

ANALYSIS OF ECONOMIC EFFICIENCY INDICATORS OF THE CONTENT DELIVERY NETWORKS

Khujamatova Shakhlo (sh.khujamatova@gmail.com)

*PhD student of Tashkent University of Information Technologies named after
Muhammad al-Khwarizmi*

Abstract: In this article, the criteria and the corresponding indicator of the effectiveness of the introduction and use of networks based on the content delivery network (CDN) technologies were determined. Also, the developed efficiency criterion consists of the superiority of general utility over costs, which made it possible to study the efficiency of CDN implementation and use, taking into account technical and economic factors.

Introduction: Today, telecommunication networks occupy an important place in the development of various industries, because the industries work on the basis of communication technologies in conducting their internal and external activities. From this point of view, scientific researches are being carried out all over the world for effective delivery of services in the field of telecommunications. The main direction of such research is the effective use of network resources, which includes increasing network throughput, reducing existing traffic delays, increasing energy efficiency, etc.

Today, the traditional Internet network operates as an international computer network aimed at ensuring the availability of various information resources using the TCP/IP protocol stack. The conducted analyzes show that by the end of 2023, the number of network users worldwide will be 5.3 billion.

The growth in the number of Internet users for the entire period from 2018 to 2023 was six percent. The fastest growth during this period was between 2019,

when 300 million new internet users were added (depending on the reason for the worldwide quarantine), and the growth rate compared to 2018 was 7.7 percent.

The Internet provides users with the following functions:

-data transfer. Ability to transfer audio, video, text and graphic data between networked computers and other devices;

- communication. The communication function of the Internet allows users to communicate with each other, exchange information and collaborate on projects, regardless of their location;

- searching for information. The information retrieval function of the Internet includes a variety of tools and technologies that enable information retrieval and access, such as search engines, online databases, and digital libraries. This makes it easy for users to access large amounts of information on almost any topic.

- electronic commerce. The possibility of selling/buying services or goods through Internet services and online stores;

- entertaining content and communication. The ability to watch online video, play games and communicate in it, and implement other types of entertainment mechanisms;

- cloud computing. The ability to store/process data on remote servers and clouds to access data from any location through any tool;

- remote control. Control of computers and other devices using special software, etc.

The above-mentioned are considered part of the opportunities offered by the Internet network, and reducing and optimizing Internet traffic plays an important role in providing such opportunities.

Main part. A content delivery network is a network technology that is geographically distributed in the Internet network environment, designed for effective delivery of content and allows operators to reduce network traffic.

The state of development of content delivery networks can be characterized by the following trends: the increase in the number of content delivery network nodes in the world, the increase in the number of users of mobile devices, the development of CDN technologies and algorithms, security issues and data distribution models.

Content delivery networks have been showing all their potential in the next ten years, in this case, the analysis of its development trends is relevant.

The analysis of economic indicators of the effectiveness of content delivery networks requires the identification of criteria, and the existence of such criteria is necessary for the development of methods for evaluating the effectiveness of CDN networks and their use.

Based on this criterion, it is possible to assess the effectiveness of the implementation and operation of CDN networks, as well as to determine the appropriateness of their implementation in certain conditions and to choose implementation options. Based on the results of the analysis of the CDN implementation and operation processes and using a mathematical model, the development of the principles of network implementation is considered, and they are highlighted below.

The principle of planning, on the one hand, emphasizes the need to consider the technological and economic aspects together, on the other hand, it requires the separation of the main task of achieving utility through the project from the personal task of distribution and pricing of utility services. Such a division allows to solve both problems more efficiently, and the joint consideration of economic and

technological features allows to avoid disruptions inherent in existing technological projects, including CDN.

In addition, this principle indicates the need to determine in advance the goals, criteria and performance indicators of the CDN network being implemented, which allows making informed decisions at all stages of the development of this project. Experience with CDN implementation shows that the lack of clear performance metrics makes it difficult to monitor the performance of these networks. The scheduling principle is general and can be applied not only to CDN, but also to the scheduling of other technology projects. This principle defines the goals and possible methods of implementing and developing a technological project, as well as grounds conceptual decision-making.

The principle of modeling and development correction makes it possible to take into account various options for the development of a technological project thanks to the use of modeling. As a result, it will be possible to correct the development in time and predict the consequences of the adopted decisions in case of deviation from the intended goals. One of the reasons for the decline of this industry is the lack of timely efforts to correct the development of CDN networks. In general, this principle is used in most cases, except for cases where standard projects are implemented and additional modeling is not required.

Unlike the first two principles, which are of a conceptual nature, the principle of implementation and operational efficiency assessment, as well as the principle of taking into account technological features, are more focused on determining practical measures for the direct implementation of CDN.

The principle of evaluation of the effectiveness of implementation and use determines both the performance indicator of CDN activity and its structure - separate components of benefits and costs. Thanks to a clear understanding of this structure, it is possible to target individual network parameters to improve the

performance of the entire network. At the same time, the currently dominant empirical approach to the development and use of CDNs often leads to insufficient efficiency of their operation and slows down the development of the industry. It should be noted that the performance indicator and its structure proposed by this principle are used in many cases, and its use in corporate networks seems to be the most successful. However, in accordance with the principle of planning, for each specific situation, depending on the goals of the project, its own criterion and performance indicator can be selected. Thus, the scope of application of this principle is limited by the conditions and tasks of a particular CDN network.

The principle of consideration of technological features emphasizes the characteristic features of the process of implementation and use of CDN. Taking them into account allows you to improve the efficiency of the implementation of CDN networks and avoid errors in the adaptation and use of approaches and technologies used in other technological projects. In general, this principle applies in many cases, but the scope of a particular feature is limited by the implementation conditions.

While the use of the first two principles can be done mainly on a methodological basis, the application of the third and fourth principles requires the knowledge and clarification of a significant amount of background information and characteristics. In a generalized form, this knowledge and features are presented in the form of various coefficients and parameters of the mathematical model of CDN performance. They are determined by the components of external conditions, the order of network implementation and its technological features.

The costs of creating a CDN depend on the number of CDN data centers and the cost of their creation and operation, as well as the initial and ongoing costs incurred during the implementation and operation phases. In addition, the cost of computing and other resources should be considered. Determining the values of

these parameters is related to the technological and economic conditions associated with the implementation of a specific network based on CDN technologies:

- available equipment and communication channels;
- prices of hardware and software, as well as data transmission;
- necessary specialists, salary, etc.

At the same time, when switching to a CDN, it is necessary to take into account the savings resulting from the partial or complete abandonment of the use of a centralized system. In general, a variety of economic methods can be used to estimate costs, primarily for use in the communications industry. It is also important to study the experience of previously implemented networks, as well as the characteristics specific to a certain region or corporation.

It is important to note that the various internal and external parameters discussed above have unequal effects on CDN implementation and operation processes. In particular, the size of the source network and CDN network, as well as the flow of incoming requests, have the greatest impact, while changing the frequency of information updates has, in most cases, a negligible impact. In addition, the impact of many parameters is determined by the goals and objectives of the implementation. For example, if the main goal of implementing a CDN is to reduce the amount of traffic transmitted by the network, the parameters c_{traf} and b will be the most important for the implemented system.

Based on this, let's consider the prospects of introducing a CDN into the telecommunications network. There are a number of cases that show the special relevance of CDN implementation in the Internet segment of the telecommunications network:

- significant number of Internet users and high growth rates;

- the large spatial size of the network and the concentration of available information resources in several large centers;

- lagging development compared to developed countries, which allows us to take into account both positive and negative experiences when introducing new technologies;

- the presence of great opportunities for the development of the network.

Conclusion: It should be noted that although some delays in the development of the Internet allow the use of experience gained abroad, it is necessary to be very careful in making analogies with projects developed in developed countries, because the implementation between them Due to the significant differences between our countries in the terms of promotion and operation of the CDN.

Thus, the further development of CDNs and their implementation in telecommunication networks should be based on the scientifically based principles developed and explored in this work.

Reference.

1. <https://datareportal.com/reports/digital-2024-deep-dive-the-state-of-internet-adoption>
2. <https://www.grandviewresearch.com/industry-analysis/content-delivery-networks-cnd-market>
3. <https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/>
4. Fortino G., Palau C. E. Next generation content delivery infrastructures: emerging paradigms and technologies. — IGI Global, 2012.

5. Maillé P., Tuffin B. (2014) How Do Content Delivery Networks Affect the Economy of the Internet and the Network Neutrality Debate? Economics of Grids, Clouds, Systems, and Services. Springer. P. 222–230.

6. MIPRO‘2015. 38th International Convention Opatija, Croatia, 25-29 may 2015.

7. Xujamatova Sh. Axborot-kommunikatsiya texnologiyalari va barqaror iqtisodiy o‘rinish: integratsiya va rivojlanishi // Muhammad al-Xorazmiy avlodlari ilmiy-amaliy va axborot-tahliliy jurnali. 2024 yil 2(28) –son, 261-266 betlar.

8. N.N.Xasanov. Kontentni yetkazib berish tarmog‘ining rivojlanish tendensiyasi // Akademik T.D.Radjabovning xotirasiga bag‘ishlangan “Zamonaviy ilm-fanning dolzarb muammolari, yutuqlari va innovatsiyalari” mavzusida respublika ilmiy va ilmiy-texnik anjuman maqolalar to‘plami. Toshkent - 2023 yil, 27- May. 28-31 betlar.

9. Petroc Taylor, “Internet user growth worldwide from 2018 to 2023” Technology & Telecommunications, Statista - Jan 19, 2023.

10. Podlipnig S., Boszormenyi L. Replacement strategies for quality based video caching //Proceedings. IEEE International Conference on Multimedia and Expo. – IEEE, 2002. – T. 2. – C. 49-52.

11. Khujamatov Sh. Increasing the Efficiency of Content Distribution Networks with Sustainable Economic Growth // International Conference on Advance Research in Humanities, Sciences and Education. Hosted from Istanbul, The Turkey June 30th 2024. p.p.-246-249.