Acta Technica *62* No. 2A/2017, 415–424

Network computing principle and application analysis based on distributed peer-to-peer

Lei Liu[1]

Abstract. The development of network computing principle based on distributed peer to peer is very important for the improvement of computer operation function. In order to improve the relative theory and technology of computer industry in our country, the principle of network computer based on distributed peer to peer was recognized in this paper. CPF technology was used as an example of this research, and the network computing algorithm was applied to the actual network operation process. The results show that the distributed peer-to-peer network computing principle has a great positive impact on the efficiency and accuracy of the computing process. The conclusions provide a theoretical support for the development of network computing technology in China, as well as s significant reference for the progress of China's overall economic industry.

Key words. Distributed, reciprocity, network computing principle.

1. Introduction

With the rapid development of the world economy, a lot of innovative sciences and technologies have been gradually developed in people's productions and lives, and have played a certain role in promoting the development of various industries with the combination of related enterprises and fields, and have had a positive impact. Among them, the development and application of computer network technology is one of the important technologies for the rapid development of science and technology in the current era. This research is mainly aimed at the computation principle and application of network computer technology, the purpose is to provide a theoretical basis for the development and progress of China's computer industry and provide a technical support for the improvement of the comprehensive economic level of our country.

[1]Department of Computer Science and Engineering, The City College of Jilin Jianzhu University, Changchun, Jilin, 130000, China

2. State of the art

Computer technology has more data information, so that a lot of industries can further analyze the status and trend of development through the analysis on the relevant data information [1]. Because of the support of a large amount of data and information, the industry can rely on the analysis of basic data in the process of development to sum up the pros and cons of each link of the development of the industry, so that it is of great significance and influence to the development plan and the target formulation of the industry. And the application of computer network technology in real life breaks the restriction of time and space better, which makes the exchange of information among various sectors increase, and provides more communication ways for the interactive development of enterprises [2]. Furthermore, it also can promote enterprises to communicate with related technologies and theories, and promote the development and improvement of related technologies too, so as to rectify their shortcomings, further enhance the overall strength and progress of enterprises and provide certain data supports and scientific basis [3].

Through the use of the computer network industry, there have been many major changes in the mode of development happening quietly in many industries, which are very important for the development of the industry itself and the promotion of the country's comprehensive strength [4]. With the rapid development of computer network technology, more and more enterprises and areas begin to apply this technology into the operation process of traditional industries, at the same time, the characteristic of data sharing of the computer network information technology promotes the development of the industry [5]. However, while each industry makes great progresses, it also requires further improvement and promotion of computer network technologies and theories, especially for the emergence of new innovation areas with more advanced development levels nowadays. The demand for computer network technology has gradually increased, which requires that the computer hardware facilities should be more perfect. The computer's speed and data transmission are more efficient, and then it has more accurate computing methods, thus promoting its own development [6]. In this trend, the upgrading of the computer network principle and theoretical improvement has gradually become one of the important subjects in the research of computer technology in the world. Only by a better investment in the subject of human and material resources, can we make the development of computer network technology continue to analyze its shortcomings. And it can also improve the related operation principle, so as to realize the win-win situation of computer network technology and other industries [7]. The application of computer network technology in China has gradually matured, and the development of computer technology has also provided a certain technical support for the progress of various industries in China.

2.1. Methodology

With the continuous improvement of China's comprehensive economic level, all the industries in our country have been developed to a certain extent, and the

introduction of computer network technology has greatly promoted the progress of various industries in China (Fig. 1).

Fig. 1. The development of computer technology

Various industries in our country have begun to combine the theory and technology of the computer with the traditional way of development of the industry gradually, which has brought more positive influences to the further improvement of the comprehensive level of the industry [8]. As the basic information and data in China's industry continues to rise, the amount of data continues to expand too, so that the analysis and processing of a large number of data resources have become an important research content of the industry. This requires computer network technology to support large data systems. And because of the increasing interaction among different industries, the importance of the exchange of basic information that is related to the industry has become a major way for all sectors of the industry to develop together. In the development of these industries, they use network computer technology to share their basic information by remote transmissions, so that more data resources can be excavated in many ways, which further realizes the efficient use of data resources and reduces the waste of relevant resources and information [9]. The development of computer network technology also further breaks down the restriction of time and space between different industries and regions, which has a certain impact on the lower cost of the development of the industry [10]. Through reading and analyzing the related data, it can be seen that the development of network computer technology has a great influence on the promotion of the comprehensive level of various industries in China. And our country has begun to gradually put more manpower and material resources into the development of computer network technology, and has made some considerable achievements. The researches of computer network technology in our country are more in the development of computer hardware, and the research and analysis of relative principles are still few, so that the network computing principle of the network computer cannot be further analyzed more fully, which indirectly affects the practical application of the related enterprises in the network computer technology to a certain extent. It may cause the lack of knowledge about the relevant theories of the enterprise, which cannot combine the theories and technologies with the development needs of the enterprise,

so it is extremely detrimental to the development of the enterprise. In this uncoordinated phenomenon, researchers in China have begun to gradually strengthen the importance of network computing principles, and the relevant theories have been applied to the actual production activities [11]. Therefore, the purpose of this research is to analyze the network computing principle and its application status based on distributed peer-to-peer. The purpose of this study is to provide a scientific basis for the continuous improvement and enrichment of the computer network theory in China, and provide technical supports for the comprehensive improvement of the overall economic level of our country.

In this study, the relevant data was firstly read and summarized, then the network computing principles based on distributed peer-to-peer and the related concepts were summarized [12]. Then, based on the related algorithms, the related characteristics of distributed peer-to-peer computing principles were analyzed (the DCF protocol under distributed peer-to-peer technology was the object of this study). The model equations used are as follows:

$$backoffTime = Random * \mathrm{a}SotTime\,, \tag{1}$$

$$BackoffTime = [0, CW]slotTime(CW_{\min} < CW < CW_{\max})\,, \tag{2}$$

$$AIFS[AC] = AIFSN[AC] * aSlotTime + aSIFSTime\,. \tag{3}$$

Here, $BackoffTime$ represents a distributed peer-to-peer model operation waiting time, $SlotTime$ is the protocol frame interval, $CW_{\min}$ represents the minimum contention window, $CW_{\max}$ represents the maximum contention window, AIFS is arbitration inter frame spacing, AIFSN is arbitration inter frame coefficient, and $SIFSTime$ represents the minimum time interval between frames.

Based on the full analysis and understanding of the relevant operating mechanism, the advantages of distributed peer-to-peer network computing principles were further analyzed.

2.2. Result analysis and discussion

With the rapid development of the world economy and the continuous progress of science and technology, our production and life have gradually entered a new era of information technology and industrialization with high developments. In this new era of development, the world's various industries are constantly receiving the impact of the development of information technologies. In this context, the rapid development of network computer technology has provided positive effects on the progress of various industries, such as the world's culture, economy, military, medicine, etc. [13]. With the rapid development of this technology, many industries are undergoing unprecedented changes and progress (Fig. 2). Nowadays, people's thinking and living habits are changing under the trend of constant accumulations of data and information, and the development of network computer technology is driving the change and progress of today's society with a more powerful means. Many scholars

believe that network computer technology, as the new and contemporary science and technology, plays a huge positive role in the collection and processing of data information. With the increasing emphasis on some basic information in various industries and fields, the combination of network technology and computer technology has gradually become the trend of the development of the industry. Especially the development of the large amount of data of network computer technology has promoted the progress of people's society and the development of the industry to a higher level. Under the influence of computer network technology, the cognition and achievement of various trades and fields are gradually enriched [14].

Fig. 2. Development of computer and other industries

With the rapid development of the world economy and the continuous optimization of the industry, the computer network technology has more massive databases, and its basic information collection process is more perfect, and it can make further collection and processing on the relevant data, so as to achieve different client sharing. As a result, it is constantly used in many fields and industries, such as in some commercial, financial, medical, health and aerospace industries. The development of these industries can access relatively large basic data information. The development of the industry and the improvement of the speed and efficiency require all sectors to introduce the network computer technology and rely on the basic performance of the technology, so as to realize the sustainable development of the industry. With the development of the times, the development of computer network technology has become an important research topic in the development of the contemporary era. The research of computer network technology has gradually turned from the research of its hardware facilities to the analysis and discussion of the related program calculation principles [15]. Especially with the development of network computer technology in various industries and fields, the influence has gradually increased. Now, many researchers have begun to gradually analyze the principles of network computer technology. On the basis of many limitations and restrictions of the existing mechanism, the shortcomings of the original mechanism are improved, so as to design an operational theory with the relatively perfect systematical analysis. This provides a certain technical support for the development of computer network

technology and a scientific basis for the application and combination of computer technology in other industries. A lot of computer network algorithm operation theories have been gradually mentioned and applied, and they have brought the cross-age significance for the quantifiable dimension of human life. The principle of distributed computer network is a new network computing model that is developed under the trend of expanding the Internet scale and increasing the bandwidth. The computer system of each terminal user is connected with each other, and each node in the connection process arbitrarily connects the plurality of lines without any rules. When a terminal line is damaged and blocked, it can rely on other lines to complete the use of related functions, so that the computing method can be more accurate and efficient to complete the sharing of information resources. The distributed technology of network computing came into being around 1980. The premise of the design is to let more users share the resources of some networks, and make the information run on multiple computers simultaneously. Several of the main techniques designed are summarized in Table 1.

Table 1. A brief overview of distributed technologies

	Distributed technologies	Brief overviews	Technological advantages
1	Grid computing	The large computational problem is broken up into many smaller parts, and then they are executed by a number of computers	It not only solves large-scale computing problems, but also supports cross-domain computing, and it takes full advantages of the large amount of idle resources of heterogeneous computers.
2	Peer-to-peer technology	It rises as the antithesis of the C/S model	There are no central nodes in the model, and the node resources are equal. Each node can serve as a resource for the server, and it also can also serve as a client to apply resources to other nodes.
3	Middleware technology	A service program between the operating system and application software that can provide the running and development environment for the upper application software	It can provide resource sharing for different distributed technologies. As an independent and reusable system software, middleware can calculate resource management and communication in the distributed system.
4	Message passing	A communication mechanism adopted by a distributed system that uses *send* and *receive* primitives to send and receive messages respectively	Large scale and high performance and portability. The technology can be used for parallel computer writing.
5	Web Service	Component programming	Whether it runs on the same operating system and whether it is programming the same language or not do not affect the communication between applications.

The main technical forms are divided into 5 major categories, and each of these distributed technologies has its own advantages and characteristics that are related to the technology. Only by analyzing and applying the characteristics of all kinds of distributed technologies, can it provide a certain theoretical support for the perfection of the relevant theories and the integration of traditional industries.

Then, the DCF protocol under the distributed peer-to-peer technology was taken as the object of this study, and the related characteristics were analyzed. First of all, the mechanism of DCF was explored, and the mechanism was analyzed, as shown in Fig. 3, and the operation mechanism of the graph was analyzed. The result shows that the operation model deals with the related data. Thus, in the process of data transmission, the priority degree and importance of data are further analyzed. It arranges the channel for the more important data information, thus ensuring that the priority data information can be further arranged and processed, and it also reduces the data transmission conflict in the transmission process due to the insufficient channel, so as to effectively ensure the efficiency and accuracy of data transmissions. Therefore, this kind of distributed peer-to-peer network computing technology can effectively realize the transmission and sharing of different types of data information, which has certain advantages.

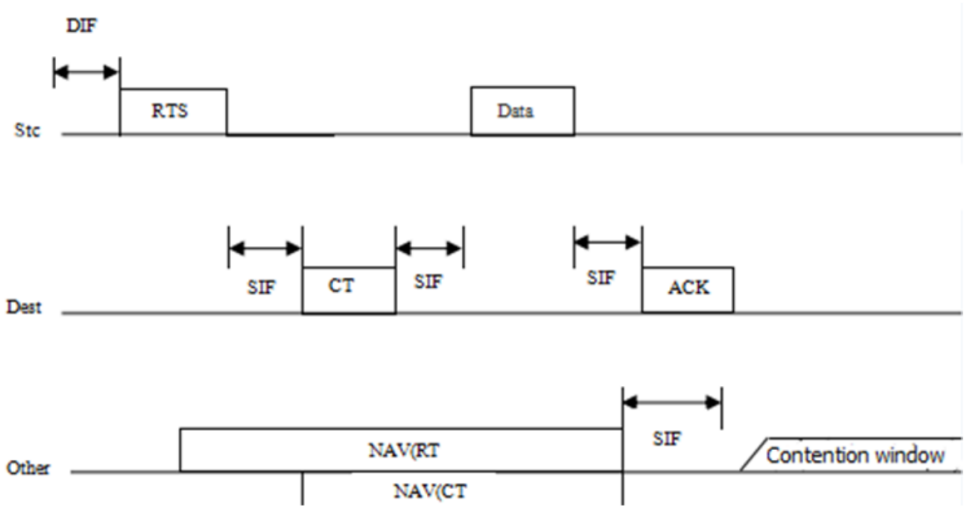

Fig. 3. Distributed peer-to-peer computing principles and process diagrams

On the basis of full understanding of the concepts and related theories of PCF's distributed peer-to-peer network computing technology, the relation between the priority level of data information and the access category of data information was analyzed. The results are shown in Table 2. On this basis, the relevant operational index data of PCF's distributed peer-to-peer network computing technology was further generalized. The results are shown in Table 3.

Through the summarization and analysis of the related distributed peer-to-peer network computing technology principles, and based on the cognition of theories and concepts of PCF's distributed peer-to-peer network computing technology, the

related data was analyzed, and then the advantages of the application of the distributed peer-to-peer network computing principle were confirmed. The analysis results are shown in Figure 4.

Table 2. A summary of the relation between data information priority levels and access categories of data information

Priority	UP	AC	Designation
Lowest to highest	0	AC-BK	Best Effort
	1	AC-BK	Background
	2	AC-BK	Background
	3	AC-BK	Best Effort
	4	AC-VI	Video
	5	AC-VI	Video
	6	AC-VO	Voice
	7	AC-VO	Voice

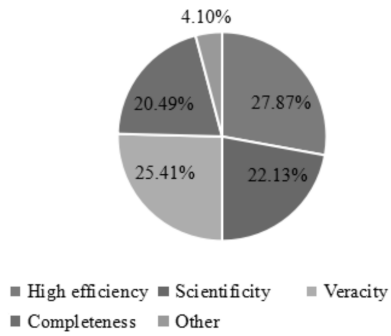

Fig. 4. Analysis of the advantages of distributed peer-to-peer computing

3. Conclusion

With the development of science and technology, the rapid development of modern technologies has brought great convenience for our productions and lives, so that people can contact the outside world more easily in today's era. Network technology, as one of the important technologies in the development of science and technology in the present era, has brought great impetus to the change of human lives. In particular, a large number of data reserves have been better transferred and shared, which has further realized the maximum utilization of data resources. There is no doubt that such a process can promote the production and life of the present era.

Table 3. Related operational index data for PCF's distributed peer-to-peer network computing technology

AC	CWmin	CWmax	AIFSN	TXOP		
				For PHYs defined in Clause 15 and Clause 18	For PHYs defined in Clause 17 and Clause 19	Other PHYS
AC-BK	aCWmin	aCWmax	7	0	0	0
AC-BE	aCWmin	aCWmax	3	0	0	0
AC-VI	(aCWmin+1)/2–1	aCWmin	2	6.016 ms	3.008 ms	0
AC-VO	(aCWmin+1)/4–1	(aCWmin+1)/2–1	2	3.246 ms	1.504 ms	0

With the development of the times, the demand for network technology continues to increase, and now the computer technology is beginning to gradually develop toward a more perfect theory. The development of distributed peer-to-peer network computing technology is one of the main manifestations of the rapid development of computer technologies. However, the relative theory of this technology is still lacking in our country. Therefore, in this study, the related theories and concepts of the technology were summarized and further illustrated by examples. The purpose of this research is to provide a theoretical basis for the development of distributed peer-to-peer computing technology in China, and provide a reference for the progress of the overall scientific and technological level in China. Because the related theory of equality is relatively complex, the author's theoretical level is limited, the result has certain limitation.

References

[1] K. W. Kwong, D. H. K. Tsang: *A congestion-aware search protocol for heterogeneous peer-to-peer networks.* Journal of Supercomputing *36* (2006), No. 3, 265–282.

[2] S. Sezer, S. Scott-Hayward, P. K. Chouhan, B. Fraser, D. Lake, J. Finnegan, N. Viljoen, M. Miller, N. Rao: *Are we ready for SDN? Implementation challenges for software-defined networks.* IEEE Communications Magazine *51* (2013), No. 7, 36–43.

[3] H. Li, P. Li, S. Guo, A. Nayak: *Byzantine-resilient secure software-defined networks with multiple controllers in cloud.* IEEE Transactions on Cloud Computing *2* (2014), No. 2, 436–447.

[4] I. Martinez-Yelmo, A. Bikfalvi, R. Cuevas, C. Guerrero, J. Garcia: *H-P2PSIP: Interconnection of P2PSIP domains for global multimedia services based on a hierarchical DHT overlay network.* Computer Networks *53* (2009), No. 4, 556–568.

[5] M. H. Aghdam, N. Ghasem-Aghaee, M. E. Basiri: *Text feature selection using ant colony optimization.* Expert Systems with Applications *36* (2009), No. 3, Part: 2, 6843–6853.

[6] W. Zhao, C. E. Davis: *Swarm intelligence based wavelet coefficient feature selection for mass spectral classification: An application to proteomics data.* Analytica Chimica Acta *651* (2009), No. 1, 15–23.

[7] Y. Marinakis, M. Marinaki, M. Doumpos, C. Zopounidis: *Ant colony and particle swarm optimization for financial classification problems.* Expert Systems with Applications *36* (2009), No. 7, 10604–10611.

[8] J. A. Lazzús, M. Rivera, I. Salfate, G. Pulgar-Villarroel, P. Rojas: *Application of particle swarm+ant colony optimization to calculate the interaction parameters on phase equilibria.* Journal of Engineering Thermophysics *25* (2016), No. 2, 216–226.

[9] N. Karaboga: *Transverse vibrations of orthotropic non-uniform rectangular plate with continuously varying density.* Journal of the Franklin Institute *346* (2009), No. 4, 328–348.

[10] G. Zhu, S. Kwong: *Gbest-guided artificial bee colony algorithm for numerical function optimization.* Applied Mathematics and Computation *217* (2010), No. 7, 3166–3173.

[11] M. S. Kiran, M. Gündüz: *The analysis of peculiar control parameters of artificial bee colony algorithm on the numerical optimization problems.* Journal of Computer & Communications *2* (2014), No. 4, 127–136.

[12] F. Kang, J. Li, H. Li: *Artificial bee colony algorithm and pattern search hybridized for global optimization.* Applied Soft Computing *13* (2013), No. 4, 1781–1791.

[13] S. C. Satapathy, A. Naik, K. Parvathi: *Weighted teaching-learning-based optimization for global function optimization.* Applied Mathematics *4* (2013), No. 3, 429–439.

[14] P. Rocca, G. Oliveri, A. Massa: *Differential evolution as applied to electromagnetics.* IEEE Antennas and Propagation Magazine *53* (2011), No. 1, 38–49.

[15] A. Qing: *Comment on "Differential evolution as applied to electromagnetics".* IEEE Antennas and Propagation Magazine *53* (2011), No. 4, 169–171.

Received July 12, 2017