NAVIGATING THE CONTENT DELIVERY NETWORK LANDSCAPE: CHALLENGES, OPPORTUNITIES, AND FUTURE DIRECTIONS

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Abstract--*A Content Delivery Network (CDN) refers to a collection of servers strategically positioned across multiple geographical locations, with the primary purpose of caching content close to end users. A Content Delivery Network (CDN) facilitates the expeditious transmission of essential components for rendering digital content on the Internet, encompassing HTML pages, JavaScript files, style sheets, images, and videos. The utilization of Content Delivery Network (CDN) services is witnessing an upsurge in popularity, presently accounting for a significant proportion of web traffic, even encompassing major platforms like Facebook, Netflix, and Amazon. Due to the importance of this site, this paper will discuss the concept of CDN, and the important topics related to it related to the network, what are its types and divisions, and its importance in the world of information technology. The research analyzes the most important studies presented by researchers from 2021 to 2023.*

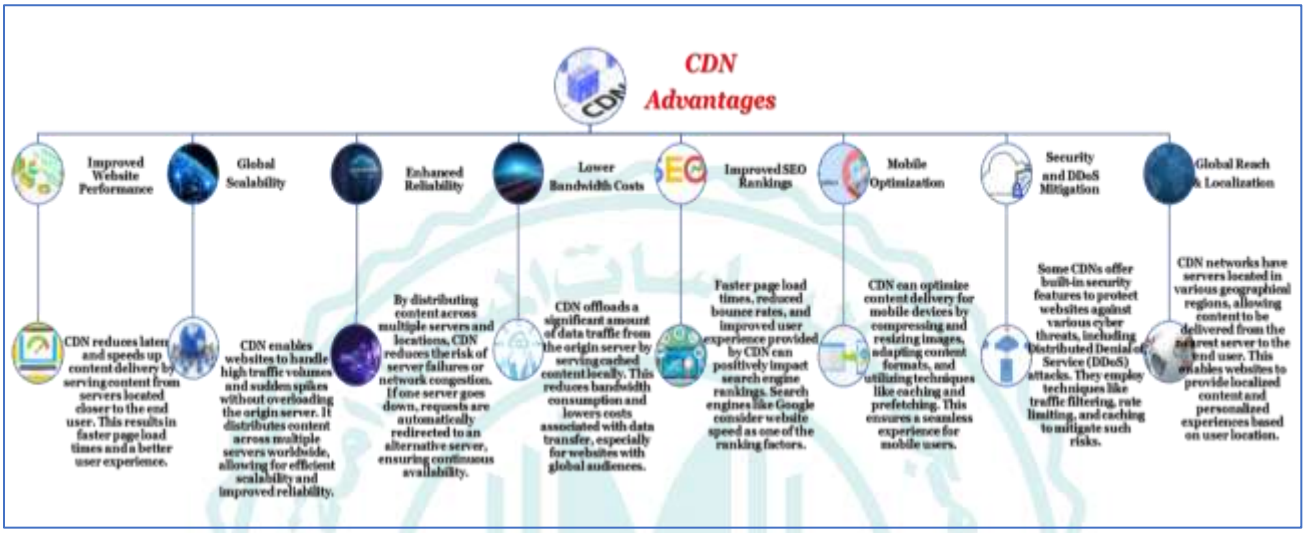
Keywords: CDN, Network, Technology, Analyzes.

1. INTRODUCTION

A content delivery network (CDN) refers to a dispersed collection of servers, positioned in various geographical locations, which serve as caches for delivering content in proximity to end users. A Content Delivery Network (CDN) facilitates the expeditious transmission of essential elements required for the loading of online content, encompassing HTML pages, JavaScript files, stylesheets, images, and videos [1]. CDN services have garnered substantial popularity and are currently experiencing a widespread increase in usage. Presently, a significant portion of internet traffic is facilitated via CDNs, encompassing the traffic of prominent entities such as Facebook, Netflix, and Amazon. A suitably configured content delivery network (CDN) has the potential to provide added security by offering protection against prevalent malicious activities, including Distributed Denial of Service (DDoS) attacks, to websites. The concept of a Content Delivery Network (CDN) can be encapsulated in the understanding that the temporal delay in delivering website content to the screen of a user is influenced by the geographical proximity between the user and the hosting server [2]. Furthermore, apart from mitigating bandwidth consumption, the extensively dispersed network of data centres enhances the swiftness of delivering web page content to users, regardless of their geographical location in relevance to the primary server. In order to achieve this objective, a caching system retains transient replicas of website files in the proxy server that is geographically closest to the user, thereby enhancing the speed at which the web page is loaded. The advantages offered by a content delivery network (CDN) are contingent upon factors such as the magnitude of the website, the proximity of the server to the primary source of traffic, and the volume of generated traffic. An instance that illustrates this assertion is a regional enterprise that operates a brick-and-mortar establishment catering to a limited geographic vicinity. This type of business would not derive substantial benefits from the implementation of a content distribution network [3]. This paper reviews the conceptions of CDN and how they are effective in the network.

2. OVERVIEW AND BACKGROUND OF CDN

CDN is a server network that delivers content quickly, cheaply, reliably, and securelyIn order to enhance speed and connectivity, a Content Delivery Network (CDN) strategically deploys servers at the interface points between disparate networks. Internet exchange points (IXPs) serve as the primary hubs where various Internet service providers (CDNs) strategically position Data Centers at various locations worldwide to optimize efficiency and mitigate potential risks. The primary objective of CDNs is to enhance the security of data transmission and ensure uninterrupted connectivity in the face of diverse failures and Internet congestion [5]. The graphical representation presented in



establish connections with one another, granting access to the traffic generated within their distinct networks[4]. A content delivery network (CDN) provider has the capacity to decrease expenses and transit durations associated with high-speed transmission of data by establishing connections with these meticulously connected and expeditious locations. In addition to the deployment of servers in Internet Exchange Points (IXPs), a Content Delivery Network (CDN) implements various enhancements to enhance conventional client/server data transfers. Content Delivery Networks

Figure 1 provides a concise overview of the benefits associated with Content Delivery Networks (CDNs).

Figure 1: CDN benefits

Users leave slow-loading websites. CDN services reduce load times, as following Figure 2

Figure 2: CDN reduces load time.

The continuous and reliable functioning of internet properties necessitates a high level of uptime. Web servers may become inaccessible and impede website or service accessibility due to hardware issues or traffic surges caused by either malevolent attacks or increased popularity [6]. The implementation of a comprehensive Content Delivery Network (CDN) effectively mitigates downtime as demonstrated in Figure (3).

A content delivery network (CDN) incorporates information security as an essential element within its framework. In contemporary digital contexts, a content delivery network (CDN) possesses the capability to uphold a website's security by utilizing up-to-date Transport Layer Security/Secure Sockets Layer (TLS/SSL) certificates, thereby fortifying authentication protocols, encryption mechanisms, and data integrity. This essay investigates the manifold security concerns associated with content delivery networks (CDNs) and proposes viable strategies to ensure the secure transmission of content. The topic under scrutiny pertains to the examination of CDN SSL/TLS security and the associated consumption of bandwidth that occurs when an origin server replies to a particular request.

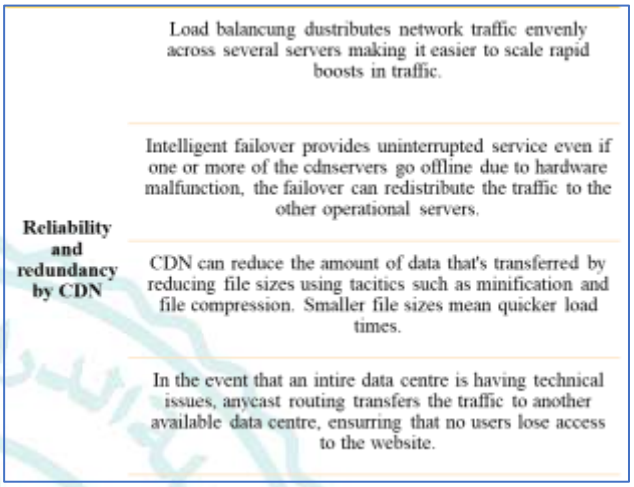
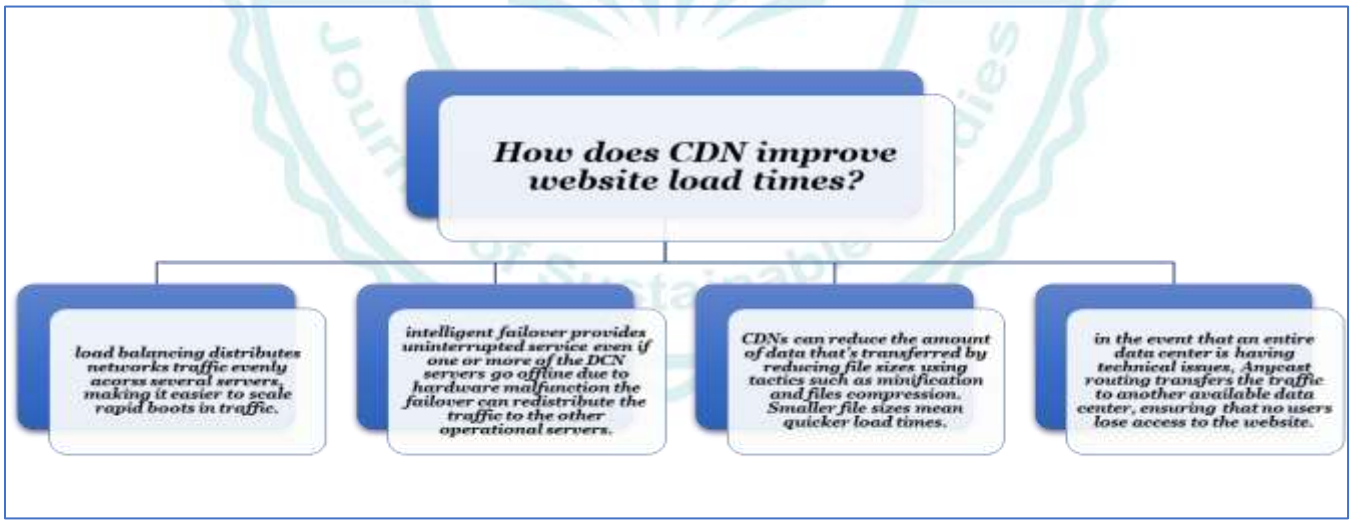


Figure 3: Reliability and redundancy by CDN

This paper aims to explore the ways in which a content delivery network (CDN), such as the renowned Cloudflare CDN, effectively mitigates the frequency of origin requests while concurrently minimizing the expenses incurred in terms of bandwidth. Hence, the significance of Content



Delivery Network (CDN) cannot be overstated, as it provides a conducive platform for researchers to further its advancement [7].

3. TAXONOMY OF CDN

In recent years, there has been a significant amount of research dedicated to studying Content Delivery Networks (CDNs). Several scholarly inquiries have been conducted to

scrutinize Content Delivery Networks (CDNs) in order to classify and assess their distinctive characteristics, vulnerabilities, opportunities, and prospective trajectories. Peng provides an extensive examination of Content Delivery Networks (CDNs). This paper presents a comprehensive taxonomy of Content Delivery Networks (CDNs) by examining four pivotal factors, elucidated in Figure (4).

Figure 4: four key issues of CDN taxonomy.

The first issue addresses numerous CDN organization and formation topics. Structure-based CDN classification. CDN content distribution is the next concern. It describes CDNs' surrogate placement, content selection, delivery, outsourcing, and cache/replica management. Current CDN request-routing methods are next. CDN performance measurement is the final issue[9]. The following Table (1) describes this key.

Table (1): Taxonomy of CDN[8][6][9].

Key name	Description
CDN Composition	CDN structural features show that infrastructural components are strongly connected. The material and services a CDN offer affect its structure. A CDN uses surrogates to form the content-delivery component, relationships, mechanisms to redirect client requests to surrogates, and interaction protocols to communicate amongst CDN elements.
CDN Organization	Overlay and network CDN construction methods distribute web material, streaming media, and real-time video using application-specific servers and caches. Overlay strategies simplify management and allow for additional services. Network methods involve routers and switches recognizing application types and forwarding requests based on predetermined policies. Akamai, Mirror Image, and other CDNs combine network and overlay methods, allowing content requests to be routed to local caches or content-optimized servers.
Servers	CDNs employ origin and replica servers. The origin server holds the content's final version. The content supplier updates it. However, a replica server may be an authoritative reference for client answers. The origin server talks with the dispersed replica servers to update its content. Media, Web, and cache servers can be replicated in a CDN. Digital and encoded content are served through media servers. The software is a media server. Media servers provide the requested video or audio clip to clients. A CDN's streaming media links and other Web content are on a Web server. A cache server caches content at the network edge to avoid visiting the origin server for every content request.
Relationships	CDN components interact with clients, surrogates, origin servers, and proxy caches to share content and save time and network traffic. Caching saves time and reduces network traffic for similar queries. Clients can request origin servers from surrogate servers, and users can communicate transparently. Routers and switches forward traffic to cache servers/proxies, which serve client requests to construct CDNs. Caching proxies can communicate outside partnerships and support 2-3 users sharing CDNs.
Interaction Protocols	CDN component interaction protocols include NECP, Web Cache Control Protocol (WCCP), CARP, ICP, HTCP, and Digest. NECP signals servers and network devices that reroute traffic, while WCCP connects routers and interception proxies. WCCP allows proxies to register with routers for traffic redirection, dividing Web cache load and carries router-cache traffic. CARP divides URL space across several proxy servers and a hash function, with CARP HTTP clients requesting any Proxy Array member. Proxy sorting reduces cache duplication and boosts global cache hit rates. ICP is used for cache-to-cache communication, helping caches find objects and messages.
Content Distribution and Management	Content distribution and management are crucial for CDN performance and content delivery. Content distribution includes selecting and delivering based on user requests, surrogate placement so edge servers are close to clients, and content outsourcing to choose a methodology. Content management relies on cache organization methods. (i.e., caching techniques, cache maintenance, and cache update)

Key name	Description
Content Selection and Delivery	Efficient content delivery requires content selection, which reduces server and client download time. Full-site content selection and delivery involve surrogate servers replicating the content site to consumers, but this method is unfeasible due to web object size expansion. Partial-site content selection and delivery link CDN elements with host names in the provider's authoritative domain, while origin servers retrieve the base HTML page. Web content replication approaches include empirical, popularity, object, or cluster-based partial-site replication. Popularity-based methods replicate favorites, while greedy methods work but are difficult to apply. Cluster-based replication groups web content by correlation or access frequency, while session or URL clusters find linked pages and browsing habits. Experiments show that clustering-based content replication reduces client download time and server load.
Surrogate Placement	The content distribution procedure relies on the surrogate server location, so choosing the optimum site is emphasized. Optimal surrogate placement reduces user-perceived delay and network bandwidth consumption for replicating content from servers to clients. Optimizing these parameters lowers CDN infrastructure and transmission costs. Thus, optimal surrogate server location allows CDNs to offer high-quality services at reasonable prices.
Content Outsourcing	An efficient content outsourcing approach is essential for a CDN infrastructure with correctly situated surrogate servers and chosen content for delivery. Content outsourcing uses cooperative push, non-cooperative pull, or cooperative pull methods. Surrogates must pre-fetch content for a cooperative push-based strategy. The origin pushes content to surrogate servers, which cooperate to reduce replication and update costs. The CDN maps material to surrogate servers and directs requests to the closest surrogate or origin server. Using the greedy-global heuristic method, collaborating surrogate servers can decide on replication. It remains v.
Cache Organization and Management	CDN speed is mostly based on content management and cache organization. The caching methods and cache update frequency provide content freshness, availability, and dependability. Other than these, cache organization may include CDN infrastructure caching and replication. Integration may help a CDN manage content. Replication and caching in a CDN can increase perceived latency, hit ratio, and byte-hit ratio.

Key name	Description
Request-Routing	Request-routing systems provide material from surrogate servers to clients. Network elements support single-CDN request routing. The "closest" replica server handles client queries. Client requests may not use the closest server. Thus, a request-routing system guides users to the closest surrogate that best satisfies the request using network proximity, client-perceived latency, distance, and replica server load. CDN request routing depends on content selection and delivery techniques. (full-site and partial-site). If a CDN uses the full-site technique, request routing sends client requests to surrogate servers, which store all outsourced content. Request routing delivers fundamental material from the origin server and embedded objects from surrogate servers in the partial-site approach. CDNs use request routing. Algorithms route client requests. It guides client request edge server selection. Request-routing methods inform clients. This method initiates a request-routing algorithm and informs the client of its selection.
Request-Routing Algorithms	Adaptive or nonadoptive request-routing algorithms exist. System conditions determine cache server selection. Replica server load or network link congestion estimates the system's condition. Heuristics, not system conditions, select a cache server in non-adaptive request routing. Implementing non-adaptive algorithms is easier. Adaptive algorithms are difficult. Heuristic assumptions enable non-adaptive algorithms. Adaptive algorithms survive flash crowds. Round-robin, the simplest non-adaptive request-routing strategy, distributes all requests to CDN cache servers to balance demand. Cache servers should handle all client requests. Simple methods benefit clusters with all replica servers in one place. Round-robin request routing fails in wide-area distributed systems with remote cache servers. This ignores replica server distance. Thus, client queries may be directed to distant replica servers, degrading user performance. Load balancing is limited by request compute costs. Another non-adaptive request-routing method ranks replica servers by expected demand. Server request counts determine predictions. This algorithm balances client requests between replica servers by client-server distance.
Request-Routing Mechanisms	Request-routing techniques tell clients of their replica server selection. Several criteria classify request-routing techniques.

Key name	Description
Performance Measurements	CDN's performance is measured to determine its ability to deliver client content and services. Content providers analyze CDN performance using five indicators. The hit rate is the ratio of the number of cached documents versus the total documents requested. A CDN's high hit rate indicates good cache management. **1)** Reserved Bandwidth: Origin server bandwidth. The origin server retrieves it in bytes. **2)** Latency: User-perceived response time. Origin servers reserve less Bandwidth with lower latency. **3)** Surrogate server utilization: The percentage of time surrogates are busy. Using this measure, administrators calculate CPU load. Requests served and storage I/O consumption. **4)** Reliability: Packet-loss measures define CDN reliability. A CDN with low packet loss and high availability is reliable.
Internal Measurements	In order to measure the performance of a CDN end-to-end, servers may be outfitted to gather statistics. The placement of probes (hardware and software) around the network and the comparison of the data gathered by the probes with cache and server logs can also be used to gauge end-to-end performance.
External Measurement	In addition to internal performance evaluation, an impartial outsider informs CDN clients of the guaranteed and verified performance through external evaluation. This method is effective because benchmarking networks of strategically placed measurement computers connected to significant Internet backbones in numerous cities are supported by independent performance-measuring businesses. These computers analyze service performance parameters in key areas to determine how well a specific Web site functions from the end user's perspective.
Acquisition of Network Statistics for Performance Evaluation	Several parameters determine network statistics acquisition methods for internal and external performance measurement. Network probing, traffic monitoring, and surrogate feedback are examples. Network statistics acquisition often includes geographical closeness, network proximity, latency, server load, and server performance.
Performance Measurement through Simulation	Researchers utilize simulation techniques to evaluate CDN performance. Some researchers test CDN protocols on PlanetLab. Since commercial CDN traces and logs are proprietary, researchers can use software CDN simulators to build, test, and debug CDN performance. Since no dedicated gear is needed for experiments, such a simulation technique is cost-effective. It can also simulate a link with any bandwidth, propagation delay, router queue size, and management approach. Researchers can do tests in a virtual network without uncontrollable factors like unwanted external traffic.

4. CHALLENGE AND PROBLEM IN CDN

The complexity of content security and adaptive bit rate streaming encompasses challenges that have a direct impact on the delivery experiences of end users. Conventional content delivery networks (CDNs) necessitate further development and adaptation in order to effectively tackle these challenges pertaining to the distinct requirements of business-to-business (B2B) applications. CDNs may employ edge processing to tackle the challenges. However, the inclusion of instream watermarking and forensic watermarking necessitates the integration with vendor software. Consequently, edge processing becomes exceedingly intricate from a software integration and testing standpoint. In order to offer a viable solution for B2B applications, it is imperative that established Content Delivery Network (CDN) providers or specialized niche players assume the forefront position in this domain. As this phenomenon persists, bespoke remedies will persist in mitigating the distinctive obstacles that significantly impede the holistic user experience (10). The forthcoming point encapsulates the challenge associated with the conceptualization of Content Delivery Networks (CDN) based on the sources [7] and [11].:

A. **Scaling**: a Content Delivery Network (CDN) efficiently across various geographical locations while upholding security measures is a pertinent concern.
B. **Edge**: The utilization of edge computing is a crucial consideration in optimizing performance. In the context of streaming video, exploring the role of edge computing becomes imperative. Furthermore, highlighting the potential capabilities of edge computing in this domain is vital. Moreover, the efficient and effective scaling of edge computing infrastructures necessitates further investigation.
C. **Flexibility**: It goes without saying that preserving network flexibility across mobile, fixed, and wireless will be required if the demand for broadcasting increases significantly. That thus becomes a challenge for a CDN. How can you link everything while guaranteeing a consistent signal? Ensure a wonderful experience.
D. **Latency**: Everyone is aware of the reaction time, or latency. With more people viewing live sports online as they begin to operate without an actual fan presence, this is perhaps one of the trendiest subjects for CDNs right now. There must be no lag between the broadcast and the live broadcast, or even with the broadcast itself, as a result.
E. **Consistency**: Changing the bit rate while streaming by 50 is the worst thing you can do. This is not good at all. Thus, CDNs are attempting to find a solution for the issue of preserving such uniformity across the flow during periods of high traffic. How do you ensure that there is a decent level of quality suitable to the specific devices that people are using on the bandwidth they have when suddenly everyone is jumping?
F. **Interoperability**: All owners of content rights have begun utilizing numerous CDNs. How can you ensure that these CDNs cooperate? To make it simpler for a

content rights holder or streaming platform operator to manage distribution over various networks, how do CDNs assure compatibility with other CDNs? These are some of the difficulties that our groups are starting to investigate.

These points and questions are the challenges of working on a CDN topic. And CDNs reduce content delivery distance. Content closer to users is better for your business, till now. CDNs must adapt to these new difficulties. A single social media page can fulfill hundreds of requests to improve user experience. Requests are rising rapidly. CDNs may struggle, slowing content delivery and hurting your bottom line. Amazon found that a 100ms page load time delay can reduce revenue by 1%[12].

5. DATA AVAILABILITY

The topic of CDN is very important because of its importance, and to review the concept of its data, the following Figure shows how it works and generates data.

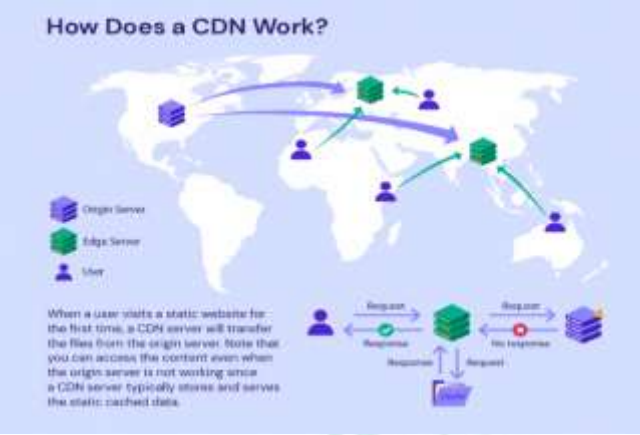


Figure (5): CDN work and how data is generated.

A content delivery network, or CDN, aids in distributing or delivering your material throughout the internet. With a typical web host, all the files are kept in one location on a web server and are made available as needed. So, the capacity of that server has a significant impact on how quickly a website loads[7]. Your data are kept in backup copies via a content delivery network system on several servers all over the world. These networks are made up of a number of devoted servers that act as dispersed hosts for your content, particularly static assets like photos, videos, Java scripts, CSS files, and other similar items. The servers at their closest/fastest point of presence are used to deliver the contents to users. The IP address of the user is the primary factor in the host selection [6].

The following point is a famous topic in CDN:

A. Data Tables CDN

Data Tables' software is permanently stored on the Data Tables Content Delivery Network (CDN) for usage on your site without hosting it. The CDN may also offer Data Tables components and dependencies as a single concatenated and minified file or multiple files using the data tables download builder. Just add files to the page! This improves site performance and simplifies prototyping. Cloud Flare Powers Data Tables CDN. Hairstyles Select the stylistic libraries you want to utilize using the buttons below to view the files your page should contain. Data Tables is the core software of the Data Tables project and involves two primary files, the Data Tables JavaScript and CSS[13].

B. Vega-datasets CDN files

Example datasets for CDN Vega and Vega-Lite are free and open source. This information may be found at Vega/Vega-datasets on GitHub. example datasets that Vega projects have utilized. As other projects (Vega, Vega Editor, Vega-Lite, Polestar, Voyager) depend on this data for testing and examples, keep modifications to this repository to a minimum. There are sources in SOURCES.md. [14] VVV.

6. CDN TYPES

A material Delivery Network (CDN) is a global network of web servers or PoPs that delivers material faster. The CDN replicates and stores material so users can access data stored near them. This is more efficient than storing content on a central server. A client accesses a local copy of the data to prevent bottlenecks at the central server[15]. The following Figure (6) shows the summary benefits of CDN.

Figure (6): best benefits.

These points are illustrated in the following graphic about the importance of having a CDN

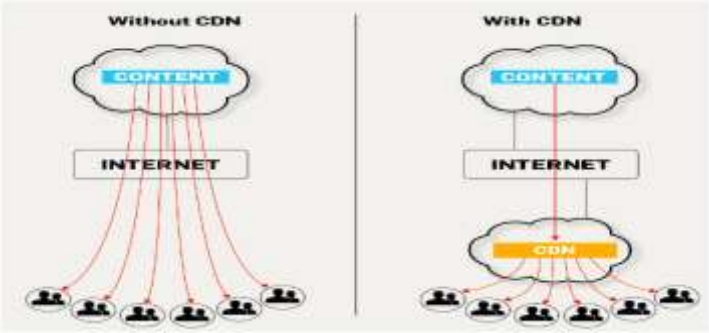


Figure (7): roll of CDN in the network[15].

Based on the above description can summarize the CDN type as following Table (2):

TABLE (2): SUMMARIZE THE CDN TYPE

Type	Description
Peer-to-Peer CDN [9]	This technology uses Peer-to-Peer. Torrent's protocol. AT&T and several non-profits distribute content via peer-to-peer. This method uses CDN users without caching. Users share content by downloading and uploading without disrupting their browsing experience. Many CDNs offer P2P for free because it uses less hardware and resources. Peer-to-Peer CDNs include PeerCast, PPS.tv, Freecast, etc.
Push CDN [16]	These CDNs physically push content to CDN servers. Those servers support the main server. CDN servers host these files. The web server sends files to CDN servers. Amazon CloudFront employs it. Push CDN is great for static sites with large downloads. Hosted CDN is Push CDN.
Origin Pull CDNs [8]	Origin Pull CDN saves web servers' cached content, allowing users to fulfill requests by the nearest server. It is best for WordPress blogs, but may not be suitable for initial users with photos. Pull CDN offers cached content and content expiration control. There are two subcategories: full-site and partial-site content delivery.

The following Figure (8) shows the type of CDN.

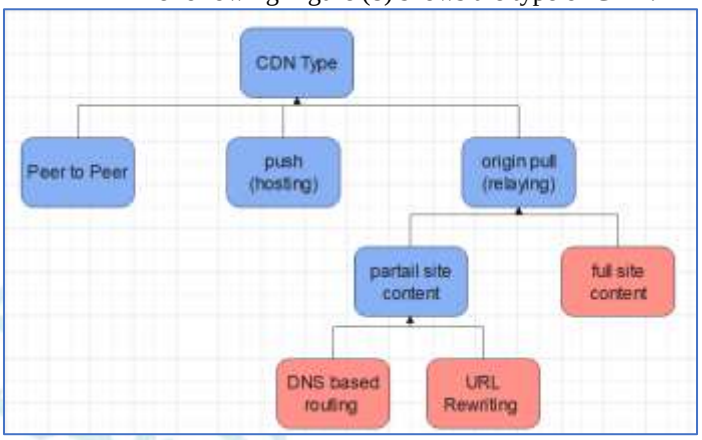


Figure (8): Type of CDN.

7. EVALUATION OF CDN

The Internet has matured. Traffic has increased due to broadband penetration, system complexity, and information richness. Internet change complicates content management and distribution. High demand bottlenecks prominent Web services. Web servers might become hotspots if content requests spike. Unexpected demand strains web servers. Web servers crash due to a rapid traffic surge. Web content providers deliver rich content. Long download times and service quality decreases irritate users. E-commerce profits companies. Thus, they want better online user service. Thus, Web content distribution and service delivery technologies have improved recently. These technologies' infrastructures form a content network. Several content networks improve QoS to boost performance. (QoS)[17]. Upgrade the Web server hardware with a faster CPU, extra memory, disk space, or a multi-processor system. It's strict. Small server system upgrades are impossible. ISP-deployed caching proxy helps narrowband Internet users. Local caching proxies boost performance and Bandwidth. Caching proxies optimizes resource use and detects server problems. Web queries often use these caches instead of origin servers. This setting uses a caching proxy for browsing. Caching proxy users' most popular things are cached. Providers can also place local, regional, and intercontinental caches. Hierarchical caching. Increased bandwidth savings and performance[9].

Server farms scale better. Content networks have been utilized for years. A server farm handles website queries on several Web servers. Content switches analyze content requests and deliver them to servers. Surrogates replace server farm switches. More versatile, scalable, and fault-tolerant. As Internet links connect Web sites, server farms

grow. Server farms and hierarchical caching through cache proxies improve Internet Web performance. However, they have limits. Servers near the origin do not improve network performance due to network congestion. Proxies can cache. Cache client-requested items. Popular content producers may need massive server farms, load balancing, and high-bandwidth connections. Late-1990s content networks solved these challenges[8].

A Material Distribution Network (CDN) is a system of Internet-connected computers that transparently delivers content to users. CDNs hosted content providers' websites. Its stability and scalability without expensive infrastructure helped. CDN infrastructure development began. MIT's flash crowd research created Akamai Technologies. Multiple companies specialized in fast and reliable content distribution within a few years, making CDNs a lucrative market. After the 9/11 flash mobs, some sites encountered serious caching issues. CDN companies-built technology to protect websites from flash crowds. First-generation CDNs prioritized static or dynamic Web documents. Second-generation CDNs stream audio, video, and VoD. They're researching. With the CDN business boom, vendors standardized.

IETF RFCs (Request For Comments). Other than IETF, Broadband Services Forum (BSF), ICAP forum [103], and Internet Streaming Media Alliance created standards for streaming broadband content, including video, audio, and data, over the Internet. Large ISPs implemented CDNs and offered specialized services by 2002. Over 3000 companies spent $20 million monthly on CDNs in 2004. Streaming media delivery made CDNs twice as much in 2004 as in 2003. 2005 streaming video and Internet radio CDN revenue increased by 40%. Streaming audio, video, advertising, download media, and amusement were worth $385 million to $452 million in 2005 marketing research. The market was projected to generate $2 billion in total revenue over the course of four years (2002–2006), with the key content categories being music, sports, and entertainment. Yet according to the most recent AccuStream iMedia Research study, the CDN market has spent $1.65 billion since 2002 to distribute streaming video (excluding storage, hosting, and application layering). The commercial market value for media and entertainment in 2006, which includes content, streaming advertising, movie and music downloads, and UGV distribution, would account for 36% of the four-year total. Streaming media delivery CDN market potential, strategies, and estimates from 2004–2009 is accessible [18].

8. PREVISE STUDIES

Many studies dealt with CDN, and the following are the most prominent studies with high citations for 20201-2023.

TABLE (3): ANALYSIS OF THE PREVISES STUDIES.

REF.	Year	Author	Aim	Contribution
[19]	2021	Zeqi Lai et al.	STAREF.RONT optimizes global CDNs using low-latency constellations and cloud platforms, reducing latency and operational costs.	Study explores cost-effective, low-latency CDNs using STAREF.RONT architecture, focusing on dynamic network topology and pricing.
[20]	2021	Tsung-Kang Hung et al.	Random linear network coding can improve streaming systems across heterogeneous networks, requiring re-encoding, decoding, reduction strategies, and content delivery networks with varying field sizes.	Peer streaming systems utilize random linear network coding, Galois field, and diverse content delivery networks.
[21]	2022	Shihan Lin, et al.	InviCloak protects user and website communications without altering TLS or CDNs by distributing a new public key and establishing a TLS encryption channel, ensuring safe and anonymous communication.	InviCloak is a system that protects user and website private communications without modifying TLS or CDNs.
[22]	2022	Reza Farahani et. al.	This article discusses hybrid CDN-P2P live-streaming architectures for low-latency, high-quality live video streaming, overcoming challenges in cost-effective, scalable, and flexible infrastructures. The RICHTER architecture combines CDN and P2P modes, utilizing edge computing, NFV, and distributed video transcoding.	Introduce a hybrid P2P-CDN architecture (RICHTER) for low latency live video streaming, go into the specifics of its design, and then offer some suggestions for future research.
[23]	2022	Yijing Wang and Han Wang	This text explores CDN concepts, workflow, domain names, and a machine learning-based service detection model using random forest classification techniques. It confirms its effectiveness through experimental analysis and emphasizes its necessity.	Using classification (ML) to analysis

REF.	Year	Author	Aim	Contribution
[24]	2022	Daniel Pakkala and Juhani Latvakoski	P2P Extended CDN concept explored, examining technologies for content distribution platforms, service provisioning, modular designs, and prototype validation.	P2P extension enhances star topology CDN functionality, reach, explores technologies, and provides extension scenarios.
[25]	2023	Venkat Venkateswaran, et al.	Create cache sites using cyber-deception security technique to reduce latency, enabling homogeneous attacks against adversaries using proactive obfuscation and reactive randomization.	Give an example of a security management plan that uses deception to safeguard a content distribution network's content-data cache site.

9. PREVISE REVIEW AND SURVEY

Many articles dealt with the topic of CDN, the main idea of this section is to analyze the studies (type) and find out what they are referring to and compare them with the presented paper.

TABLE (4): COMPARESION THE PRESENTED PAPER WITH PREVISES STUDIES.

REF.	Challenge	Taxonomy	Problem Doman	Data Availability	CDN Type	Advantages and disadvantages of CDN	Analysis Studies
[9]	✓	✓	X	X	X	X	✓
[8]	X	X	X	X	X	X	✓
[6]	✓	X	X	X	✓	X	X
[28]	X	✓	X	X	✓	X	X
[27]	X	X	X	X	✓	X	✓
[26]	X	X	✓	X	✓	X	✓
Proposed	✓	✓	✓	✓	✓	✓	✓

10. CONCLUSION

Internet content providers often use cloud-based content delivery and distribution networks (also known as CDNs) to offer wide-area data access that is both highly available and relatively quick. On the other hand, when seen from a global perspective, a sizeable percentage of users continue to experience excessive content access latency due to the inadequate deployment of terrestrial cloud infrastructures. This PAPER aims to analyze the topic of CDN from many aspects and to address the most important topics mentioned by previous researchers, but individually to give an overview of the importance of the topic, so the concept of CDN, its division and types, and the analysis of practical studies on it were explained, as well as the analysis of articles (**review and survey**).

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