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A NEW APPROACH FOR RELIABILITY ENHANCEMENT IN FDDI NETWORK

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ABSTRACT

Predicting the failure or predicting fault in network components plays a important role in data transmission in a computer network. Network quality is an evergreen issue and it is one of essential t part in the development of any communication system. Defect-Prediction of a communication system is the probability that the communication system failed to achieve its target. The main objective of given paper is to Predict various parameter of network as predictors of communication system and, therefore, determine whether these parameters can be used as reliable network components for communication systems. In this paper various possibilities of faults or defects e.g. lost token, link failures are considered, and using all of these defect detection and reliability mechanisms are studied This early decision of defect-prediction in a Network components enables various experts to concentrate their time, efforts and resources on the defects and part of Network system which is under consideration. In the given paper, we Explains the way to calculate the various parameters to illustrate how defects-proneness detection can be performed. Error free data after complete communication can be used to predict quality of communication using various tools. It is one of the important parts to ensure quality in the Communication System. The main objective of this research paper is to Proposes a method for identifying defects using various parameters and also to suggest a combination of parameters by using which the given network can be declared as more reliable network. In this experimental process we have used Op-Net as simulator for data validation. The repository of OP-Net contains various parameters and error parameters at various levels. In the given paper we have proposed a new way to transfer data using various hardware modules. This validation of data used for enhance reliability of a communication system.

KEYWORDS*:* Communication Network*, FDDI* Network, Token Passing, LAN, Data Transfer Time, Latency Time, Reliability, Efficiency.

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INTRODUCTION

FDDI is a standard for data transmission using a LAN or other network that can be extended up to the range of approx 200 km [6]. FDDI is network that is a ring based token network also called as topology. Its maximum standards are taken from the 802.4 token bus timed token standard [6]. It does not use the IEEE 802.5 token ring standard as its base.

FDDI uses two topologies as (1) Single-Attached Station-token bus passing ring topology (2) Dual-Attached Station- counter-rotating token ring topology.

Both, The Token Rings and Fiber Distributed Data Networks have two data transmission paths which provide redundancy. Then, one of the two paths can be used at a time and other becomes unusable [2].

The token ring method uses only one mode at a time during whole of the communication Process. This is the main principle of token ring protocol. Only one modem is used to transmit message through the ring. When the given message passed whole of the ring [2]. Then the given modem used to removes the data from the concerned ring. Now, the given modem transfer control to next mode in the line.

The given methods work effectively for the distributed data. The reliability of FDDI network can be set or change by controlling various parameters like ring latency or this can also be achieved by minimizing the value of ring latency [2]. Besides the value of ring latency the reliability can also be achieved by using proposed model. Response Time play a vital role in performance analysis of computer network [3]. The response time majorly depends on transition delay and propagation delay i.e. the desired value can be set by changing these two values. The same path can be used to transfer the data until the same path is available [1]. In other words, we can use same path for transmission until the given path is available, if it is not available only then another path can be used [21]. We have also tried to cover full connectivity in the given network even when multiple link failure occurs in the network [4]. This one is the added advantage to the existing FDDI network.

In order to enhance Data reliability we can also cover data part [4]. Data part means, certain error detection and correction methods are used to validate the data transfer. These methods can be used to maintain data consistent. These error detection and correction code must be send with data packet being sent [4]. It is very clear from here that there is a direct relation between performance of network and reliability .So, the optimization of performance will also directly affects the data reliability. The reliability of the communication network can also be increased by analyzing performance or by optimizing performance of the given network. FDDI's topology is based on a dual counter ring which is rotating that is also known as trunk ring topology. Under normal conditions, only one ring of the topology is used for transmission in communication network. The other ring works as purely a back-up ring. The reliability can also be increased by allowing reconfiguration of the given communication network especially when two or more than two nodes become fails, this reconfiguration also uses isolating any of the failed nodes of the given network, this is done only by joining the surviving ring segments into a single logical ring.

The paper is organized under different segments as: Section 2 describes the meaning of reliability in a computer network especially in reference to FDDI. Section 3 explains the proposed model for fault prediction and ultimately to enhance Reliability of network. In the next Section we have explained the Experimental working model of FDDI in detail Solution is provided at the same

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section. Conclusions of the Experiments is presented in Section 5.

RELIABILITY IN COMPUTER NETWORK

It is very important to discuss reliability in term of communication network. There are multiple ways to understand the term reliability [15]. Reliability is just like the term “trust “used in our daily life. Network Reliability is said to be the ability of a computer network to carry out communication [18]. In other words we can say, Reliability is a most important feature of any network related component which performs desired operation with less percentage of error [15].

The term reliability is the vast term in context to a network depends on the communicating nodes which are under communication or it is said to be a method which is used for transfer of tokens in the given topology.

a. TERMINAL NODE TO TERMINAL NODE COMMUNICATION

The terminal to terminal communication must be considered before deciding the reliability of a network. Sometimes data transfers from one node to another but do not reach to terminal node; this kind of network cannot be called as reliable network [15].

b. MANY SOURCE NODE TO TERMINAL NODE RELIABILITY

In his case we must consider different sources of communication but one terminal node as destination only. This must be considered during checking reliability of network. If more than one source is able to send data to one terminal node then it may be reliable network.

c. SOURCE NODE TO MANY TERMINAL NODE L RELIABILITY

In this case of communication, one must check transmission of data from one source to many terminals. Before calling one network as reliable one must check this Part of communication. If there is no loss in data transmission then it can be called as reliable Network.

d. ALL TERMINAL NODES OR NETWORK RELIABILITY

Most important part is the all terminal transmission of data. It means when there is proper transmission of data from one sources to destination only then the given network can be called as reliable network.

So, from all these four aspects of reliability last one is the most important. Before considering one network as reliable one cannot ignore the last one but all are added advantages to the same [10].

Reliability is the complex issue and one cannot declare the any system as most reliable because scope of improvement is always there. So, after covering this initial layer one can go in to depth in to second layer by considering some other aspects [15].

1. ONE COMMUNICATING NODE TO OTHER COMMUNICATING NODE DELAY

From one communicating node to another communicating node delay is the part of second layer of analysis that is beside whole network one also consider one node to another delay. This is just because to reduce chances of fault [9].

2. AVERAGE NODE RELIABILITY

Average node reliability again adds one layer to reliability where reliability of the network can be enhanced. But here is the way of calculating average node reliability will play a great role in deciding a network as reliable network.

3. FUNCTIONAL RELIABILITY

Functional reliability is consideration of the function of node in reliability calculation.

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Ultimately this is the role or function which decides reliability of node and ultimately network reliability [7].

4. PROBABILITY OF FAULT

This is again added dimension to calculate reliability because fault tolerance is the core part of network system. So the probability of fault will be an added part to reliability calculation [4].

During network communication bandwidth is the important resource. The bandwidth means overall capacity of the connection to transfer data. One conclusion can be drawn from here is greater the capacity, this leads to better results in term of communication. In other words, bandwidth can be called as the total amount of data that passes over the given connection in term of bits per second (bps).

The total time delay in transmission of data from one point to another is called as the network latency. Here in order to calculate the time delay the two end points are always considered. In other circumstances, network latency can also be defined as the time it taken by the data for full circuit back i.e. from the starting point to the ending point [2].

There are several parameters to be considered for calculating transmission time i.e. one way time or two way time. The given two way time is also called as round trip time. There is no restriction to use this round trip time, but without using round trip time or by using single trip time we cannot calculate all factor's correctly. These all factors contribute to the calculation of reliability. But when two network nodes are in continuous communication, then round trip time is the best option to calculate reliability. There are several components to calculate round trip time .Some of these are as:

- **QUEUE TIME:** it is the time interval between the end of previous transmission & the arrival of the new frame.
- **DELAY IN ACCESS:** it is the time interval between the last transmission and beginning of a new transmission.
- **TOTAL TRANSMISSION TIME:** it is the time period between the transmission of the 1st bit and the last bit .Here the given time is dependent on the frame size.
- **PROPAGATION DELAY TIME:** total time consumed to travel by a bit from source to destination node. This is dependent on the location of stations on the given ring.
- **RESPONSE TIME:** the total time period between the completion transmission and the arrival of the new frame.
- **TRANSFER DELAY TIME:** it is the total time period between the reception of its last bit at the destination and arrival of the new frame.

These all factors collectively used to calculate total transmission time and that time indirectly contribute to the calculation of reliability of the communication network.

METHODOLOGY

Continuous assessment is the key for improvement. Similarly, in case of computer network Continuous monitoring is one of the most essential parts of the network [1]. In order to configure the network continuously, we need to monitor the failed segment or defective nodes. this reconfiguration process does not need MAC layer, this only needs physical layer for configuration [1]. So, only the nodes wrapping the network have certain information while other nodes are completely unaware about this information. During this reconfiguration process some of the frames may be lost in that case we have to transmit the frame again. There may be several solutions also Circuit switched connections can also be a solution as it passes overwrapping [1]. This is a technique by which FDDI network can be reconfigured and would be able to tolerate multiple link failure and also for physical layer reconfiguration. This kind of

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reconfigurations executes without any consequences. Here a trunk ring may be used to connect nodes which are connected to both of the rings. So, here to achieve the desired results one can use a complex Dual Attached Stations. Here duplicate MAC layer is also possible to avoid redundancy. Here, those Stations station which are attached to MAC layer have two options to attach i.e. with either of the MAC layer both can be attached [1]. Dual Attached station has a feature called which allows them disconnection from either of the transmission medium i.e. called optical bypass capability. Another, class of stations described for FDDI Network are the Single Attached Stations [1]. These are the class of station which intends to be double attached in order to enhance the reliability of the ring [1].

The given standard also allows trees of cascaded concentrators and slave stations also of these constitute different kind of different trees. This is the reason why FDDI called as dual ring of trees. One of the other cases may be the formation of the trunk ring into a single concentrator which forms the root of a tree [1]. But null of the attachment is considered over here. In addition to it, a DAS (Dual attached station can also works as a pair of SAS). Here all are connected to different concentrations. But here, interconnection between the two ports within such a station can be forbidden [1].

The second physical layer can also be implemented in the different rings of the same network, but still interconnection is not allowed [1]. The connection of the two different kinds of rings at a level may be visible to Medium access Control and Physical Layer. But this dual homing layer needs more capabilities which can also be provided. During Normal Conditions the two rings uses independent paths for token transfer [1]. Here each of the given rings can be used for the transmission of data based on the type of data or need. A large number of the standards include the usage of the second ring for simultaneous transmission. Those Stations which have more than one MAC i.e. a full scaled DAS may be set up by using both counter rotating rings. Thus, both MAC layers have access to full data capacity under normal level configuration. Ring must be reconfigured to the wrap state due to certain faults to achieve direct communication between MACs attached to different rings during reconfiguration of network duplicate MAC layer may lead to a problem called non-negligible problem Under these situations the unnecessary MACs must be avoided. This process seems complicated so there is another way which is less complicated, this is how this can be achieved is always avoid using same MAC address two or more than two times and avoid mapping the station address with one of the associated media access addresses. The given network has a important ability to modify its topology dynamically and also leaves some effects on its reach ability. here in this case both of the rings can be used for the transmission of data, For certain duration of time , here some of the MACs may be able to reach other MAC entities in case when the given network is wrapped, and these become separate again when the given network unwraps itself [1]. The dynamic nature of the FDDI topology independent of dual-MAC or single-MAC stations on the secondary ring. There is also another way to address the same problem that is putting one bridge in between the rings [1]. This bridge addresses the problem and also increases reliability of the network. This may also be considering a way to enhance reliability but as right always comes with duty same way enhancement always comes with certain restrictions or challenges.

When two rings used in a network, so it provides a back up means when get failed another will maintain the link. This Process reduces the overhead as compared to full connectivity. So, this is also an optimal way to enhance reliability. Another idea is the hold policy of dual ring, this helps in correction of more than one fault. When none of the ring is under operation only then ring

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wraps. But this approach has a limitation that we need two MAC to monitor the each ring. But harmony is still important issue in the same. One can also suggest removing one MAC i.e. the presence of one ring but this kind of solution is contradictory with the existing standard of FDDI [1].

The proposed system may have errors but this does not mean to separate rings. One ring is ultimate solution but in that case we have to preserve the bridge or link which is used to connect multiple rings [1].

This can be achieved by using slow optical multiple switches which changes the rotation direction of links. In addition to this the complex configuration management can also be a good solution.

However, the Existing FDDI standards already provide a great variety of different topologies. In addition to this certain restrictions could make it as a potentially useful standard [1]. But besides several benefits we must consider the negative part of FDDI .without considering negative part none of the study is complete. The term reliability can also be directly or indirectly linked with efficiency. So the analysis of reliability is incomplete without efficiency. In other words, Efficiency is the pathway to get reliability. It will depend on the analysis of parameters of efficiency to decide reliability.

RESULTS ANALYSIS

During the Execution of standard, each station waits for certain duration after releasing the token [6]. This can be taken as$2T + 2D$. Maximum time delay can be the given time interval. [7]. so, the given time delay will varies with load, as the load increases time delay also increases. So, access delay also changes with no. of active stations. If there are no of three active stations:

Maximum access delay can be represented as;

$$MAD = (3-1)T + 2D$$

And for three consecutive active stations, the efficiency can be calculated as [6]:

Efficiency; $\eta = \frac{3(T-D)}{3T+D}$

The same can be generalized, by replacing this three by *n.*

i. e.

Efficiency; $\eta = \frac{n(T-D)}{nT+D}$ (i)

$$MAD = (n-1)T + 2D \qquad \text{(ii)}$$

An analytical model can be derived from these two equations. As,

The above equations can be used to calculate MAD and efficiency of the given network.

Moreover, we are free to either decrease or increase the efficiency of the system by increasing or decreasing the value of D. As the value of D is increased /decreased the efficiency of the given FDDI system will be increased/ decreased.

So, we can directly conclude from here that there is a direct relationship between D and efficiency of the system.

Now, we will explain and analyze the results for the performance of the given network on the basis of efficiency which leads to increase reliability of the network, both of the term is directly or indirectly related. During the experiment we need to fix the number of stations to certain fix number and then one can analyse the overall performance of the FDDI network [3]. The Experimental results carried earlier are shown. We have also presented the analysis of results. The value of T can also set according to results. During the current experiment it is set to the value of 4ms also the value of the latency can also set be as 2ms (the values can also be changed according to their own results). The

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relationship graph is also drawn between MAD and TTRT has been illustrated in the given figure. We can conclude the maximum access delay [MAD] increases with the increase in TTRT value. It means one is directly proportional to other. So, one can easily control the maximum access delay by decreasing the value of TTRT or vice versa [3].

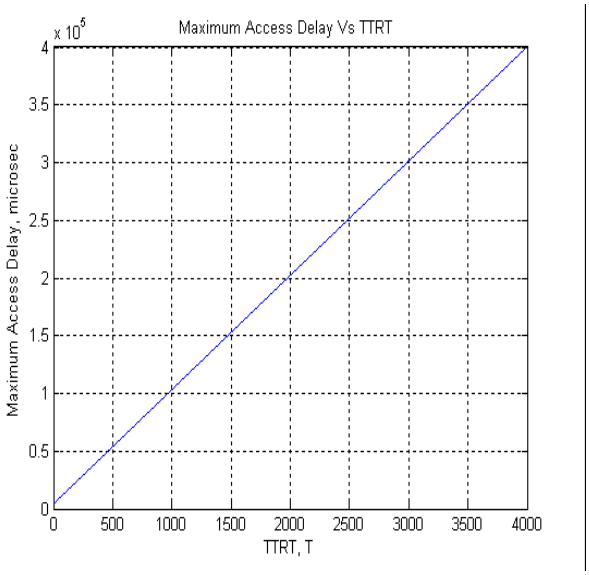

Figure 1.maximum access delay vs. TTRT

PERFORMANCE ON THE BASIS OF RELIABILITY

There are no of ways by which one can send data from one node to another without any defect/error/failure. One easy way is to send data over different routes from the source to destination [2]. Most of these can be used simultaneously but this decision is totally dependent on the requirement of data. So one can accept or reject data according to their own choice. Also, the receiver is free to decide which data to accept and which to reject [2]. There are no of possibilities as in our daily life as one can decide to send data by one path while the concerned path may or may not be available. One can also use another path when no of paths are available to send. Sometimes one can use one path for some distance and another time another path can be used.

Data reliability also depends on the data being sent by data packet. So sometimes to increase reliability can also be increased by modifying the data packet which carries data. [2]. Some of the existing systems uses a frame check sequence field for storing error detection and correction methods in the data packet. one major drawback associated with fibre optic cable is the breakage of cable. To minimize effect of this drawback one can use error detection and correction sequence with data packet. Sometimes, one can ignore the use of error detection and correction methods as the concerned system already exist in the hardware, then there is no need for additional improvement; since the devices connected to the network already perform this function [2]. But when this is not available with the system one must incorporate the same to the network. This also adds a dimension to enhance reliability of a network as data protection is ultimate objective of reliability.

CONCLUSION

The whole study is incomplete without discussing conclusion so, we will bind up with the conclusion and also effect of proposed system on the existing one all of the discussion we can conclude here that ring latency can increase the efficiency of the given network , In other words, ring latency plays a important role to increase

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efficiency. [6]. this means increasing or decreasing this value directly affects efficiency of network which also affects reliability of the given network. [19].

The transition delay and propagation delay can also be used to control response time in the network .one can also analyze the performance of FDDI network by optimizing the value of efficiency with TTRT value and also with latency. At the Data level, reliability of the FDDI very much depends on data packet i.e. if the data in data packet is attached with some error detection and correction method, then it will enhance the efficiency of the given network. So, one cannot ignore detection and correction method in the network.

Although it is very clear that existing Network already have some error detection and correction methods but scope of improvement is still there. We must consider the factor of cost [6]. There are several factors which affects overall cost of the network like as the cost of the fiber and modems, standard which are being used in the network. So the cost of network can be minimized by minimizing the use of modem and fiber used. Also, there are several ways to minimize the cost. One way is by using a modem which has minimum value of latency time [19]. So, by considering above factors or by analyzing values one can easily analyze the performance of the FDDI and this performance analysis can be used to design a reliable communication network. After studying and analyzing all these factors one can conclude easily that designed network must have larger efficiency also larger reliability with lower cost, minimum response time. This is what a user ultimately needs. As in the current scenario all of the users are strong part of the market so, this is ultimate requirement of market.

"Change is the only constant in his word" the given line is the benchmark for all technologies. In case of reliability this also works well. If technocrats will keep on analyzing reliability they will keep on changing the system which will create a permanent place in the market.

REFERENCES

[1]. Pek-Hooi Soha, Edward B. Roberts, "Networks of innovators: a longitudinal perspective", Research Policy 32 (2003) 1569–1588.

[2]. P. S. Rathore, A. Chaudhary and B. Singh, "Route planning via facilities in time dependent network," 2013 IEEE Conference on Information & Communication Technologies, Thuckalay, Tamil Nadu, India, 2013, pp. 652-655. doi: 10.1109/CICT.2013.6558175.

[3]. Rahul Malhotra, Vikas Gupta and Dr. R. K. Bansal, "Simulation & Performance Analysis of Wired and Wireless Computer Networks," International Journal of Computer Applications (0975-8887), Volume 14, No.7, February 2011.

[4]. Yong-Jin Lee, M. Atiquzzaman, "Optimal Delay-Constrained Minimum Cost Loop Algorithm for Local Computer Network" Proceedings of the 10th IEEE Symposium on Computers and Communications (ISCC 2005), 1530-1346/05, 2005.

[5]. Zhaoyi Lu, Lihong Wang, Dongyi Yao, "Study on the modelling of timed-token protocol", Applied Mathematical Modelling Vol. 26, pp. 797–805, (2002).

[6]. Edward Chan, Daoxu Chen, Victor C.S. Lee, "Effectiveness of the FDDI-M protocol in supporting synchronoustraffic", The Journal of Systems and Software, Vol. 56, pp. 51-62, (2001).

[7]. Izhak Rubin, James C.-H. Wu, "Analysis of an FDDI network supporting stations with single-packet buffers", Computer Networks and ISDN Systems, Vol. 29, pp. 249-266, (1997).

[8]. Lionel C. Briand, Jurgen Wust, John W. Daly, D. Victor Porter," Exploring the

 ISSN: 2581-5113

relationships between design measures and software quality in object-oriented systems", The Journal of Systems and Software 51 (2000) 245-273.

[9]. Ioannis E. Kassotakis, Maria E. Markaki, and Athanasios V. Vasilakos, "A Hybrid Genetic Approach for Channel Reuse in Multiple Access Telecommunication Networks", IEEE Journal on Selected Areas in Communications, Vol. 18, No. 2, February 2000.

[10]. Marco Conti, Lorenzo Donatiello, and Marco Furini, "Design and Analysis of RT-Ring: A Protocol for Supporting Real-Time Communications", IEEE Transactions on Industrial Electronics, Vol. 49, No. 6, pp. 1214-1226, December 2002.

[11]. Pramod Singh Rathore and Atul Chaudhary. Article: Algorithm for Route Planning via Facilities with Time Dependent. International Journal of Computer Applications 64(6): 26-29, February 2013.

[12]. "Networking: A Primer," pp. 4-5.

[13]. Halsall, Fred, "Data Communications, Computer Networks, and Open Systems", Addison-Wesley, 1996, pp. 289-300.

[14]. Neeraj Bhargava, Ritu Bhargava, Pramod Singh, Abhishek Kumar, September 2017 Volume-5 Issue-9 "An Adaptive Method of Odd-Even Scanning (OES) Algorithm in WSN For Enhancing Network Efficiency", International Journal of Advanced Computational Engineering and Networking, PP: 86-90.

[15]. Halsall, Fred, "Data Communications, Computer Networks, and Open Systems", Addison-Wesley, 1996, pp. 304.

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