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Comparative Study of Video Routing Techniques

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Abstract: As the internet keeps growing the number of users also increase causing traffic in the network. Online video is the main cause of data traffic .To satisfies the user requirements high quality videos are provided to the user using heavy-weighed applications. Video Delivery using LANs over networking and joint source coding is used to increase the quality of the video delivery. Here many coding and networking components are integrated. Here a multi-layer stream of data is produced by an effective video coder called as 3D-OCTREE. Content management for a* UGC *video delivery system in mobile internet is used to provide a system which is highly scalable, flexible, high performance built using algorithms such as UGC measurement and analysis, Content Replication and request Routing. Optimizing Video Request Routing in Mobile Networks with Built-in Content Caching focuses to reduce the total link utilization and reduce the link cost by using fast algorithms and protocols like hop-by-hop increasing the efficiency for more videos to move in the path and hereby decreasing the cost of transporting the video. Adaptive Routing Algorithm for Joint Cloud Video Delivery uses many servers and clouds the algorithm is used to reduce the cost based on the service, area and quality this system to deliver videos uses flash terminals and light-weighted terminals it uses the URR algorithm for the video splitting and delivering it to the host by using joint cloud technique where the video is taken from the nearest region available. In this paper we take the algorithms and try to find a efficient algorithms that can be used to build a system that is reliable, less cost, available and a reduced buffer system considering the merits and de-merits of each algorithm.

Keywords: UGC, VOD, Diffserv, CDN, Joint Cloud, QoS.

I. INTRODUCTION

There is a tremendous change in the video services from past few years when noticed. In a report prepared by CISCO it shows that 82% of internet traffic will be caused due videos by 2020. There are various newly developed applications like high-quality video streaming, 4K technology etc. But all these methods need lot of infrastructure and resources. The methods of routing mainly deals with UGC or the VOD systems Mobile or wireless ad hoc network is an independent system with certain number of nodes which operates as host and also as routers .The connection between a pair of nodes can be done dynamically. This network does not require any pre- Existing network and reconfiguration and deployment can be done rapidly. To support the idea of Diffserva new QoS mechanism for routing is introduced. To take the advantage of the DiffServ a new method SAMS is introduced. The performance is measured by the quality of video in the end to end delivery [1]. In an Adaptive Content Management for UGC Video Delivery the introduction of managing the content, replication by joint content and routing request should be considered to design a highly scalable system. Next the temporal popularity of the video and the geographical distribution of the video with highest views is taken into consideration. Based on the popularity the content is replicated using routing algorithm at cost effective places and the server is selected being aware of the content [2]. The main objective of Optimizing Video Request Routing in Mobile Networks with Built-in Content Caching is to reduce total link utilization and reduce the total cost. Here first the routing of a video requested problem is solved by simultaneously selecting servers and the flow is through the LTE networks with cache in it. Next completely polynomial time algorithms is proposed to reduce the cost and link utilization, next we use hop-by-hop forwarding of packets with flow splitting rules to forward a outgoing packet[3]. Adaptive Routing Algorithm for Joint Cloud Video Delivery uses a new routing algorithm based on joint cloud. Here URR is used directly to get the on the clients to gather the status of the video playing by this a list can be made of the frequently preferred videos of the client and this can reduce the streaming cost and also can be used to optimize other factors. Here the algorithm is used to utilize the joint cloud and minimize the cost. Then a VOD system is built which is embedded with this algorithm and then the VOD system can be evaluated by gathering the log usage to check its performance [4].

II. LITERATURE SURVEY

Video routing is becoming challenging due to the tremendous growth of internet and the various services that are being provided. There are many methods that are already proposed and still research is being done to provide a buffer free smooth delivery of the video. And various factors are considered for video routing like availability, load balancing, multi-path flow, scalability,

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performance, cost etc. In this survey we consider few of the existing techniques and analyze to find an efficient technique to route the videos to meet the user requirement.

Hong Man and Yang Li[1] tells the wireless ad hoc network, or mobile ad hoc network is a set of mobile nodes which operate not only as hosts but they also act as routers[5]. The nodes not only can send and receive packet but also store and forward packets. This network does not require a pre-existing network infrastructure but it allows rapid deployment and reconfiguration. Here a new video routing method is introduced using wireless ad hoc IP network. To support differentiated services (DiffServ) over the networks new QoS algorithm are introduced. It includes several routing techniques such as load-aware, multipath discovery, class-based multipath routing to improve the QoS without letting down the performance. A concept of single-application multiple-stream (SAMS)is introduced here taking the benefits of DiffServ. SAMS is a progressive source coding property used in many state-of–the-art video coders. Using progressive coding layered or embedded data streams are generated in which bits are arranged from high importance to lower importance. Importance is measured by the contribution of the bit in construction of the video. There are different QoS path which is been provided by the DiffServ network, the compressed video stream can be divided into many sub-stream. The idea heres to allow important sub-streams to take path with high QoS and the less important sub-stream will take the path with low QoS. The performance is measured by end to end delivery of the video and its quality. In traditional data network we see that all the packets are treated equally but it is not true in the case of multimedia network. The DiffServ working with IETF has set up standardization for the quality of service and associated network management, traffic handling techniques for IP networks[6][7]. DiffServ code point (DSCP),is given to each packet which gives the class of services the packet must receive. Even if DiffServ was introduced for IP networks its application on ad-hoc networks is studied recently. A new QoS is developed which provides DiffServ over ad-hoc networks. The new QoS has the following components: 1)Load-aware multipath discovery.2)Class-based multipath routing at source node.3)Class-based queuing at intermediate nodes. The routing algorithm is source routing algorithm which uses dynamic source routing protocol (DSR). It is a complete source routing approach in which the route information is given by the source and is stored in the packet header. For the route discovery step the source will broadcast a route request packet. The route request packet will move to each intermediate node which will add its address and its queue length. When the destination receives the route request, it will send the route reply which contains the address and the aggregate queue length The DSR allows the intermediate node to reply if it has the route to the destination in its cache. The average queue length can give the traffic each intermediate node can hold. The source generally will get multiple responses for the same route. All these routes are stored in the cache of the source which helps for a quick response if any of the routes are damaged. The source data is divided into sub streams using SAMS. The sub streams will be classified into priority depending on the source quality layers. Same label and the TOS field is given to the packets having the same priority. Each priority stream will be sent in a particular route class and the route with lowest cost will used for packets of higher priority. CBQ is introduced to divide the queue into sub-queue dynamically. When the traffic is from the single class the entire queue is used but if the traffic is from two different classes then the traffic is divided among the sub-queue. The challenge here is to divide the streams based on their priority if streams are overloaded then they cannot achieve the performance even if the stream is from higher priority. But this is not a problem in ad-hoc networks because it is small scaled and application oriented. And in wireless local area network only one or two videos will be moving at a time generating dominate traffic flow.

Qilin Fan, Hao Yin, Zexun Jiang, Haojun Huang, Yan Luo, and Xu Zhang[2] tells about the two design frameworks that are used to satisfy the requirements such as1)High scalability 2)Flexibility[8] 3) High performance[9] 4) Controllable cost. The first design principle to support this framework is proactive self-adapting content management into content distribution. Content management is essential in a CDN for efficient video delivery. High dynamic access is a new feature for UGC video distribution in mobile internet environment. Hence a self-adapting content management mechanism is developed into UGC content delivery for satisfactory user experience. Merge content replication and request routing together is a second design principle used. The CDN decides where to replicate the data in an intelligent way this decision is making is called as content replication problem. Also the user faces a request routing problem that is the CDN should decide the best server that should be used to respond to the user. Both the problems are dependent on each other and both should be considered together to work efficiently.UGC Measurement and Analysis using this algorithm first the dataset is crawled using the snowball sampling in which the videos with missing information and non-UGC videos are removed. And the remaining videos attributes are collected such as:1)Total number of views 2)Views per day 3)How many views from which province 4)Its top ten lists of cities with more traffic. The following techniques are used in UGC Measurement and Analysis: Temporal Popularity is a method which is used to predict the popularity of the video in a day and also calculate the target number of views to that video. The prediction of the popularity of the video is calculated from the previous history and a minimum three days of views for a particular video is required. Geographic Location here analyse the geographical distribution of the views for the UGC videos in province granularity and city granularity. Province Granularity: Here for each video

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the geographic view from each province is are taken and sorted in a decreasing order. We then compute the cumulative distribution of the views and find the average popularity of each video. City Granularity: Here the top ten cities having a data traffic for the similar videos and the content is replicated in the local site so it can be accessed easily to avoid most of the traffic. Content Replication consists of three steps 1)Initial Replication first when the video is uploaded by a user the video will be in a server close to the uploader. 2) Replication Update first checks the number of views each video gets in a particular time. Only if the video exceeds a particular threshold it will be put in higher level.3) Request routing an abstract function QoS (u, r) the quantity of service of user u and replica r. The QoS can be related to many factors such as latency and network congestion. For a traditional CDN we use simple server selection mechanism that is selecting one replica with best QoS for a particular user. The working of a traditional CDN and compare it with a ACM-based CDN and conclude that the ACM- based CDN performs much better. There is improved latency between CDN and an ACM –based CDN, network load that is the number of videos transferred is more in ACM-CDN, server load in a traditional CDN is half of the load of ACM-bases CDN. Jun He and Wei Song[3] says that the goal is to minimize the maximum link use which is the LP problem the first problem is the link capacity and the second problem is the demand for a video at a particular node. The existing LP cannot be directly applied due to the large size of the video clips. Here consider two TE objectives: 1) Minimizing the maximum link utilization[10] 2) Minimizing the total link cost[11]. To minimize the maximum link utilization here the link capacity is checked and the demand for that video. The problem can be extremely large due to the large number of video clips and the LP techniques cannot be applied directly to solve this problem. Network cost is the cost of all the links. Here focus to minimize the aggregate cost of all edges. The delay in the end to end can also be dealt and this problem the problem can be converted into edge flow formulation and solved using optimal techniques but this is applicable for small and middle size problems. Here since we deal with large problem an approximate solution is considered obtained by LP techniques Algorithm for Min-Max Link Utilization here the request made by a destination node could be answered by many of the source nodes. The problem is the selection of the source node. One node is considered as the super source node and all the remaining nodes are connected to forming a directional with infinite capacity[12][13].Algorithm for Minimum Total Link Cost here a cost bound B is introduced but the optimal solution of the problem is larger than B. Hence binary search algorithm is used to find an optimal solution[14].The Routing Protocol instead of sending the decision to each router only the destination router is sent with the incoming traffic. Depending to the destination address a flow is split and sent to the next hops according to the routing table. Here it uses hop-by-hop forward designing Here to address the problem of real time video routing in mobile networks a fast approximation algorithm is introduced and practical routing protocol with hop to hop forwarding design is developed. Zexun Jiang and HaoYin[4] says that multi homing content is become a very important area of research due to the increasing internet and only a individual provider finds it difficult to provide all the facilities. In multi homing content the data is replicated among various servers cloud and then the data can be accessed from any of the servers to fulfil a request. To boost the overall performance in multi homing the data can use more than one server cloud using the Joint Cloud mechanism effectively[15].There are two methods used to extract the data required for the user. The first method uses the set of instructions from the user or pre-configured rules which are static. The second method focuses on balancing the load and the selecting the path dynamically. Industries use three different techniques:1)Integrators and switches are used in the first approach .Efficient usability is bought into existence by using API’s of commerce platform by joining many CDN’s.2)Balancing the loads belongs to the next category. Here a set of rules is used to split the data within multiple CDN’s 3)The third step is used to respond to the request in an interconnected CDN environment. Another related work is to manage the traffic of the videos. Here in the beginning information is gathered from the user and the cloud and then it decides how to send the video in a efficient manner. Here see that most of the methods are used to optimize the delay at the server-end and tries to minimize the delay from the server end to the client[15]. A client-end method is adopted this concept is used to measure the quality of the real-time playing video and the status of the network. The network status is used to find the servers that can be used to increase the downloading speed of the video and to minimize the time a video buffer.

III. ALGORITHM COMPARISION

Content replication algorithm :The algorithm below is the content replication algorithm which is being used in Adaptive Content Management for UGC Video Delivery in Mobile Internet Era by Qilin Fan, Hao Yin, Zexun Jiang, Haojun Huang, Yan Luo, and Xu Zhang. The replication can be done in three steps [2]:In the first step of the algorithm the content is uploaded in the nearest server of the uploader called as Intial Replication [2].In the second step the video is replicated in the servers of the location having the maximum number of views called as Replication Update. The videos that have a threshold between medium threshold and hot threshold if it exceeds it then the video will enter a level called as cold level for permanent storage of the video [2]. In the final step

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the QoS of the video is considered which is received by the viewer this step is called as Request Routing. The factors such as scalability, latency, congestion can be considered for QoS[2].

1) If video v is newly uploaded then
2) Replicate the video v to the closest cold location
3) Else
4) Calculate the views for video v
5) If (number of views< medium threshold) then
6) If v is hot or medium level at time t-1
7) Delete video from hot or medium level
8) End if
9) Else if number of views is greater medium threshold and less than hot threshold then
10) For location is a medium level location do
11) If views at time t is greater than the views at medium geographic area
12) Replicate video at that location l
13) End if
14) End for
15) Remove the extra copies in hot or medium level
16) Else
17) For location is a hot level location
18) If views at time t is greater than the views at hot geographic area
19) Replicate video at that location l
20) End if
21) End for
22) Remove the extra copies in hot or medium level
23) End if
24) End id

Algorithm -1: Content Replication Algorithm

Algorithm for min-max link utilization: Here for every video request k at node i, has one destination but any sources. To solve this problem a super source is introduced which is connected to every node. Here the super source decides the path the video has to take.The main focus here is to reduce the link utilization for the delivery of the videos so that multiple videos can move concurrently in the link[3].

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Input: Network graph G=(N,V,E)
Output: Primal solution y and π

1) Initialize the load at the edge by knowing the capacity of the edge
2) While the load of demanded video < 1 do
3) For node j=1 to v do
4) For set of requests at node initialize ,$d^k_{j=}d^k_j$[demand for any video]
5) While load of demanded video L < 1 and demand for any video >0
6) the requested video is available d^k_j>0
7) the shortest path is used to send the video from set of paths available
8) the set of in-network paths are considered to check the link utilization
9) for video requested is provided do
10) the flow of the video depends on the dividend of demand for any video and video requested is provided
11) demand for any video is the difference of demand for any video and flow
12) the primal solution for the is of paths is he sum of primal solution and flow
13) end for
14) load at edge e is the load at edge taking the factors like path ,flow and the capacity of the edge
15) end while
16) end for
17) end while
18) primal solution is the quotient of primal solution considering the log value of € π is the minimum value of summation of path available and the path available o he request

Algorithm -2: Min-Max Link Utilization Algorithm

Urralgorithm: Consider a video v is considered with its total duration t_{play} The video is divided into m time slices of equal duration. $D_t$is the minimum size of the chunks that can be can be downloaded for a smooth playing of the video in a time slice. $D_{pre}$is the amount of data that is unfinished from the previous time slice [4].Before the client wants to play a video he requests the server list from the different cloud. The servers that can fulfill the request are given in a particular order according to their priority. The priority is calculated by the factors such as performance, optimization parameters and the cost. The priority list is a sorted list of n-servers given as:**$S = \{ (s_1,p_1), (s_2,p_2),\ldots\ldots,(s_n,p_n) \}$**$s_{1\ldots}s_n$are the list of servers containing the video request with a priority of s_i bring p_i and $s_1>s_2>\ldots>s_n$

Input:

1. Video v.
2. S being the priority list

Output:

For every time slice T_i determines servers $\{sr_1, sr_{2\ldots}\}$ that servers to optimize priority and availability.

Step 1 Update:

1. Check buffered data, and notify the video player the length of buffered video.
2. Calculate the downloading task for this time slice. $D_{Taskpool}= D_{pre}+ D$

Step 2 Dispatch Tasks:

1. Check the bitmap of the video, and prepare un-downloaded data chunks
2. Initialize R = { }.
3. As the order of $s_1 s_n$,dispatch downloading tasks for $D_{Taskpool}$ data chunks. For the server s_i.
   a) If $T_i \geq L$,dispatch L_i data chunks for s_i.
   b) If $T_i < L$, adds_i into S.
4. If R is not empty, shuffle the order of R, and repeat the steps of dispatching tasks.

Step 3 Execute Tasks:

Start the time slice, start to execute all downloading tasks.

Step 4 Check Tasks:

1. At the end of the time slice, check downloading tasks. For s_i
   a) Push downloaded data chunks into the video buffer and refresh the video bitmap;
   b) If s_i finishes dispatched tasks , $L_i=L_i+1$;
   c) If $s_i$does not finish dispatched tasks, $L_i= L_i/2$.
2. Calculate a D_{pre}, and start next time slice.

Algorithm -3: URR Algorithm

By using the Content Replication Algorithm the system can take the benefits such as reducing the latency, network load and server load. In the second algorithm the reduction of the link utilization will increase the performance of the system and also helps in reducing the cost of transportation [4] In URR algorithm the video is split into packets for fast delivery of the video and also the utilization of multiple cloud technique provides availability, reliability and ubiquitous access. A system can be built taking the benefits of the three algorithms to build a fast, cost-efficient and reliable system taking the advantages of the three algorithms The videos are divided according to the geographic area with maximum number of views by the first algorithm and then can use the second algorithm to reduce the link utilized to stream the videos and from the third algorithm take the property of splitting the videos for delivering. The servers can be stored as a secondary storage from where the user can directly access the data if the content is found missing the user can extract the videos from the cloud. If the cloud meets the cold lever as mentioned in algorithm 2 then the video can be saved in the nearest server[4]This can be used to provide a fast, efficient, low cost and highly efficient system available throughout to provide a buffer free video

V. COMPARISON BETWEEN DIFFERENT APPROACHES

Authors & Ref	Policy	Advantage	Technique Used	Future Scope
Hong Man and Yang Li [1]	Video streaming over LAN	Small scaled and application oriented	DiffServ	Handle data traffic
Qilin Fan, Hao Yin, Zexun Jiang, HaojunHuang, Yan Luo, and Xu Zhang [2]	UGC Video Delivery	Reduced latency	ACM based CDN	Improved Flexibility and Performance
Jun He and Wei Song[3]	Built-in Content Caching	Maximum link utilization. Minimum cost	Hop to hop forwarding design	Real time videos
Zexun Jiang and Hao[4]	Joint Cloud Video	Availability	URR Algorithm	Smooth and buffer free video.

Table 1: Comparison of the Literature Survey

VI.CONCLUSION

From the above literature survey it is clear that every system has its own merits and demerits a system might be highly reliable but not cost efficient, if the system is reliable by taking cost also as a consideration it might have latency issues. In order to deal with these issues the following algorithms are considered. Content Replication Algorithm is used to reduce the latency of the system by distributing the video on the servers depending on the location with highest number of views which is obtained by Adaptive Content Management for UGC Video Delivery in Mobile Internet Era. Min-Max Link Utilization Algorithm is used to develop a system which reduces the link utilization and the reduction of cost is also considered by taking the factors into consideration like primal solution for the flows as given in Optimizing Video Request Routing in Mobile Networks with Built-in Content CachingAlgorithm3 is used to develop a system to divide the packets by following the 4 steps of the algorithm to provide a buffer free video streaming and utilization of joint-cloud mechanism gives a system that does not compromise the reliability and availability of the system. We consider the merits of each system and try to build a useful system for future use by taking the joint cloud mechanism as we live in a world where cloud computing is taken into consideration in all aspects and then by considering the location content replication video is replicated in the servers depending on the location of high demand and by considering min-max algorithm the link consumption is minimized and by URR algorithm fast delivery is guaranteed by taking multiple cloud in consideration. This gives a fast, cost effective and reduces the buffering of the system

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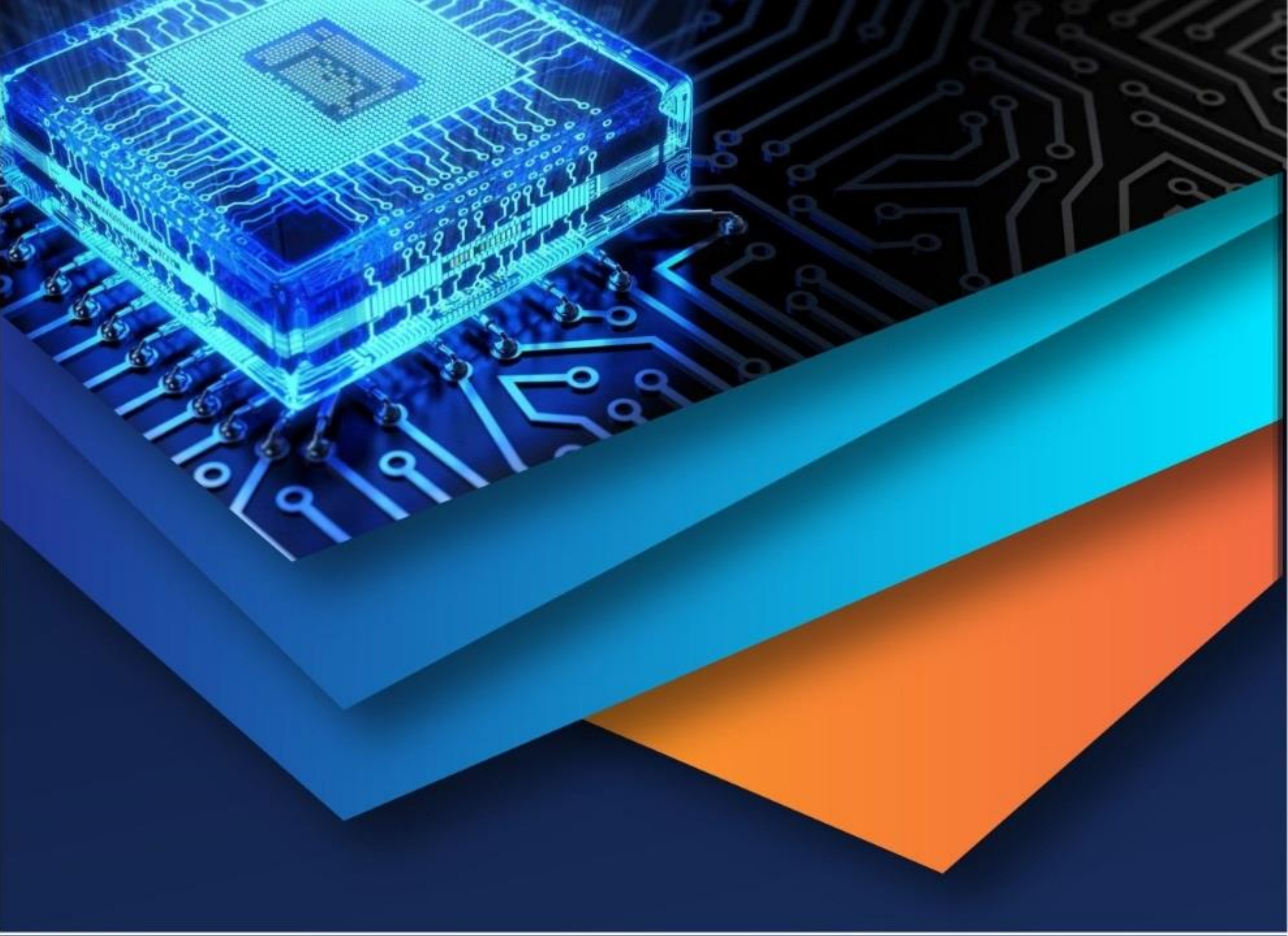

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