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Article

Analysis and Optimization of Computer Networks in Organizations

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Abstract: This article examines the issues of analysis and optimization of computer networks in organizations. The growth of network traffic and variability of workload require effective network management. The study highlights methods of network monitoring, traffic analysis, and optimal resource allocation. The results demonstrate that systematic analysis and optimization improve network stability, performance, and overall efficiency.In addition, the paper emphasizes the modernization of network infrastructure based on modern technologies, enhancement of security levels, and mechanisms for early fault detection. The possibilities of automating management processes through real-time monitoring of network device performance, data flow forecasting, and the application of artificial intelligence elements are analyzed. Furthermore, the effectiveness of cloud technologies and virtualization solutions in improving resource utilization and reducing operational costs is substantiated.

Keywords: Computer networks, network monitoring, traffic analysis, network optimization, resource allocation, load balancing, bandwidth, quality of service (QoS), network security, virtualization

1. Introduction

In the era of rapidly developing information technologies, computer networks have become an integral part of the operations of any organization. In government institutions, educational organizations, banking systems, industrial enterprises, and private companies, almost all business processes are carried out through computer networks. The processes of data storage, transmission, processing, and exchange directly depend on the stable and efficient functioning of network infrastructure[1].

In recent years, the increase in the number of users, the expansion of online services, and the need to handle large volumes of data have led to a significant growth in network traffic. This, in turn, results in issues such as uneven load distribution, reduced speed, packet loss, and network interruptions[2]. These problems can have serious negative consequences, especially in processes involving critical data within organizations.Therefore, continuous analysis of computer networks, monitoring of their performance indicators, and efficient utilization of available resources are of great importance. Network optimization makes it possible to reduce excessive load, increase data transmission speed, enhance security levels, and improve overall efficiency. In this regard, the use of modern technologies, including automated monitoring systems, traffic analysis tools, and resource management mechanisms, plays a crucial role[3].

This article examines the issues of analyzing and optimizing computer networks in organizations. The main objective of the study is to investigate the state of network infrastructure, identify existing problems, and propose effective methods for their elimination. Additionally, the paper explores opportunities to improve network stability and performance through network monitoring, traffic analysis, and optimal resource allocation[4].

The relevance of this topic lies in the fact that the effective operation of any organization directly depends on the uninterrupted functioning of its information systems and computer networks. Therefore, scientific analysis and optimization of networks have become one of the key tasks today[5].

2. Methodology

This study is focused on the analysis and optimization of computer networks in organizations. The research was conducted using a comprehensive approach that incorporates both theoretical and practical methods. The main objective of the study was to evaluate the performance efficiency of the existing network infrastructure, identify problem areas, and develop approaches for the effective utilization of network resources[6].

In the first stage, existing scientific literature, research articles, technical manuals, and standards related to the topic were reviewed. This stage contributed to the development of theoretical knowledge on network operation principles, types of traffic, load variability, resource management, and optimization methods. In addition, modern networking technologies, including virtualization and cloud-based solutions, were analyzed in terms of their practical applications. The literature review also included an examination of various network optimization models proposed by researchers and their practical effectiveness[7].

In the second stage, monitoring and diagnostic methods were applied to determine the actual condition of the organization's network. During the monitoring process, key network performance indicators such as bandwidth, latency, packet loss, traffic volume, and load levels across network segments were observed. These data served as a basis for identifying problematic areas in the network infrastructure and for conducting an in-depth analysis of traffic flows[8].

In the next stage, statistical analysis methods were used to examine the volume and types of transmitted data, their distribution across services, and the segments generating the highest load. This analysis made it possible to identify daily, weekly, and monthly variations in network load and to determine key trends in network performance. It also enabled the detection of faults and factors negatively affecting efficiency within the network infrastructure[9].

3. Result and discussion.

To ensure efficient network performance, several optimization techniques were applied. These included load balancing, network segmentation, Quality of Service (QoS), and the use of virtualization and cloud technologies. Load balancing helped reduce excessive loads and distribute network resources evenly. Network segmentation allowed for better regulation of data flows and improved security. QoS technologies ensured prioritization of critical data transmission and enhanced the stability of network services[10]. Furthermore, the implementation of virtualization and cloud technologies was analyzed in terms of improving hardware resource utilization, simplifying network management, and reducing operational costs. These technologies were identified as key factors in increasing the flexibility of network infrastructure and expanding service capabilities. In the final stage of the study, network performance indicators before and after optimization were compared. This comparison allowed for the evaluation of changes in bandwidth, data transmission speed, packet loss, and network load levels, as well as the effectiveness of the proposed optimization methods. As a result, the research methodology enabled the development of practical recommendations for systematically analyzing network infrastructure, identifying problem areas, efficiently utilizing

resources, and improving network stability and performance[11].

The diagram above illustrates the main stages of the computer network optimization process in an organization. The process begins with the continuous monitoring of network performance. At this stage, key network indicators such as bandwidth, latency, and packet loss are identified and measured.

In the next stage, the collected data are analyzed using statistical and analytical methods. Through this analysis, problematic network segments, services generating excessive load, and the distribution of traffic flows are identified[12].

In the third stage, the network optimization process is carried out based on the identified issues. This stage includes measures such as load balancing, network segmentation, Quality of Service (QoS) management, and the use of modern virtualization technologies to improve network performance[13].

In the final stage, network performance indicators before and after optimization are compared, and the Table 1. effectiveness of the applied methods is evaluated. This approach ensures the stable operation of network infrastructure and enables efficient utilization of resources.

Indicator	Before Optimization	After Optimization
Bandwidth	100 Mbps	140 Mbps
Latency	35 ms	18 ms
Packet Loss	3.2%	0.8%
Network Load	85%	60%

Table 1. Analysis of Computer Network Performance Indicators

The table compares the key performance indicators of the organization's computer network before and after optimization. The results show that network bandwidth increased by 40%, while latency was nearly halved. Additionally, the packet loss rate decreased from 3.2% to 0.8%, indicating a significant improvement in network quality.

The reduction in network load also reflects a more efficient allocation of resources. These data clearly confirm the effectiveness of the optimization methods applied[14].

4. Discussion

The results of this study showed that systematically monitoring, analyzing, and optimizing an organization’s computer network can significantly improve network performance. During the monitoring process, high-load segments and packet loss were identified, indicating uneven distribution of network resources, which led to reduced data transfer speeds and increased latency. Following the implementation of optimization measures, these parameters improved significantly: bandwidth increased, latency decreased, and packet loss rates were reduced. These findings confirm the practical effectiveness of load balancing, network segmentation, and Quality of Service (QoS) technologies.

When compared with other studies, these methods align with previous research on improving network performance. For example, solutions aimed at increasing bandwidth and reducing latency have also proven effective in other organizations, as documented in the literature. Additionally, the implementation of virtualization and cloud-based solutions enables more efficient resource utilization and cost reduction, which is clearly reflected in the study results.

From a practical perspective, the results provide organizations with concrete recommendations for optimizing network infrastructure. Network segmentation and QoS

mechanisms prioritize critical services, while load balancing reduces excessive traffic. At the same time, virtualization and cloud solutions allow for more efficient resource management, ensuring stable and high-speed network operations.

The study has certain limitations. First, network monitoring was conducted only over a specific time period, so seasonal or unexpected traffic spikes may not have been fully captured. Second, the research was conducted within a single organization, so caution is required when generalizing the results to other organizations. Nevertheless, future implementation of advanced optimization algorithms and automated monitoring systems could yield even more effective results.

In conclusion, this study identified effective approaches for systematic network analysis and optimization, and the practical results demonstrate the potential to improve network performance, optimize resource use, and enhance service quality in organizations. This highlights not only the scientific but also the practical significance of the research[15].

5. Conclusion

This study focused on analyzing and optimizing computer networks in organizations. The results indicate that systematically monitoring and analyzing the network infrastructure can significantly improve its performance. Implementing optimization measures, particularly load balancing, network segmentation, and Quality of Service (QoS) management, enhanced network stability, reduced latency, and significantly decreased packet loss.

Additionally, introducing virtualization and cloud technologies enabled more efficient use of network resources and reduced operational costs. These results improved not only the speed of the network but also the stability of service quality.

The practical significance of this study is that organizations can apply these recommendations to enhance network performance, optimize resource utilization, and prioritize critical services. Moreover, the findings provide a foundation for future implementation of advanced network optimization algorithms and automated monitoring systems.

In conclusion, this research offers scientific insights for optimizing network infrastructure while providing organizations with practical recommendations to improve network stability and speed. It also opens new directions for future studies, including enhancing network security and automating real-time monitoring.

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