iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** XII **Month of publication:** December 2021

DOI: https://doi.org/10.22214/ijraset.2021.39673

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

Performance Metrics for Bluetooth Scatternet Scheduling Using Relays

Ravi Kishore Veluri[1], Dr. Neeraj Sharma[2], Dr. V. V. Krishna[3]
[1]*Research Scholar, Department of CSE, SSSUTMS, Sehore.*
[2]*Associate Professor, Professor in CSE, SSSUTMS, Sehore.*
[3]*Professor in IT, Vasavi College of Engineering, Hyderabad*

Abstract: ***While various ad hoc mobile wireless networks are already accessible, Bluetooth is one of the most up-to-date. A single-hop connection known as piconet is a simple Bluetooth communication architecture, allowing for just eight functioning electronic equipment, seven of which are operational slaves under a single master. A common hub called a relay links a huge network named Scatternet to a number of piconets. The efficacy of Scatternet design is clearly intrinsically connected to the effectiveness of relay nodes. Because every relay has several piconet transactions to process and manage, a reduction in the number of switches might lead to poor performance instead. The major aim of this research is to examine performance characteristics which impact interplay since the role of the base station is to multiple piconet transitions. In this study, we evaluate and respond to the technical issues that must be optimally solved the Scatternet data flow based on the relay node.***
Keywords: Bluetooth, Piconet, Scatternet, Relay Node

I. INTRODUCTION

The state-of-the-art wireless communication technology is Bluetooth. Bluetooth is an advantageous standard for short wireless communication with minimum power, due to the requirement for networking between these devices. Not only for long-range communication, cable substitute technology is effective but also excellent data transfer for short-range WSN connections.

The Bluetooth technology operates with a free, worldwide licensed frequency of 1 MBPs (ISM). The frequency hopping (FH) approach reduces interference, which changes the carrier frequency on each packet transmission. For Bluetooth, the hop transporters mentioned are 79 with either an ISM range of 1 MHz. Before genuine communication can begin[1], Bluetooth users need to create algorithms to communicate. Bluetooth is able to connect to 8 network nodes, irrespective of the size or location of a network development partner as a piconet. There is one principal device (master) in this system that manages access to the channels, while another seven slaves have lesser power. All communication channels are always under the headmaster's cautious observation. Only one master should be linked to the piconet route. Every seven slaves are used and about 255 more may be retained as long as the piconet has an overview line. Master Piconet Slaves The piconet channels employ frequency hopping to keep them in sync with the Master Piconet control frequency. The master and also the slaves utilize TDD slots to talk to one other.

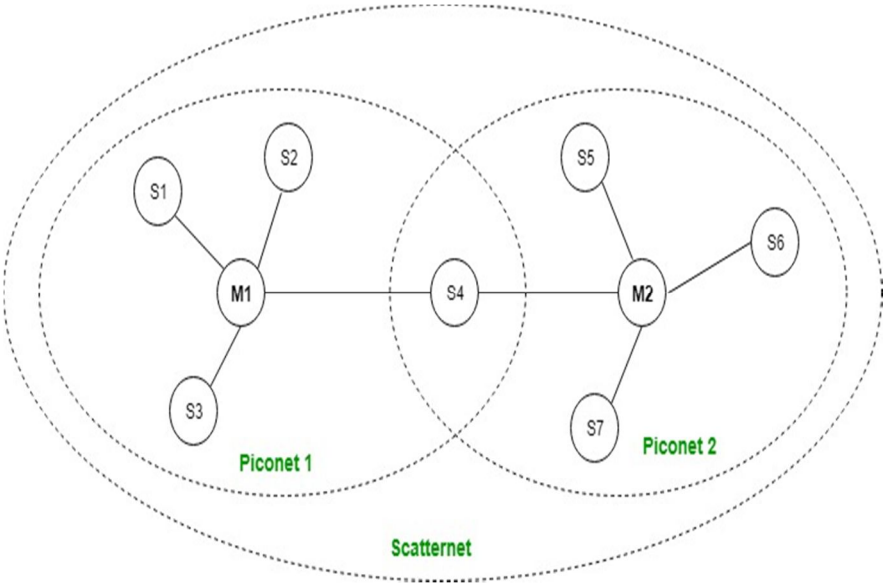
The channel is divided into 625µs slots. The piconet among master and slave may be synchronous as well as asynchronous. In even numeric slots, distribution between master to slave begins, whereas communication from slave to creator begins in strange numeric spaces. Downlink is the master slave communication while uplink is the master slave communication. The Bluetooth Session is a downstream packet with the uplink packet below. The master interacts with the slaves by sending packets and data. Only when the master greets the master's slaves. Data are transferred in packets with 1, 3 or 5 slots to subsequent slots. The frequency stays unchanged during the packet transmission process the frequencies are varied and the dependability of communication before the next packet transfer is enhanced. If the slave master does not have the information, it delivers the slave to the 1 slot NULL member content packet to the slave and delivering it. The master and the intended slave do not communicate using the same communication channel at the same time, as described above. [1, 3]. A larger network known as Scatternet is created when a huge proportion of Bluetooth devices exceed the piconet limit in one place. A Bluetooth device may utilize more than one piconet. The bridge as well as relay unit is the device which forms part of a piconet. Scatternet design is considerably constrained in the absence of bridge nodes or additional slaves (3 - 7). A relay may be engaged at any moment just one piconet. The communication is indeed restricted to other piconets. Once the relay has finished in the current piconet for the required period, it is transferred to the next piconet. This results in delays and decreases network performance. This issue is recognized as an issue with interpersonal planning. There have been several inter-piconet communication protocols.

©IJRASET: All Rights are Reserved

Since scatternet is an intra transmission line, the input and output devices could be on different piconets, requiring many hops to transmit the information. Several research papers recommended that packets be routed from and to their destination. A lot of effort has been performed in the bridge switching area. Incorrect inter-piconet scheduling might significantly effect system performance. Specifications for inter-piconet scheduling are not exact, although there are no suggestions from Bluetooth. More research is required to discover solutions to the problems. As a result, novel inter-iconet communication mechanisms have been developed[8, 9]. The aim of the research is to examine inter-piconet scheduling strategies based on relays and to see whether affordable and efficient solution towards the inter-piconet scheduling issue exists or not. Inter-piconet proposed methods are crucial in designing and optimizing since they Could give insight into their creation and execution. This work is arranged as described in the preamble. Part 2 gives an introductory examination of Bluetooth satellite technology and Section 3 includes measures of performance. In section 4, the outcomes of the simulation are summarized.

II. CONTEXT

A piconet may have up to 8 devices. If there were other than 8 devices, two or more piconets are required to cover them all. Scatternet consists of many linked piconets. Every network device may play one of three functions in a piconet: master, slave, nor relay. The Master is really a device which organizes the operations throughout the piconet and is fully aware of the piconet. Just the master may talk to the slaves. The scatternet is the connection between piconets and a relay node. Only packets between piconets are sent the relay node inside the scatternet. Each master of the piconet gives to each engaged slave a distinct Active Member Identify (AMI). Bluetooth utilises a time-division-duplex access technique dividing one second into 1600 625 second time slots. As previously indicated. The master is granted the same time frame to forward packets to the master's slave. The slave who gets a packet with an even slot from the master has the right to transfer that packet to the master. A relay that switches across piconets while participating in many piconets synchronizes with each piconet's hopping sequence.



The structure of Scatternet Fig.1.

The Bluetooth technical standard[1] does not yet explain how bridges may manage journeys in various piconets. This is a topic that is presently undergoing a lot of investigation. Although the functionality of scatternet is superb, several shortcomings render the application unstable. The bridge device may flip between slave and master modes to start with. Second, if numerous profiles are run on one device at the same time, there is an issue that is not addressed by the Bluetooth standard. Many metrics of performance can also be used to assess the success of a sattern. A master controls the packet flow here between slaves of a piconet. It requires a great deal more electricity. As a consequence, the quantity of masters should be maintained to a minimum in a satellite. Similarly, the frequency of bridges should not exceed that ever since a bridges node distributes its work amongst the piconets it belongs to, hence spending more energy on the bridge. If an M/S bridge works as a slave, all the operations in its piconets will be postponed and the capacity will be reduced.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

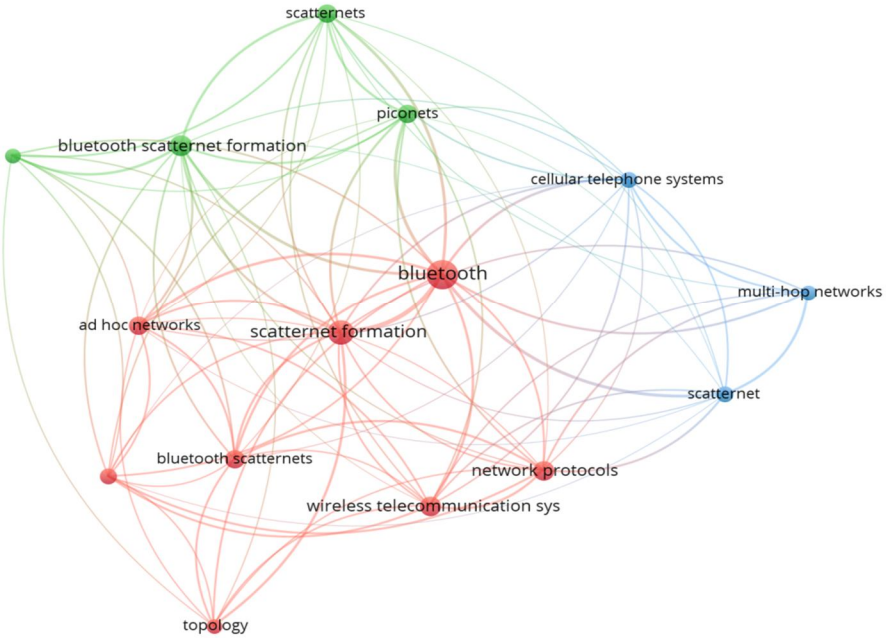


Fig 2.Network Visualization in Bluetooth scatternets

III. PERFORMANCE METRICS

The major measures used to assess planning performance are the recovery from the break, repair of links, prediction of breaks and reduction of relay. Below is a quick summary of the parameters.

A. Link Recovery for Breakage

It is suggested to use a new Path Breakage Prediction (RBP) protocol to predict connection failure before it occurs. A Route Breakage Prediction method avoids data packets from being lost and lowers the amount of time required for recovery. Following the proposed protocol, a table is maintained by each of the master devices and bridge devices in the network.

The master device creates a Master Record Table (MRT), which contains the records of all connected slaves, although the bridge device creates a Bridge Record Table (BRT), which contains the records of all attached masters with in Bluetooth network, and the two devices communicate with one another via Bluetooth.

The suggested protocol predicts the failure of a link based on the intensity of the signal received. Because the master and bridge technologies are responsible for establishing a communication channel between both the source and destination in a Bluetooth network, each master device chooses a Fall-Back Master (FBM) among its connected slaves, and each bridge device choose a Fall-Back Bridge (FBB) from among its connected slaves (FBB). The FBM may be readily picked by the master device from among its slaves; a slave equipment that is within coverage area of all the other slaves is chosen as the FBM by the master device.

B. Repair link

This section comprises of the Inter piconet Communication Link Repairing method that fixes damaged links locally.

1) *Information on Relay:* Each master keeps relay data in a relaying table, where the master records relay ID and clock drift and degree. Table I shows in an ascending sequence the master within each piconet and first chart contains the relay ID. The connectivity here between masters is 1 and null signifies that the master has no connection. M2 maintains a Relay Connection Table (RCT) based on Fig. 2, as presented in Table I. R1 connects M1 and M2, thus their correspondence is 1, while the remainder is null. By taking into account the degree each master selects the relay locally as per the DRR. The key difference between the approach presented and also the DRR would be that the DRR eliminates the information of the lower grade relay nodes from the relief table & assigns them to slave roles. However, the technology suggested does not delete the below on relay node information and assigns the lower degree nodes to the backup relay (BR) function. With Bluetooth devices linked to Ad Hoc Network, devices can be moved arbitrarily

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

C. Link Breakage Prediction

Link Breakage Predictions [11] is a way to predict a connection break before the link breaks. The signal intensity is employed to prevent a connection breakdown. Each master & bridge contains a database that tracks all connected devices. A beginning value is provided for the signal strength. A fresh device is chosen for master or relay whenever the value for the master or channel node lowers to a minimum.

If the present Relay Node Ri signal strength is poor,
    = search relay list Renew (mi)
    If NULL is not renewed then
    Set rnew as the source vertex relay
Otherwise
    Change of roles(slave index)
    Exit if
Exit if

After a certain threshold is reached in the data transmission of the master, all of the slaves are elected as masters simultaneously. If the link of the relay network fails, one of the base stations is selected as the intermediary node. If the scenario does not have a relay node, a roll-switch operation is done. The procedure for forecasting a break is shown above.

IV. STUDY PERFORMANCE

The performance of various programming methods should be reassessed in accordance with the abovementioned parameters of the Inter-piconet communications platform.

The simulation is running on NS2 and the Bluetooth extension has been activated. The Round Robin approach is used to analyze the quality of the aforementioned metrics in order to assess if effective inter-piconet planning is possible. Table 1 shows the parameters of the simulation.

A. Network Delay

Link Breakage Recovery (LBR) is just a relatively expensive solution to retrieval of broken links. The link repair technique is used to mend the damaged link. Link repair. Due to the failure of Link Breakage Prediction (LBP) to find the replacement route for damaged connections, the total latency is minimised. The network latency for the aforementioned experiments is shown in Figure 2. As the remaining nodes in the satellite rise, the bandwidth of the whole network rises. Link Reparation & Link Breakage Prediction minimises network delay during packet transmission.

Delay	**Simple Packet Forwarding**	**Complex Payload Modifications**
Transmission delay	$10\mu s$	$10\mu s$
Propagation delay	$1{,}000\mu s$	$1{,}000\mu s$
Processing delay	$10\mu s$	$1{,}000\mu s$
Queuing delay	$0 \ldots \infty$	$0 \ldots \infty$
Fraction of processing delay to total delay	$\sim 1\%$	$\sim 50\%$

B. The Performance

The total return of efficient messages delivered or the amount of bytes received by a Bluetooth device per unit is referred to as performance. Packet loss rises with the number of relays. As seen in figure 3, the breakdown of the transmission connection effects the scatternet's performance. LR is more efficient than other throughput metrics.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

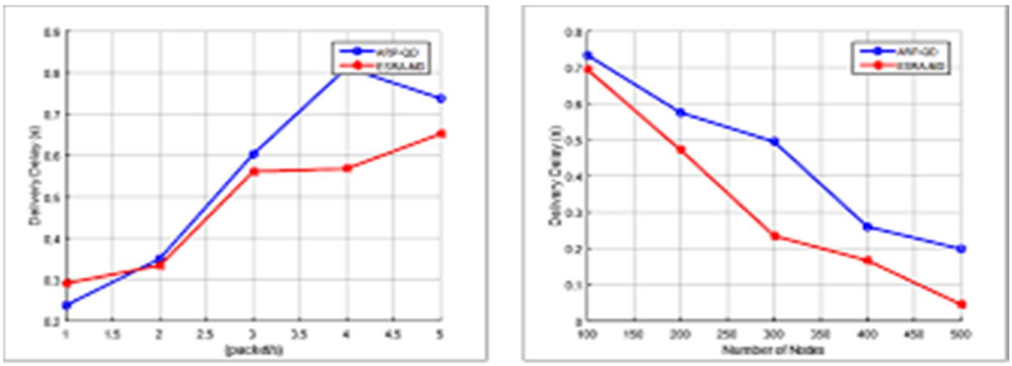


Fig 2. No.of Nodes Vs Network delay

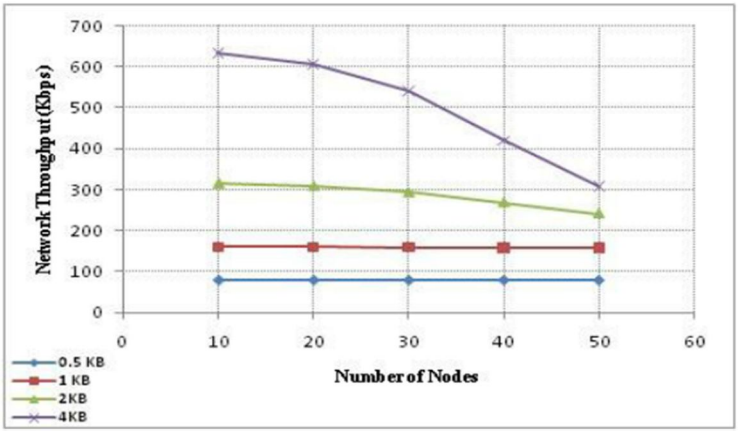


Fig 3.Performance versus Node number

C. Packet Loss

Packet loss happens when packets refuse to be sent to their destination. Figure 4 shows the median packet loss for different node counts. If a link breaks in LBR, a considerable of packet loss occurs. Due to a maintenance connection and failure prediction, the number of nodes lost during transfer is minimized.

V. CONCLUSION

In the research, we gave numerous performance measures based on relay nodes to provide a programming approach for a Bluetooth-based Intra ad-hoc wireless network. We also analyse the impact of adding these performance data in relation to relay performance characteristics in varied node counts. The interpiconet routing with in Scatternet architecture should take specific performance parameters into mind to facilitate effective communication.

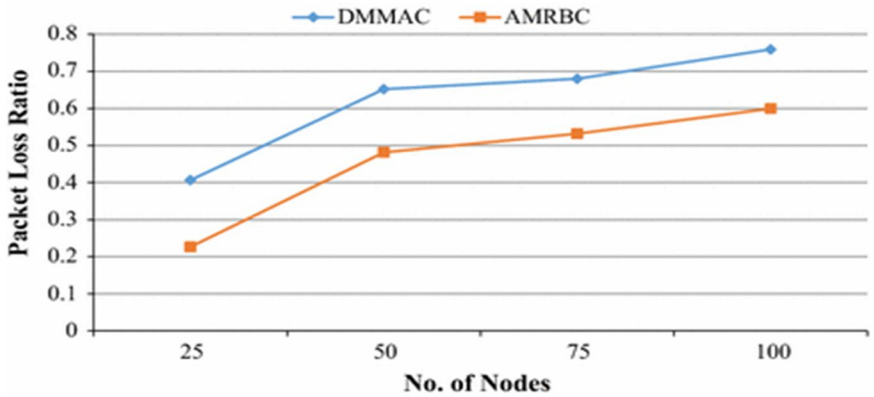
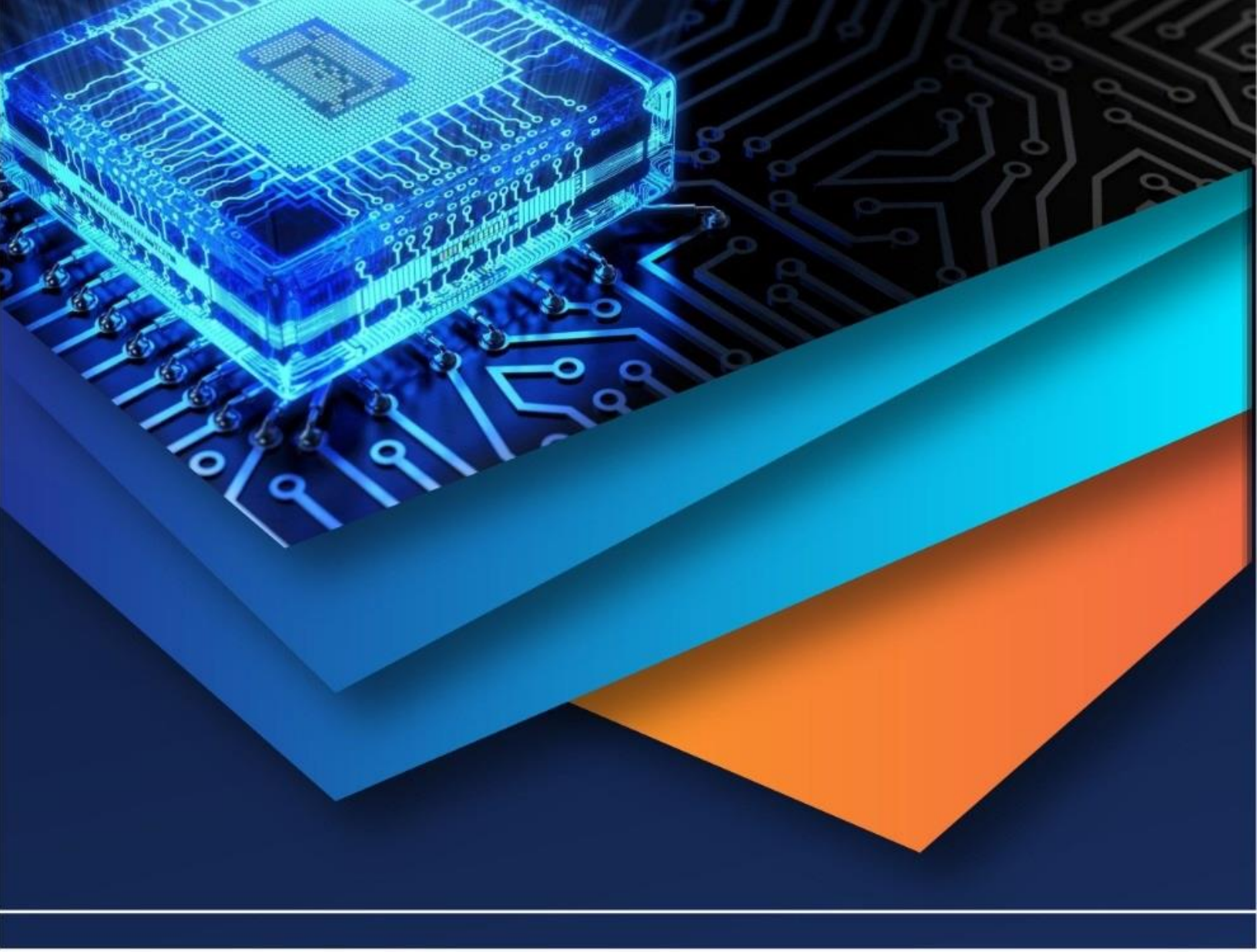


Fig 4. Loss ratio of both the packet Vs node number

REFERENCES

[1] Ramachandran Kanagavalli, B. Sankaragomathi. "Relay Based Performance Metrics of Bluetooth Scatternet Scheduling" , Indonesian Journal of Electrical Engineering and Computer Science, 2018
[2] Yu, C.-M., Yu, Y.-B. Joint Layer-Based Formation and Self-Routing Algorithm for Bluetooth Multihop Networks 2018 IEEE Systems Journal 12(1), pp. 41-51.
[3] VojislavB.Misic, JelenaMisic, Bluetooth Polling and Bridge Scheduling Algorithms (TR03/04, 2003).
[4] Ronen Kofman, Gil Zussmaan and Adrian Segall, "Bluetooth Scatternets Inter-Piconet Scheduling," PROC. OPNETWORK 2002, Aug. 2002.
[5] Manish Kalia, Sumitgarg, IBM India Research Lab, Rajeev Shorey, "Scatternet Structure and Bluetooth Communication."
[6] Ramana Reddy, Et Al., Wireless Networks 2010;16:pp. 1799–1816, "En Efficient Algorithm For Scheduling in Bluetooth Piconets And Scatternets."
[7] Sheik Tahir Bakhsh, Halabihasbullah, Sabeen Tahir, 'Bluetooth Scatternet dynamic relays management protocol;' 2012 Computers and Electrical Engineering pp. 626-642.
[8] Johansson.P, Kapoor.R, Kazantzidis.M, Gerla.M," Bluetooth Scatternet Rendezvous Scheduling," IEEE International Communications Conference 2002; pp.318-324.
[9] Johansson.P, Kapoor.R, Kazantzidis.M, Gerla.M," Bluetooth Scatternet Rendezvous Scheduling," IEEE International Communications Conference 2002; pp.318-324.
[10] Johansson.P, Kapoor.R, Kazantzidis.M, Gerla.M," Bluetooth Scatternet Rendezvous Scheduling," IEEE International Communications Conference 2002; pp.318-324.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)