

Design of Operation and Monitoring Architecture of Content Delivery Network Service

Ta-Yuan Chou
National Center for High-
performance Computing,
National Applied
Research Laboratories
Tainan, Taiwan
1203053@narlabs.org.tw

Hui-Min Tseng
National Center for High-
performance Computing,
National Applied
Research Laboratories
Tainan, Taiwan
0303118@narlabs.org.tw

Wun-Yuan Huang
National Center for High-
performance Computing,
National Applied
Research Laboratories
Tainan, Taiwan
wunyuan@narlabs.org.tw

Nai-Yuan Hu
National Center for High-
performance Computing,
National Applied
Research Laboratories
Tainan, Taiwan
2103081@narlabs.org.tw

Te-Lung Liu
National Center for High-
performance Computing,
National Applied
Research Laboratories
Tainan, Taiwan
tlliu@narlabs.org.tw

Abstract—This paper discusses the Design of Operation and Monitoring Architecture of the Content Delivery Network (CDN) service deployed in National Center for High-Performance Computing from 2021 to 2022. In 2011, we deployed an experimental node in Tainan. In 2022, we deployed two production nodes in Hsinchu and Tainan. The CDN service is deployed for the research and education units in Taiwan. Furthermore, the CDN service can be applied in another research and development fields, such as Internet of Things (IoT), Big Data analysis. Taking advantages of CDN service, the web users can have better user experiences when browsing the websites of government and academic units.

Keywords—Content Delivery Network, CDN, Big Data

I. INTRODUCTION

Content Delivery Network (CDN) is a framework that integrates Domain Name Service (DNS) and caching technology. The main process is to add edge nodes to the network to cache the content of the original website. When one client browses the origin website (or origin site), the request will be redirected to the nearest edge node according to the user's location so that the user's browsing efficiency can be enhanced. This allows general web users to browse the web without changing their habits. On the other aspect, the original site does not need to be drastically changed to enhance its service capacity.

CDN services have been developed and applied in the industry for many years. There are many companies providing CDN network services, such as Akamai [1], Amazon [2], Cloudflare [3], Chunghwa Telecom [4], F5 [5], and so on. At the time of this project in the early 110s, there was no large-scale national CDN service platform in Taiwan's academic networks.

In 2021 and 2022, We have built a CDN platform on the TaiWan Academic Research Network (TWAREN) in National Center for High-Performance Computing (NCHC) to reduce network congestion and provide better user experience in the project of Strengthening Public Sector Network Services and Computing Cloud Infrastructure of the 3rd phase of the Forward-Looking Infrastructure Development Program[6]. In 2021, we completed the experimental platform (CDN Phase I) at the Tainan Branch of the NCHC [7]. In 2022, the CDN production platform (CDN Phase II) was also completed in the Hsinchu headquarters and Tainan branch of NCHC [8].

The CDN service not only can provide well users experiences, but also can be applied to other research topics. Both experimental and the production platforms of the CDN services can be applied to big data analysis due to the 6V characteristics [9]. Also, via the broadband network TaiWan Advanced Research and Education Network (TWAREN) [10] in NCHC, the CDN can easily integrate the Internet of Things (IoT) connected to TWAREN with long distances in Taiwan.

This paper is organized as follows. Section II shows the architecture of content delivery network. The proposed approach to apply CDN in big data analysis is listed in Section III. The Monitoring System is demonstrated in Section IV. In the last Section, we describe the conclusions and future work.

II. ARCHITECTURE OF CONTENT DELIVERY NETWORK

A. Definitions and Architectures of Content Delivery Network

First, we give the nomenclatures in CDN in NCHC.

- Origin websites/sites: the original website that the user wants to connect to and browse, and the DNS of the original website is responsible for URL resolution.
- Administrators of origin sites: the webmaster of each origin sites.
- Clients/Internet users: the users who browse the original website and resolves the IP address of the original website through the user's DNS Resolver.
- System operators: the CDN system operators in NCHC.

B. Components and Functionalities of CDN

As shown in Fig. 1, the there are several subsystems in CDN architecture, such as:

- CDN portal: the subsystem for administrators of origin websites to maintain the policies of cache.
- CDN edge node: the hosts for local cache of the origin websites accessed by clients.
- CDN operation platform: maintained by operators of NCHC to monitor the performances.
- CDN security protection: various devices for security protection, such as firewall, Web Application Firewall (WAF), Protection device of Distributed Denial of Service (DDoS).
- CDN Application Interface: the communication

interfaces of 3rd-party applications for further development.

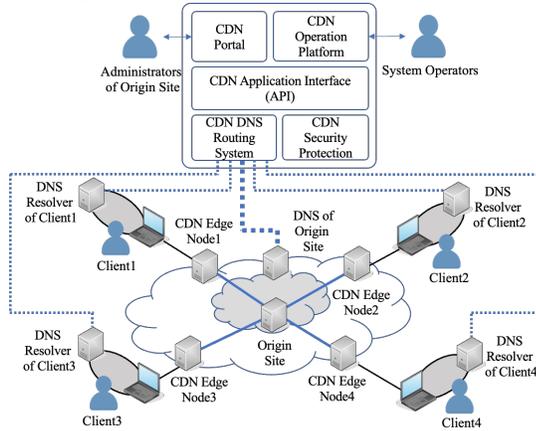


Fig. 1. Architecture of the Content Delivery Network

III. PROPOSED APPROACH TO APPLY CDN IN BIG DATA ANALYSIS

In big data analysis, there are 6 characteristics with initial character “v,” such as velocity, volume, value, variety, veracity, and variability. The CDN infrastructure in NCHC is very suitable for big data analysis.

- Velocity: the CDN can gather user access data via the 100G broadband TWAREN infrastructure.
- Volume: combining with the storage service in NCHC, the huge amount of data can be stored.
- Value: the preference browsing records can be analyzed.
- Variety: the CDN service can cache various type of file, such as text, images, audios, and videos.
- Veracity: since the records on the CDN production platform are practical data, the veracity can be yielded.
- Variability: since the amount of storage space in CDN is huge all data can be stored with variable type and formats.

As mentioned above, since the CDN platform is a local cache of many origin websites for clients to browse. Therefore, the CDN platform can be viewed as a subset of Internet.

IV. MONITORING ARCHITECTURE

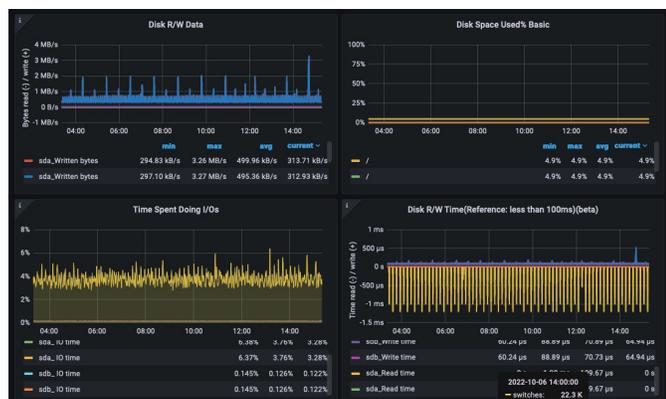


Fig. 2. Monitoring interface: the statistics

In this Section, we demonstrate the monitoring architecture of the CDN platform. As shown in Fig.2, the related statistics are represented in various type of charts. The operators of NCHC can easily obtain the information of all equipment in the system.

Furthermore, we adopt the CyberMonitor platform provided by FOX [11]. As shown in Fig. 3, each block represents the status of one equipment. Each block has a status dot with green color in the upper right corner.

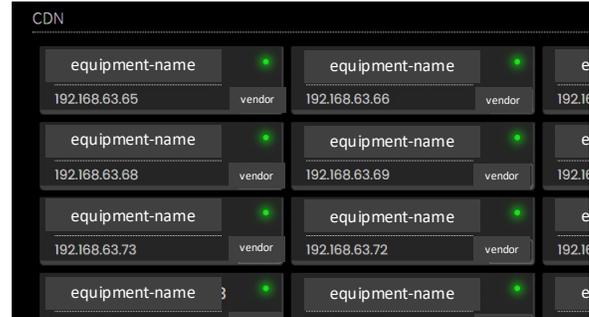


Fig. 3. Snapshot of the CyberMonitor Platform

V. CONCLUSION AND FUTURE WORK

In this paper, we demonstrate the construction and deployment of the Content Delivery service in NCHC on TWAREN. The CDN service not only can provide well users experiences, but also can be applied to other research topics, such as Big Data Analysis, and Internet of Things (IoT). In the future, we will increase the CDN nodes and enhance the performance, stability, and security of the CDN platform so that the web users can have better user experiences when browsing the websites of government and academic units.

REFERENCES

- [1] Akamai CDN service, <https://www.akamai.com/solutions/content-delivery-network>
- [2] Amazon CDN service, <https://aws.amazon.com/tw/caching/cdn/>
- [3] Cloudflare CDN service, <https://www.cloudflare.com/zh-tw/cdn/>
- [4] Chunghwa Telecom CDN, <https://www.cdn.hinet.net/index.html>
- [5] F5 CDN, <https://www.f5.com/services/resources/glossary/content-delivery-network-cdn>
- [6] National Deployment Council- Forward-looking Infrastructure Development Program https://www.ndc.gov.tw/en/Content_List.aspx?n=BCDB1EECF95E18E2&upn=7767B950199EF590
- [7] Ta-Yuan Chou, Hui-Min Tseng, Wun-Yun Huang, Nai-Yuan Hu, Te-Lung Liu, “Construction of the Content Delivery Network Service for the Public Service Network,” 2021 Taiwan Academic Network Conference (TANET 2021), Taichung, Taiwan
- [8] Ta-Yuan Chou, Hui-Min Tseng, Wun-Yun Huang, Nai-Yuan Hu, Te-Lung Liu, “Construction of the Production Platform of the Content Delivery Network Service for the Public Service Network,” 2021 Taiwan Academic Network Conference (TANET 2022), Taoyuan, Taiwan
- [9] The 6 Vs of Big Data, <https://neuralt.com/the-6-vs-of-big-data-neural-technologies/>
- [10] TaiWan Advanced Research and Education Network (TWAREN) <https://www.twaren.net/english/>
- [11] Formosa Open eXchange, FOX, <https://www.fox.net.tw/>