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Congestion Control Ability of AODV and AOMDV Routing Protocols in MANET

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Abstract—This Mobile Ad hoc Network (MANET) is forming the dynamic topology and maintained connectivity with neighbor nodes. The routing protocols of MANET are completely different with other network (Wired and Wireless) because the mobile nodes are continuously moving with random mobility in network. Due to the random mobility the routing process is affected and packet dropping is degrades the network performance. In this paper we present the routing performance of unipath AODV and Multipath AOMDV protocol. The simulation results are shows that the performance of AOMDV multipath routing is much better than unipath AODV routing because of more than one path are instantly available to break the existing path in network. The multipath routing is also able to handle the possibility of congestion and handled the extra load on network and balance the load properly that is the main factor not handled by unipath AODV routing protocol. The multipath protocol are improves the routing capability and improves the performance of network. The multipath properly handled the possibility of congestion by that the packet loss also minimized in network.

Keywords—MANET, Routing, AODV, AOMDV, Congestion

I. INTRODUCTION

Mobile Ad hoc Network is an independent, self-organized wireless mobile network. It does not require any fixed infrastructure such as base stations to operate. The nodes themselves address topology changes due to the mobility and to the arrival and departure of nodes from the network. Each mobile node in an ad hoc network moves randomly and acts as both a router and a host [1]. A Mobile Ad-hoc network consists of a collection of mobile nodes that are capable of communicating with each other without help from a fixed infrastructure. The interconnections between nodes are capable of changing on a continual and arbitrary basis. Nodes within each other's radio range communicate directly via wireless links, while those that are far apart use other nodes as relays. Nodes usually share the same physical media; they transmit and acquire signals at the same frequency band. However, due to their inherent characteristics of dynamic topology and lack of centralized management security therefore routing in MANET is the challenging task.

In a MANET, communication links are unstable due to various reasons such as interference of radio signal, radio channel contention, mobility of the nodes and battery depletion. The wireless network have limited bandwidth and are more prone to error than wired networks which further impose limits on the amount of data that can be sent. Hence, in order to conserve the limited resources, it is highly desirable that transmission should be as efficient as possible (minimal loss) [2]. The main objective of congestion control is to limit the delay and buffer overflow caused by network congestion and provide better performance of the network.

In mobile wireless ad hoc networks the key issue is network congestion and traffic blocking. The congestion occurs in mobile ad hoc networks due to limited availability of resources. The packet transmission in these networks experience interference and fading owing to shared wireless channel and dynamic topology. The network is loaded because of transmission errors. The multimedia communication in MANET is developing with increased demand in recent times. Real time traffic lead to high bandwidth and it results in congestion. Further, congestion causes [3] packet losses and bandwidth degradation and hence can waste time and resources on congestion recovery.

AOMDV (on-demand, multipath distance vector routing protocol) is a routing protocol specially designed for MANET environment. On demand multipath protocols discover multiple paths between the source and the destination in a single route discovery. So, a new route discovery is needed only when all these paths fail [4]. AOMDV extends the AODV protocol to discover multiple paths between the source and the destination in every route discovery. Multiple paths so computed are guaranteed to be loop-free and disjoint. AOMDV has three novel aspects compared to other on-demand multipath protocols. First, it does not have high inter-nodal coordination overheads. Second, it ensures disjointness of alternate routes via distributed computation without the use of source routing. Finally, AOMDV computes alternate paths with minimal additional overhead over AODV.

II. RELATED WORK

Here we are presenting survey about existing work done in the field of MANET routing protocol, congestion control and load balancing mechanism.

Makoto Ikeda, Elis Kulla et. al. “Congestion Control for Multi-flow Traffic in Wireless Mobile Ad-hoc Networks” [4] In this paper, we deal with congestion control for multi-flow traffic in wireless mobile ad-hoc networks (MANET) using OLSR routing. This approach done through OLSR routing we also apply multi flow in AODV routing approach.

M. Ali, B. G Stewart et. al. In his work titled "Multipath Routing Backbones for Load Balancing in Mobile Ad Hoc Networks" [5] This paper presents a new approach based on multipath routing backbones for enhanced load balancing in MANETs. Nodes in MANETs greatly differ with each other in terms of communication and processing capabilities. In the proposed approach, multiple routing backbones are identified from source to destination using intermediate nodes that have better communication and processing capabilities to take part in the mobile routing backbones and efficiently participate in the routing process. This work use multipath technique but not execute multipath simultaneously that case use alternative base load balancing technique.

Yuanyuan ZOU, Yang TAO at el [6] proposed a "A Method of Selecting Path Based on Neighbor Stability in Ad Hoc Network" in this paper we studies about routing algorithm based on the stability in mobile Ad-Hoc network and presents a routing mechanism based on neighbor stability. They put the mechanism in multicast routing protocol MAODV [4] and propose a improved routing algorithm NBS-MAODV which is based on MAODV algorithm. NBS-MAODV algorithm sends data according to the neighbor stability metric in the path construction process. It can reduce the times of link fracture caused by network mobility and increase the total overhead of network.

Ashish Bagwari et al [7] proposed "Performance of AODV Routing Protocol with increasing the MANET Nodes and its effects on QoS of Mobile Ad hoc Networks" In this paper they are analyzing the performance of reactive routing protocol via enhancing number of nodes and observe how it effects to QoS of existing mobile Ad-hoc network. Here Mobile ad-hoc network are dividing into clusters. Each cluster has MANET node with CHG. From one cluster to another cluster or within the cluster we applied reactive routing protocols specifically AODV to evaluate AODV protocol behavior and performance and check what kind of effect made by particular protocol on QoS.

Finally, they concluded results that confirm AODV giving better performs under such types of circumstances, providing better QoS based on good throughput and acceptable End-End Delay, less data drops. One of the notable features of this AODV protocol strategy is that, it reduces our network load which can be responsible for congestion at the time of communication. Therefore it can be used to extend the network coverage.

III. PROPOSED WORK

The Ad-hoc On-Demand Distance Vector (AODV) protocol is a reactive protocol designed for ad-hoc networks. AODV uses a broadcast route discovery mechanism which relies on dynamically established routing table entries at intermediate nodes. AODV floods the whole network with Route Request packets (RREQ) and Route Reply (RREP) packets. This flooding leads to high overhead.

Multipath on-demand protocols try to improve these problems by computing and caching multiple paths obtained during a single route discovery process. The link failures in the primary path, through which data transmission is actually taking place, cause the source to switch to an alternate path instead of initiating another route discovery. A new route discovery occurs only when all pre-computed paths break. This approach can result in reduced delay since packets do not need to be buffered at the source when an alternate path is available.

Current protocol provides multipath route discovery and path maintenance mechanism on the basis of a calculated cumulative metric value only on signal strength between two nodes in a path. This metric only address strength of link of the current path, does not address the durability of the path; which fully depends on the load of node .Also does not consider the consistency of node through the previous behaviour. Since it does not consider node's behaviour and energy, it cannot be applied in heterogeneous MANETS having high mobility nature.

The multipath routing protocol having a benefit to reduce routing overhead and throughput in network as compare to unipath routing protocol.

A. Experimental Architecture

In our approach we use data collection tool as network simulator -2 that gives the behaviour of network and analyses approach for our work.

A network simulator is a piece of software or hardware that predicts the behavior of a network, without an actual network being present. A network simulator is a software program that imitates the working of a computer network. In simulators, the computer network is typically modelled with devices, traffic etc. and the performance is analyzed. Typically, users can then customize the simulator to fulfil their specific analysis needs. Simulators typically come with support for the most popular protocols in use today, such as WLAN, Wi-Max, UDP, and TCP and MANET protocol like AODV, AOMDV etc.

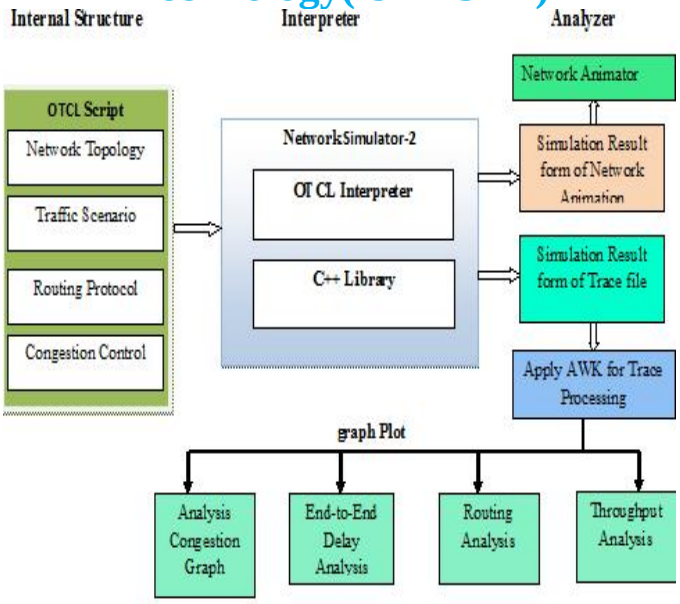

Fig. 1 Data collection module Architecture

In data collection module provide the information about internal, intermediate and outer structure of simulation structure through this scheme we collect data and analyze them. All the internal module coded through C++ (object oriented approach) and outer module coded through TCL (tool command language base) both are interlinked via object file that generated after compilation of internal C++ file and all are collectively called OTCL (object tool command language). For analysis purpose we use AWK (abstract window tool kit) and generate result in the form of graphically approach.

IV. Simulation Environment

In 1996-97, work on ns version 2 (ns-2) was initiated based on a refactoring by Steve McCanne [8]. Use of Tcl was replaced by MIT's Object Tcl (OTcl), an object-oriented dialect of Tcl. The core of ns-2 is also written in C++, but the C++ simulation objects are linked to shadow objects in OTcl and variables can be linked between both language realms. Simulation scripts are written in the OTcl language, an extension of the Tcl scripting language. This structure permits simulations to be written and modified in an interpreted environment without having to resort to recompiling the simulator each time a structural change is made. In the timeframe in which ns-2 was introduced (mid-1990s), this provided both a significant convenience in avoiding many time-consuming recompilations, and also allowing potentially easier scripting syntax for describing simulations. ns-2 has a companion animation object known as the Network Animator, nam-1, originally written by Mark Handley, used for visualization of the simulation output and for (limited) graphical configuration of simulation scenarios.

In 1997, the DARPA Virtual Inter Network Test bed (VINT) project was initiated, including LBNL, Xerox PARC, UC Berkeley, and USC's Information Sciences Institute (ISI). The bulk of ns-2 development occurred during this timeframe. Software maintenance activities also migrated to ISI during this time period, eventually led by John Heidemann. After the conclusion of the VINT project, ns-2 continued to be funded during the 2001-04 timeframe by the DARPA SAMAN and NSF CONSER awards to USC/ISI.

V. Results Description

In this section the performance description of AODV and AOMDV protocols are discussed. The performance of AOMDV is showing the better results.

A. Packet Delivery Ratio Analysis

Is defined as the number of received data packets divided by the number of generated data packets (it's also percentage of data delivery in receiver end), in this graph shows packet delivery ratio analysis uni-path and multipath case where x-axis represent simulation time and y-axis shows parentage of data received by the receiver. At the time of multipath routing sender broadcast route packet and identifies number of route from sender to destination and after getting multiple path between them we transmit data and utilize all available path that work increases packet delivery ratio and balance the load of the each path, here in result uni-path case packet delivery ratio nearly 82% and multipath case 96% that result increases the performance of network.

Fig. 2 Packet Delivery Ratio Analysis

B. Routing Load Analysis:

The total number of routing packets transmitted that is also called routing overhead because number of routing packet broadcast before communication established, if routing packet is grater that means overhead is maximum. Here we analyze routing load uni-path as well as multipath case and we get minimum overhead that is nearly 6000 packet, if route broadcast on the bases of multipath then same time more than one route information retrieve and established the route between sender to receiver and after some time any one route disconnect than other route are live and sender can't broadcast route packet and minimize the route packet but uni-path case they not work and sender broadcast route if route fail and increase route packet of the network and decrease overall performance of the network.

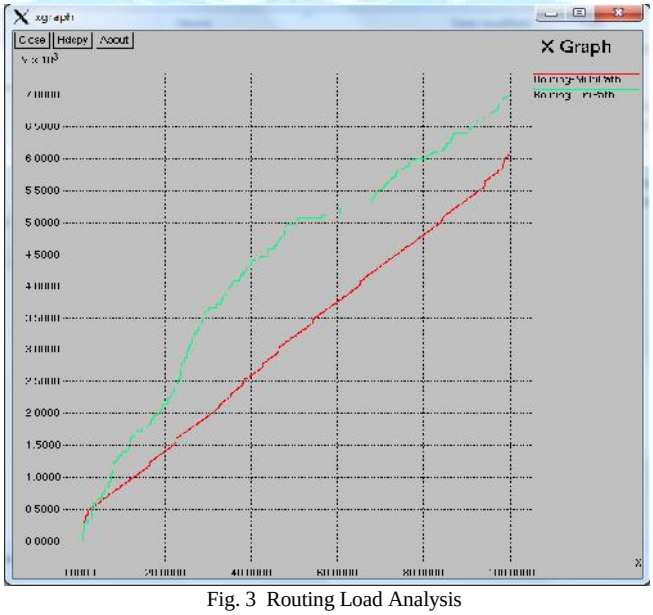

Fig. 3 Routing Load Analysis

C. Throughput Analysis

Here we analyze throughput in uni-path and Multipath time, throughput calculate on the bases of data receiving per unit time, in our simulation we taken simulation time in seconds manner, where X-axis shows simulation time in second and Y-axis shows throughput per unit time, if throughput greater means our performance is better, here if we take multipath routing than our throughput is greater than the uni-path routing.

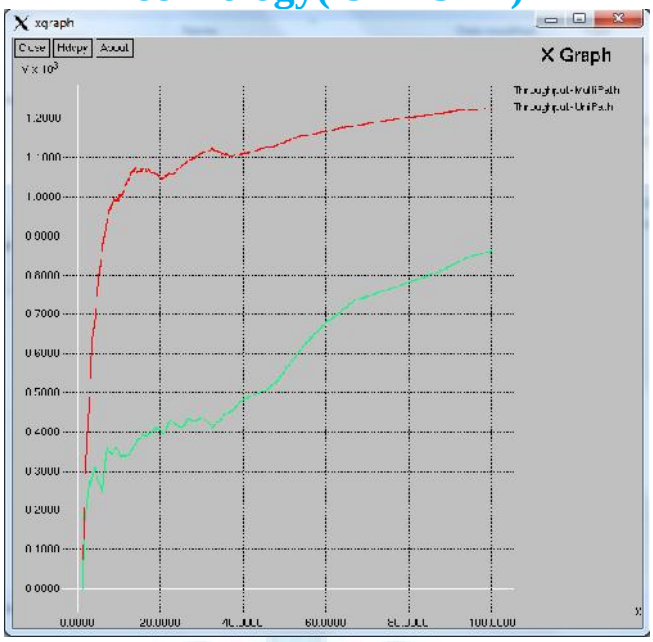

Fig. 5 Throughput analysis

D. UDP Data Receives Analysis

In this result we analyze user data gram data receiving in receiver end where UDP apply in transport layer that is connection less protocol means receiver not sends any acknowledgment to the sender, but provide fast communication and uses in video transmission, here we shows UDP data receiving in case of Multipath and Uni-path and found Multipath time gives better result.

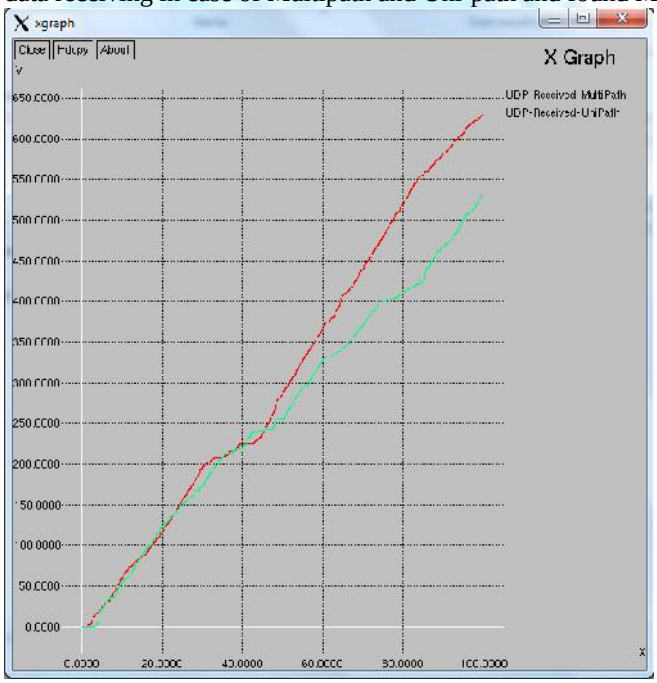

Fig. 6 UDP received analysis

E. UDP Data Loss Analysis

Loss factor is measure factor in any analysis because, if the loss minimum than our other parameter is better else poor, in fifty mobile node case we take UDP loss analysis and get multipath case minimum data drop as compare to Uni-path, and multipath routing save routing overhead and increases packet delivery ratio because that parameter effect the routing load as well as PDR result.

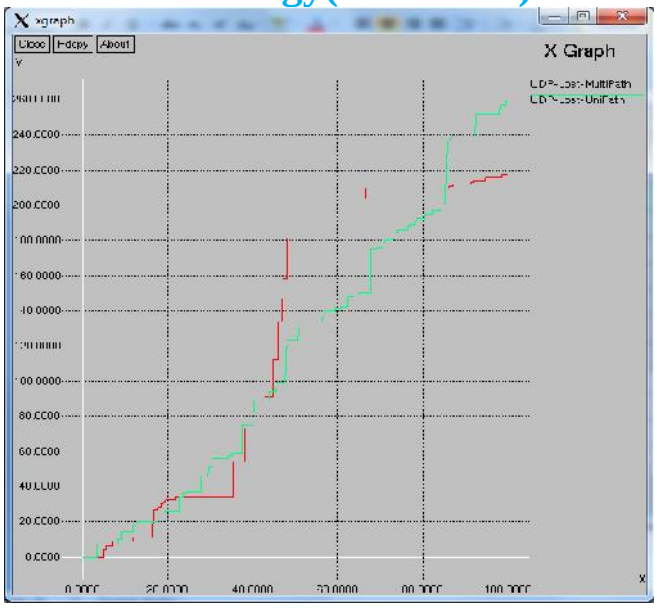

Fig. 7 UDP Lost Analysis

VI. CONCLUSION

Mobile Ad hoc network is dynamic in nature with no centralize control because every node works on temporary bases and frequently changes their location, that is why we can't predicate that where the actual destination node is and what movement the nodes can take. Some time it may happen that whole data or part of data is not reached at destination on time because of congestion or by other reasons in the network, since it is dropped in the network. So we have a need of such routing protocol that can send the packet from multiple paths by which if part of data is dropped at any hop, it will never cause loss at the end when it is collected since it will reach from other hops in network. The multipath AOMDV protocol has a capability to improve the routing strategy as compare to unipath AODV routing protocol. The performance matrices represent the performance of both the protocols and the routing performance of AOMDV is much better than AODV.

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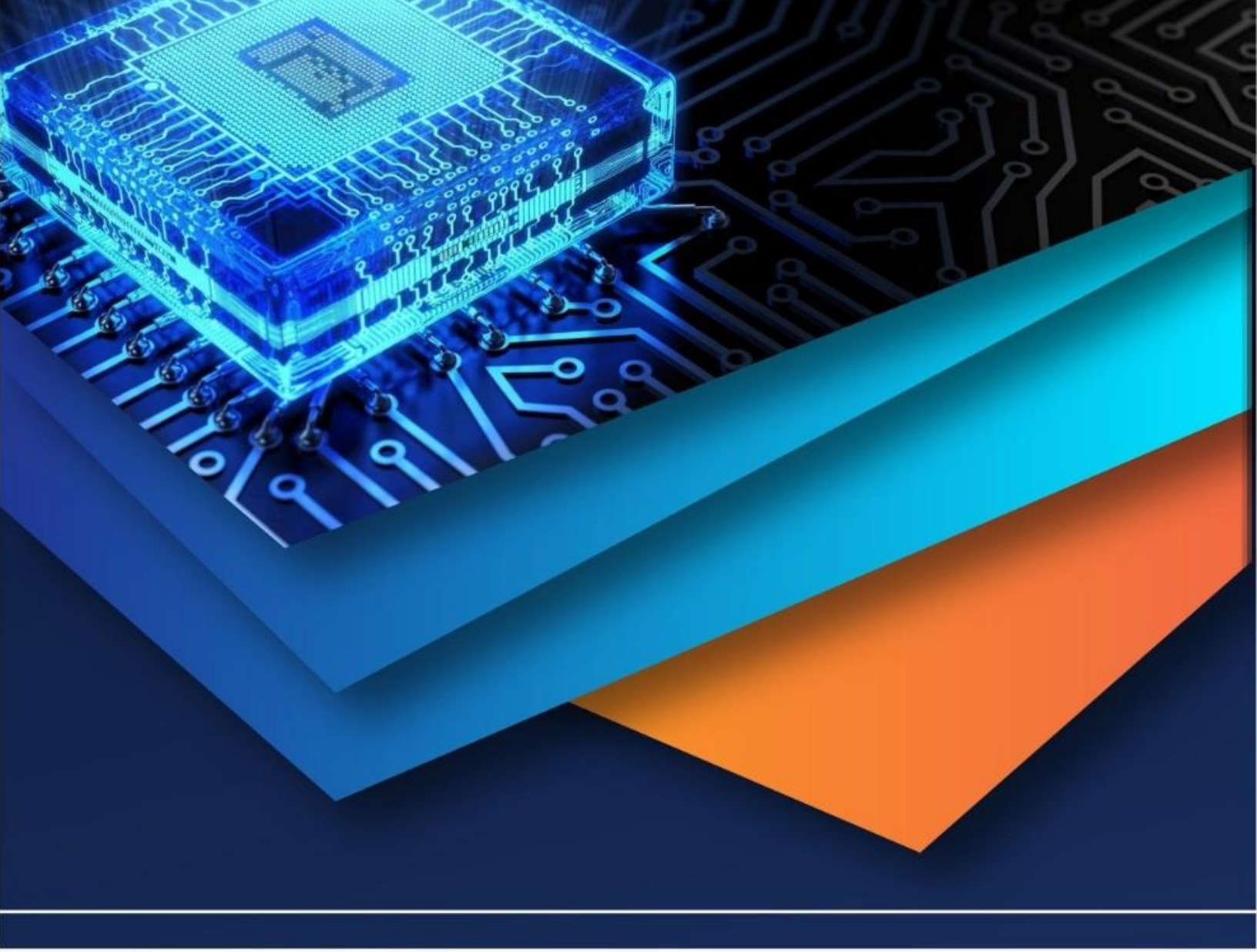

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