (BFD) method between two systems to detect faults in the bidirectional path. BFD uses a simple Hello protocol which allows pair of systems transmits BFD packets periodically over the path to validate the link or the system availability. After getting a fault in node or link in path, IP fast reroute framework [6], the apprise data plane of router to use alternate path for sending data. New path will not use the failure link.

In [7], Anindya basu and Jon G. Riecke proposed the stability of OSPF routing. In this section he studied three things. First is network convergence time. Second is routing load on processors and third is number of route flaps. They discussed the overview of OSPF-TE stands for open shortest path first protocol with traffic engineering extensions. Traffic engineering is the technique for improving the performance of operational network. TE attempts to improve the congestion- control problems by allocating the resources efficiently. In study of network convergence time they describe, it is the time taken by OSPF router in the network to go back to steady state that means if any failure occurs in the network, the network convergence time is the total time taken for the router to update their link state database and reroute all traffic engineered paths around the failure. Study of route flaps describes routing table changes in a network. It shows the network failure or recovery. If any failure occurs in the network, this information broadcast to all routers in the network and reroute the path is any.

In [8], Srihari Nelakudity, Sanghwan Lee, Yinzhe Yu, Zhi-Li Zhang, and Chen-Nee Chuan proposed fast local rerouting for handling transient link failures. This approach uses interface-specific forwarding and inhibits the link state advertisement. This approach guarantees the loop free forwarding the packets. If there is no fault in the network then FIR would be same as traditional routing. It performs local routing when failure occurs. This technique needs few changes to existing routing and forwarding planes.

3) Parameters For Analysis-

Node fault- When any router stops its functionalities in the network then it is called node fault. It causes packet drop in the network.

Link fault- When link L between two nodes u and v breaks, it is called link fault.

Preconfigured – It is predefined configuration for future point of view. IP recovery techniques use this configuration to send the data after detecting the failure in the network.

Connectionless- There is no physical link between two nodes is called connectionless. Two nodes connected logically. We assume that all recovery techniques are strictly connectionless.

Bi-connected- bi-connected means if any vertex remove from graph, the graph will remain connected. After removing any node from graph it would not split into two parts.

4) Comparison Of Parameters Provided By Different Ip Recovery Research Papers:

Scheme	Node faults	Link faults	preconfigured	connectionless	Guaranteed in bi-connected
MRC[1]	Y	Y	Y	Y	Y
Local rerouting	N	Y	N	Y	N
FIFR[3]	Y	Y	Y	Y	Y
FIR[8]	N	Y	Y	Y	Y
OSPF[7]	Y	Y	N	Y	Y
Multicast IP FRR; [4]	Y	Y	Y	Y	Y
BFD [5]	Y	Y	N	Y	Y

5) Proposed Work-

We discussed five approaches of IP rerouting after failure of node or links that alters the path of data after getting the failure. Some approaches use pre-configured path from detecting node and send data via that path. These approaches are reliable and guarantee to send the data to destination. But one problem of all approaches is, it sends whole data through only one link which is selected after failure. Definitely that new path will either equal length of older path or longer.

We are proposing a new approach for distributing the data through more than one link for solving the congestion problem.

This approach is based on Fibonacci sequence concept [9]. It will decrease number of packet drop and increase of packets and increase the delivery ratio. By default Fibonacci value of zero is zero Fibonacci value of one is one. We can get next Fibonacci value by adding previous two.

$$f_0 = 0;$$
$$f_1 = 1;$$
$$f_n = f_{n-1} + f_{n-2}; \quad \text{for all } n >= 2.$$

For example If there are 4 links from detecting node to destination after failure of main link, which will already preconfigured, then we assign these link as fib_1 *to* fib_4. We have to assign greater Fibonacci value to shortest among these four that is fib_4 and fib_3 assign to second shortest path and so on. If we want to send 8 packets from source to destination, first give chance to shortest link that is fib_4 and 3 packets from this link because fib(4) =3. We send 2 packets from second shortest link because fib(3)=2, likewise 1 packet from each third and fourth links. In first slot we have sent total 7 packets. Again we use shortest link which is fib_4 send 1 packet from that link because we have to send only last packet out of 8.

We can conclude that this new approach reduced congestion problem by seeing the results that from shortest link we sent only 4 packets out of 8.

6) CONCLUSION

As described in the paper, though there are extreme advantages in using a Fast IP recovery techniques. All the approaches which we described are able to recover the link and node failure and provide loop free forwarding the data. There are yet many practical problems which have to be solved. Congestion problem and low packet delivery are the major things which we have to solve.

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