OPTIMIZING CONTENT DELIVERY NETWORK USING PROFIT MAXIMIZATION SCHEME

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***Abstract*- :** In this paper, The profit Maximization Scheme that combines the capabilities of CDN with caching benefits was proposed. The main computing capability is offered by servers and content is distributed between various servers provided additional load during peak periods determined from regions and the capability of servers. Profit Maximization Scheme is considered to achieve the goal of quality of service in terms to offer effective on demand services to end users. The online transmission of session packets in the form of textual content is performed. Two methods are performed to manifest the optimization first one is local distribution and another is flash crowd strategy.

Keywords- Content Delivery Network (CDN), Load balancing, Quality of Service, Profit Maximization

I. INTRODUCTION

In today's life, the Communication network for exchanging information between the end systems increasing constantly and rapidly which results in many issues like network traffic, response time, etc. There are many network technologies available that provide authenticity. One of them is Content Delivery Network(CDN), a worldwide distributed network used for faster distribution of content to the user which results in high-rise performance and it provides resources for end user requests. In CDN to achieve reliable and scalable service, load balancing property should be maintained. It results to handle flash crowds. The main motive of CDN is to route content requests dynamically to the nearby content servers regardless of the load across the network.[2] Another motive of CDN is to offer improved user experience and also offers more efficient resource utilization. E-Commerce and media companies pay CDN operators to deliver their content to their audience. In turn, a CDN pays ISP's, carriers and network operators for hosting servers in their data centers.[www.globaldots.com] Bottleneck near to the server can be avoided by accessing data copy stored at server that is near to the client or end user. Optimization of CDN provides High Content speed as CDN offers the replication of the requested data stored at caching servers. Caching server reduces the time passes in between the user request and the resulting response. Optimization also offers the proper distribution of request that results in effective server response to the end users. Optimization using profit maximization Scheme provides high Caching benefits.

II. RELATED WORK

CDN is one of the technology solution that solves issues like network traffic, delay in response, etc,. It is one of the technology that provides reliable data management and effective network resource usage. The load balancing HA Proxy Load Balancer were used to achieve high reliability. The main task of load balancer is to balance all incoming requests in a proper way. The CDN technology and the HA Proxy Load Balancer technology has been combined. CDN transmitted static content and the dynamic content will be transmitted via HA Proxy Load Balancer.[1]

Optimal Routing algorithms are used to deliver the content across the network to achieve characteristics like reliability and scalability. In Content Delivery Network two properties are maintained to accomplish reliability and scalability. The first property is load awareness , responsible for partitioning the requests across the servers to achieve replication of content and this replications are dynamically selected to handle multiple incoming requests. The second property is locality awareness, responsible for selecting and allocating requests to geographically nearest servers. This property provides better Quality-of-Service(QOS) to end users.
Load Aware Network Coordinates are used to proposed a CDN's that responsible for capturing the load and regions. The designing of CDN and its architecture has been done based on Load Aware Network Coordinates.[2]

The key factor behind the faster delivery of data to intended user is the selection of appropriate edge server that is geographically closer to them. Dijkstra's Shortest Path Routing Algorithm is one of the routing algorithm used to find shortest path between users and server location. With the help of CDN

these edge servers transmitted the static content and also dynamic content to the user. Use of Dijkstra's Shortest path algorithm with euclidean distance minimizes the time required for transmission of data or content between users and edge servers.[3]

III. CONCEPT OF CONTENT DELIVERY NETWORK

Content Delivery Network is a distributed web server across the globe. The purpose of this global distribution is to provide a better and faster delivery of content. During the delivery of the content, it is replicated and also stored. It is stored at the cache servers. Content storing strategy at cache servers results in a positive experience for the user. As user requests for the same content, they will get the response from the nearest cache server instead of a central server(origin server). So, the main purpose of a content delivery network is to provide a better user experience.

CDN is a network of servers connected to achieve the goal of faster content delivery with the minimal response time. Optimality is the basic and major responsibility of CDN. To achieve optimality it uses different strategies.CDN overcomes the disadvantages of traditional web hosting. With the help of Content delivery network latency that is calculated in milliseconds(ms) is greatly reduced. High data loading speed can also be achieved by using CDN mechanisms.

There exist different CDN mechanisms like

1) Unicast , in which original user requests are hosting by the centralized server and it works well for low demand content.
2) Cache based CDN, it useful for high demand content, it is application based and network-based.
3) Multicast, it works well for high demand content and it will be a strong option for the distribution of live streaming applications.

CDN will place servers at the primary locations to improve speed and connectivity across the network.CDN benefits include optimality, reducing bandwidth costs, improving page load times, or increasing the global availability of the content.

CDN principals of transmission and caching depend upon the type of information.[1].Origin server originates all types of content such as audio, video, etc. and it is distributed across region-wise servers. These servers are client-owned edge servers or market place subscribe to the edge and these servers are virtual servers where all the content is uploaded. Actual CDN servers are hard servers that provide the content. These CDN servers get all the content from virtual edge servers because of virtual servers capable only for storing the information and not to provide it directly. Therefore virtual servers are also known as market place servers. Data or content that the client gets from the edge server is coming from originating servers as edge servers are connected with the originating server.CDN is ever-evolving and ever leaving a set of processes where there is a continuous transaction of data performed.

Key Components of CDN architecture are delivery nodes, storage nodes, and origin nodes.

Delivery nodes are the servers responsible for the delivery of the content to the end-users. These nodes are located closer to the end-users and fetch the content from the origin node.

Storage nodes are responsible for storing original data copies.

Origin nodes are the main servers that enable the distribution across the network. This is the main source of content.

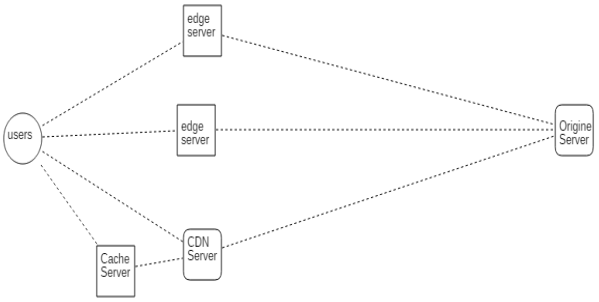


FIGURE 1: CDN Routing Flow

The Workflow is as follows:

1) The end-user will generate requests.
2) Generated requests will arrive in request arrival queue and the users will be responded by the edge servers.
3) The request will send to the server which satisfies the decision-making system which takes decisions like the nearest server, response time, and time to live(TTL).
4) The server will respond to the user as well as stores the response in cache storage.
5) Next time when another user sends a request, the edge server will first try to get a response from the cache. If the content is not available in the cache then request will be sent to the original server.
6) As the server stores, the response content in the cache storage server processed from the cache for the same content.[1]

In traditional network user accesses the content from the originate server this may lead traffic and load on a originate server. Whereas using a CDN technology user accesses the content from the cached server nearest to them instead of originate server this reduces the traffic and load on the originate servers as load is distributed across the servers. CDN redirected the Content or data from the originate server to the user. CDN has property of storing the content that it redirected to user so , next time when same content is requested the CDN cache servers deliver the content to user directly instead of further processing the requests to the originate server. this improves the latency and also reduces the traffic at originate server. CDN is capable of handling multiple requests at a time and also offers the effective and efficient cached benefits.

IV. PROPOSED SYSTEM

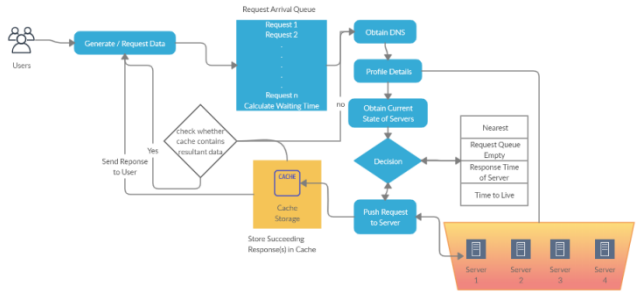


FIGURE 2: Proposed System Architectural Flow Diagram

The above diagram represents the actual working of the system. It shows the transformation of data or content using CDN.CDN is authentic and increases the quality of service. The above-proposed system combines the capabilities of CDN with caching benefits. Servers offer the main computing capacity and distributed data across these servers provides load. CDN module redirects the end user requests to cache servers and provides quality of service parameters depends on users' location. CDN provides better execution especially when multiple requests arise and that required many round-trips to load requested content. CDN improves execution of requests by a millisecond at a time.

CDN module minimizes the load that appears on the origin server when many requests gathered in the arrival queue. User-generated requests are sent to DNS. DNS fetches profile details of servers and keeps the information about the current state of servers. Profile details of servers describe the capacity of servers. Every request in the arrival queue has its own waiting time. Here waiting time is calculated and servers are responsible for responding within the waiting time. And if servers were busy then these requests are diverted. The above diagram represents the structure of various data centers placed at different locations across the worldwide network. It consists of distinct caching servers accountable for serving requests coming from end-users. These servers process that requests which arrive firstly and newly and sent back responses to intended users. And these responses also stored in cache servers so that when next time the same request arises cache servers are responsible for processing such requests and send responses to users. Here, the quality of service directly depends on no. of cache servers available in the regions.

V. IMPLEMENTATION

A implemented scheme is a novel scheme that combines the profile modules and the decision-making system that can satisfy the quality of services requirements that handles resource waste greatly. Profile modules keeps the information about the server capacity, current state of server and based on these information the decision making system takes the decision of where to allocate the request. Every request sent in the format of packet and every packet has its own expiration limit called as Time To Live. The decision making system mainly focus on this Time To Live factor while processing the requests.

We implemented the modules for the local Distribution of request and Flash crowd Strategy.

In Local Distribution, we manually generated the request and distributed these requests to the nearest servers. These requests allocated based on regions.

Algorithm: Profit Maximization Scheme

A system with multiple clusters m waiting to process requests R

Initialize Arrival Queue Aq-Queue is empty

Initialize Waiting Queue Wq as empty

Case: New Request Arrival

Add request to Arrival Queue Aq

Access Cluster Monitor Process CMP and Obtain the current status of Clusters

If the cluster is free then

assign request from arrival queue Aq to Cluster processing queue Pqn

If cluster is busy

Obtain request REQ waiting time i.e. TTL(Time To Live)

push request REQ into waiting queue.

Monitor clusters Clstr to seek if it gets empty

If clusters Clstr becomes empty

Obtain request REQ with minimum waiting time i.e. Time To Live

push request REQ towards processing queue of cluster

if clusters Clstr not empty && waiting time is near to expire

Process request REQ and release the temporary server when the request is completed.

Repeat for all requests until the request queue is empty.

Calculate Average arrival time, service time.

END

Flash crowd Strategy is liable for generating thousands of requests at once. Flash Crowd strategy processes all incoming requests indiscriminately for random distribution. It uses the Randomize Distribution Technique. This technique distributes the load across the servers supported waiting time. It distributes the request with minimum waiting time to the server that's free and nearest randomly. The randomized technique is the hyper approach used for load balancing over the CDN network. It uses Approach of randomly allocating requests to the servers.

VI. RESULTS AND ANALYSIS

We implemented Profit Maximization Scheme for Optimizing Content Delivery Network. We conducted the experiments for the requests generated by users using local distribution and flash crowd strategies. In local distribution requests generated manually and in flash crowd requests are generated randomly.

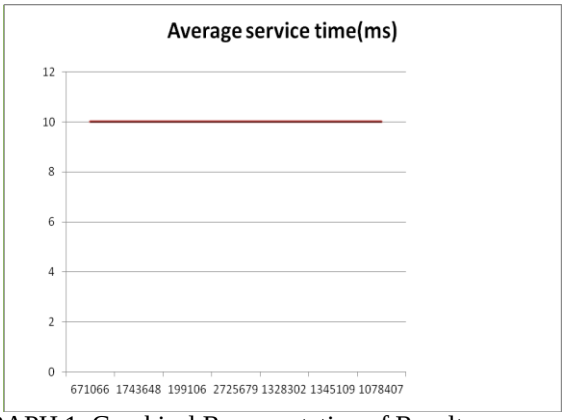
In Local Distribution method we select the IP's allocated to the particular regions manually. We can select many number of IP's for the demonstration purpose. And we executed number of experiments to check the arrival rate per experiment and its service time.

The following table shows the results of the queue that describes average arrival time that is the Instance Arrival rate and average service time.

NO. of experiments	Average Arrival Rate for each experiment(ms)	Average service time(ms)
1	671066	000010
2	1743648	000010
3	199106	000010
4	2725679	000010
5	1328302	000010
6	1345109	000010
7	1078407	000010

TABLE 1 : Results of the queue

From the above table, we can see that the average arrival rate from each experiment is different based on the no. of requests generated randomly but the average service time remains unchanged. This clears that the service provided by the server is better and cache servers efficiency also maintained. Here from the above table, it is clear that the request to the servers is properly distributed. So the proposed system provides the optimization of the data. And also it describes the increased usage of cache data



GRAPH 1: Graphical Representation of Results

The above graph is the graphical representation of the results that we experimentally conducted and this results specifies average service time is constant even though average arrival time varies based on no. of requests generated.

VII. CONCLUSION AND FUTURE SCOPE

We executed the concept of Content Delivery Network. We used the profit Maximization Scheme for the optimized content Distribution that provides effective and efficient caching benefits. This provides a high quality of service to users. We conducted the experimental view of the servers works at the CDN.

Our current work is limited to the online transmission of session fewer packets and textual contents. However, there is a lot of scopes to explore the online transmission of audio and video packets that require TLS and session pipeline.

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