COMPUTER PROCESSING ANALYSIS OF MULTIMEDIA BROADCASTING BIG DATA NETWORK DEPENDENT ON CHANNEL INTERPOLATION ALGORITHM

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In the current era characterized by an overwhelming amount of information, significant advancements in network communication, digital television, and computer technology have led to rapid developments in the acquisition, processing, analysis, and display of multimedia data such as images, videos, audio, and text. This paper puts forward a kind of calculation method for computer processing analysis of multimedia broadcasting big data network (CPAMBBDN) based on the channel interpolation algorithm, which can not only reduce the cumbersomeness of data processing work in the multimedia broadcasting network, but also reduce the amount of data transmission and improve the accuracy of the computation results. The Gaussian elimination method is employed to derive a specific number of coded packets, which are subsequently decoded to retrieve the original computer resource data bank. A comparative analysis of concepts and experimental results indicates that alternative coding computation methods exhibit higher average rates of resource retransmission and overhead control compared to the CPAMBBDN calculation method. The calculation method put forward in this paper can reduce the complicated procedures of network coding in a specific environment while stabilizing the network performance at the same time.

Keywords: Exclusive OR (XOR) Coding, Wireless Broadcasting, Data retransmission, Gaussian Elimination

1. Introduction

As a kind of performance of wireless networks, radio operation is prone to flooding. In this case, data broadcasting can be carried out, but there are the defects of the unstable signal and repeated transmission, resulting in a relatively high energy consumption at the nodes, network congestion, and node packet loss [1-3]. Due to the poor network hardware conditions, many tricky issues can occur, which may cause difficulty in the relevant work based on the channel interpolation algorithm in the network. In the channel interpolation algorithm, the primary task at present is to ensure the smooth transmission of the big data for multimedia

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broadcast. The establishment of nodes within the network facilitates the formation of multiple dissemination channels, thereby ensuring a higher reserve rate for network multimedia dissemination data. Consequently, the reliability of transmission is enhanced through effective storage of the data intended for dissemination [4-6]. At present, Advanced Data Streaming (ADS) is widely adopted for the dissemination of multimedia broadcasting big data. In this approach, multimedia data are stored in the form of Portable Executable Tag (PET). This method offers several advantages. For instance, it enables efficient storage and retrieval of large volumes of multimedia data. The use of PET format allows for better organization and management of the data, making it easier to access and process when needed. Moreover, ADS with PET storage provides a reliable and scalable solution for the dissemination of multimedia broadcasting big data, ensuring smooth and seamless delivery of content to end-users. It also enables faster transmission speeds and reduced latency, enhancing the user experience [7-10]. However, this method has the defects of a high mean packet loss rate and imperfect storage. The challenge of ensuring reliable performance in the network dissemination of data within cloud environments necessitates comprehensive analysis and research into methodologies for disseminating multimedia content. The form of channel interpolation algorithm combined with the communication chain is adopted to send the link by using the remaining bandwidth of the communication link. The dynamic form of operation is carried out on the transmission of data, which can achieve the optimal security performance in data transmission. Compared with foreign wireless networks, domestic wireless networks are not perfect enough, and there are differences in the networks and isomerization of equipment, which have limited the development of the relevant products. The application of new technologies to make up for the deficiencies of the wireless networks is the primary problem to be resolved at present.This paper presents an in-depth study of multimedia-based information transmission technology in the context of computing methods for data broadcasting in wireless networks to ensure the high security of big data transmission in multimedia broadcasting.

Next, the paper is structured as follows: Section I introduces the background and significance of the research on computer processing analysis of multimedia broadcasting big data network (CPAMBBDN) based on the channel interpolation algorithm. Section II delves into the details of the channel interpolation algorithm, explaining its application in the network environment model. Section III presents the architecture of the wireless network multimedia interactive system, while Section IV focuses on the design of the computer processing analysis algorithm based on the multimedia broadcasting big data network. Section V provides simulation and performance analysis, and Section VI concludes the paper with a summary of the findings and contributions.

The contributions of our paper reside in:

i. Proposing a novel calculation method for CPAMBBDN that reduces the complexity of data processing and improves the accuracy of computation results by employing the Gaussian elimination method to derive coded packets,

ii. Demonstrating that the proposed method can stabilize network performance while reducing the amount of data transmission and computational complexity,

iii. Providing a comparative analysis of the proposed CPAMBBDN method with alternative coding computation methods, showing that the proposed method has higher average rates of resource retransmission and overhead control,

iv. Introducing a system model for the multimedia broadcast big data network, which includes a source node and multiple receiving nodes, and the feedback matrix table T to collect and store feedback information,

v. Developing a Random Linear Network Coding approach that allows for the retransmission of lost packets and the decoding of original packets at the receiving nodes,

vi. Presenting a two-phase CPAMBBDN algorithm that includes a data broadcasting phase and a data retransmission phase, which iteratively improves the retransmission process until all receiving nodes have the necessary coded packets for decoding,

vii. Conducting simulation and performance analysis to validate the effectiveness of the CPAMBBDN algorithm, showing that it outperforms the NCWBR algorithm and the traditional ARQ mechanism in terms of packet loss rate and control overhead,

viii. Offering insights into the practical significance of the proposed method in improving the reliability and stability of data transmission in wireless networks, and suggesting future research directions for enhancing the robustness and adaptability of the method.

2. Channel Interpolation Algorithm

During the processing of multimedia broadcast big data within a network, the fundamental information pertaining to this data in the context of channel interpolation algorithms is delineated, and the multimedia broadcast packets originating from the source node are relayed through intermediary nodes in the network [11-13]. A number of computer processing analysis entries for the multimedia broadcast big data dissemination are created, and the development of an analysis plan for the computer processing of multimedia broadcast big data is completed. Before the computer processing and analysis of multimedia broadcasting big data transmission are planned, it is necessary to complete the establishment of a model for the network environment so as to improve the control of the multimedia big data broadcast to the network. In this section, the channel interpolation algorithm is employed to establish the network environment model. This algorithm, also known as the unit solution, segments the multimedia broadcasting big data environment into distinct areas or volumes through a unit decomposition approach. Consequently, it partitions the space into multiple two-dimensional or three-dimensional grids of uniform shape. Abstract description is carried out with the other elements in the network environment as a unit, and a network environment is established, which is easy to understand for the multimedia broadcasting of the big data.

The network system is defined by its length, denoted as m, and its width, represented as n. By selecting a specific angle of the network as the reference point, we establish a rectangular coordinate system with the initial grid coordinates of the upper left corner set at (0, 0). It is assumed that the load boundary is a. Consequently, if we consider the size of three-dimensional reconstruction technology a as a unit grid and subdivide the network environment into several smaller grids, the number of each grid can be expressed as follows: ceil (n/a). The number of grids in different columns is given by cell (m/a), where ceil denotes rounding up to the nearest integer.

The mapping between a two-dimensional space and a one-dimensional space is conducted within the structured network environment. During the processes of computer processing, analysis, and planning, this mapping is modified and utilized in accordance with the requirements of the planning algorithm. The detailed mapping relationship is illustrated as follows:

$$bianhao = (x-1) \times ceil(m/a) + y \tag{1}$$

If the accurate analysis of computer processing between points is not considered, whether the initial point of multimedia broadcasting big data is located at the export (with one being designated as the initial point for multimedia broadcasting) can be regarded as a typical instance of multimedia broadcasting big data during export in the context of data network processing. Conversely, if the initial point does not reside at the exit, it may be classified as computer processing within a big data network, with continuous multimedia broadcasting serving as an endpoint; that is, this pertains to computer processing in the ST-multimedia broadcasting big data network. The typical computer processing mathematical model in the multimedia broadcasting big data network can be expressed by equation (2) [15], and the optimal computer processing analysis $P = \{u_1, u_2, \cdots, u_k\}$ is calculated as the following:

$$\min Z(P_\alpha) = \sum_{i=1}^{k=1} d\left(u_{\alpha_i}, u_{\alpha_{i+1}}\right) + d\left(u_{\alpha_1}, u_k\right) \tag{2}$$

In the equation (2), P_α is used to describe the recombination of a set of k computer processing analysis points, α_i is used to describe a permutation of k, and the Manhattan distance between two points is represented by the variable $d\left(u_{\alpha_i}, u_{\alpha_{i+1}}\right)$

When the channel interpolation algorithm is used to carry out the computer processing in the typical multimedia broadcast big data network [14], all the computer processing analysis points can be deemed as individuals in the population, and the function selection for the goodness of fit is shown in the equation (2). In the context of computer processing within both the multimedia broadcasting big data network and the ST-multimedia broadcasting big data network, it is only possible to derive the optimal access sequence for broadcast computer processing analysis points through the application of the channel interpolation algorithm. As it is not accomplished based on the computer processing analysis, it cannot meet the requirements of the computer processing analysis plan for the picking of mobile wheeled multimedia broadcast large data volume. Therefore, conducting precise global planning for computer processing analysis using the channel interpolation algorithm is essential.

In the network environment, the OPEN table and CLOSE table are set in the process of advancing the plan by using the multimedia broadcast big data transmission computer processing analysis based on the channel interpolation algorithm [16]. When the data are initialized, the starting point is added to the OPEN table. Currently, The CLOSE table is empty, and the initial point can be expressed as follows:

$$f\left(s\right)=h\left(s\right) \tag{3}$$

In the preceding equation, f(s) denotes the initial evaluation function, whereas h(s) signifies the estimated distance from the starting node to the endpoint.

If the OPEN table is devoid of entries and there is simultaneously no target location, the search is ended and no effective computer processing and analysis will be carried out. Conversely, if the OPEN table contains entries, the subsequent steps will be reiterated until the target node is obtained:

1) The node in the OPEN table with the smallest f value is chosen and transferred to the CLOSE table, while its corresponding entry in the OPEN table is removed. If we denote the neighboring node with the lowest f value at the starting point as q, this initial point is considered a parent node.

2) All neighboring nodes of the current point p are evaluated. It is assumed that the neighboring node is used for the explanation of u_i, then $f\left(u_i\right), h\left(u_i\right)$ and $g\left(u_i\right)$ are obtained, and the following judgments are made for the purpose of explain the interval between the selected point and the target node based on $g\left(u_i\right)$.

(1) If u_i is designated as the endpoint, it then exits the algorithm for three-dimensional reconstruction technology, and The terminal point is used as the

starting point to backtrack to the initial point from the parent node. The shortest computer processing analysis is carried out for batch picking of the multimedia broadcasting big data;

(2) If u_i is a point that cannot be accessed, it will be disregarded.

(3) If u_i point A is located in the CLOSE table, it will be overlooked.

(4) If u_i is absent from both the OPEN table and the CLOSE table, it will be added to the OPEN table and designated as the parent node of u_i .

(5) If u_i is present in the OPEN table, then the g value is obtained based on the new computer processing analysis. Subsequently, whether it is the minimum value is determined. If p is the parent node of u_i , then f, h, and g are updated at the same time; if p is not the parent node of u_i , then no change is made.

3) The search path is recorded, and the parent node is utilized to backtrack to the initial point.

3. Architecture of the Wireless Network Multimedia Interactive System

Fig. 1 depicts the architecture diagram of a multimedia interactive system for the wireless network data. The system is fundamentally structured into two main components: the network transmission processing module and the audio-visual processing module. The audio-visual processing module is further categorized into two distinct sections: the acquisition and presentation module for audio and video, along with the editing and decoding control module for audio and video. In parallel, the network transmission processing module encompasses a message transmission unit, a multimedia data relay unit, and a direct connection unit for multimedia data, as depicted in Fig. 1.

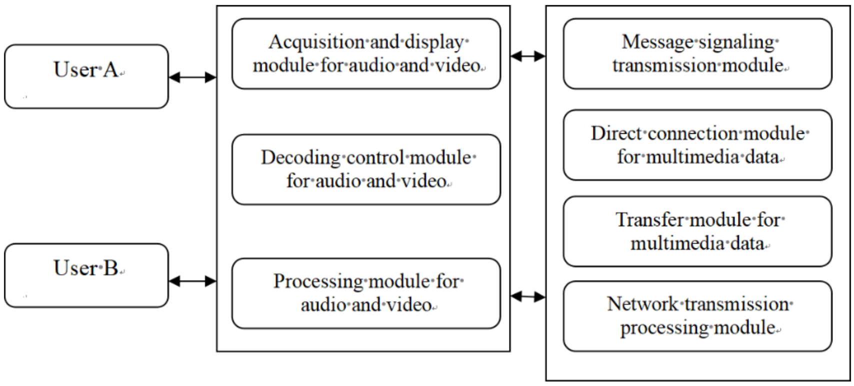


Fig. 1: Architecture of the wireless multimedia interactive system.

The primary function of the network transmission processing module is to facilitate direct conversion for user server P2P, signal transmission, terminal P2P penetration, and relaying. When wireless network terminals are connected to the network, they are typically in a specific NAT local network [17-19]. In this scenario, the relevant port and IP address are private within the local network, making it impossible to establish a direct connection between terminals in two LANs. However, by obtaining IP addresses from the network and utilizing port mapping techniques, both ports can establish a direct connection for transmitting multimedia data. If successful NAT connectivity is achieved, the P2P direct transmission module can directly transmit multimedia data. This significantly reduces the workload of server relay and improves real-time multimedia data transmission performance for a more satisfactory user experience [20]. In cases where some NATs cannot be successfully connected, the multimedia data server relay module ensures normal access to relevant terminals and facilitates distribution of multimedia data between parties involved. Fig. 2 illustrates the communication flow among terminals within this framework.

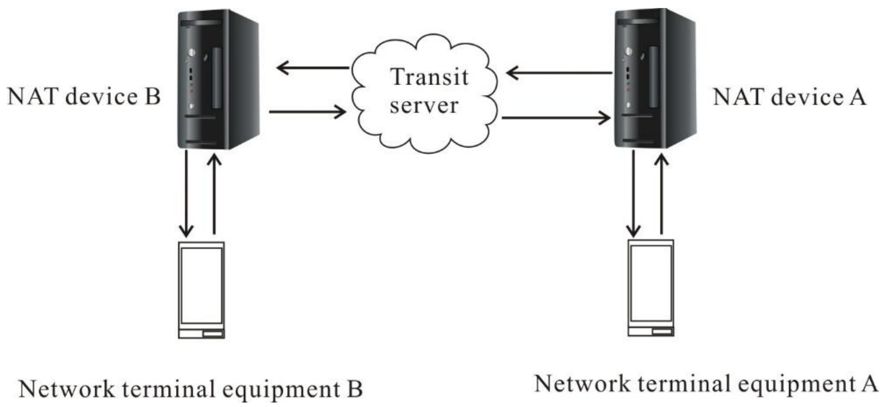


Fig. 2: Intranet terminal communication process.

4. Design of the Computer Processing Analysis Algorithm Based on the Multimedia Broadcasting Big Data Network

4.1 System Model

The broadcast transmission model for the multimedia broadcast big data network proposed in this paper is illustrated in Fig. 3 as follows.

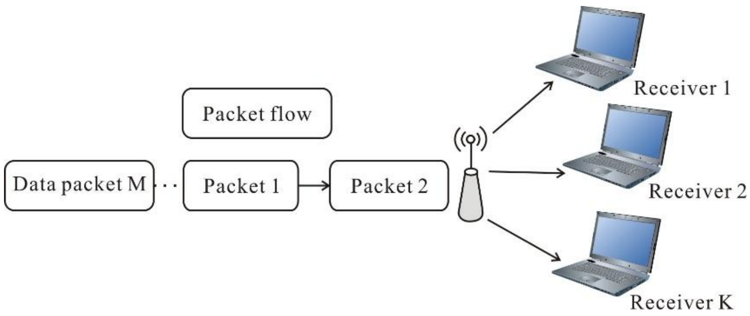


Fig. 3: System model.

1) The system model comprises a source node and K (where K > 2) configured receiving nodes, which is required to receive the packet set via broadcast. In this paper, it is assumed that the data packets need to be transmitted from the source node within a time interval Δt.

2) The receiving node transmits ACK or NAK signals back to the source node. The source node then collects and stores a feedback matrix table T, where T = (K, M). Each element T(i, j) in this matrix signifies whether the data packet was received correctly by the receiving node. In this case, R_i P_j $1 \le i \le K$, $1 \le j \le M$.

3) To conclude, this study posits that all control messages, including both ACK and NAK, are transmitted instantly and are not lost.

4) The loss rate of the data packets at the node follows a Bernoulli distribution, which is characterized by the parameter of $p_i \left(i = 1, 2, \cdots, K \right)$.

4.2 Random Linear Network Coding

In this paper, if we assume there are n packets of equal size in the network, the packets designated for transmission and grouping are denoted as $X_1, X_2, \cdots, X_n$ .The source node encodes either the random linear asynchronous or the packet that was lost at the receiving node, with the new packet Y_i represented as follows:

$$Y_i = \sum_{j=1}^{n} g_{ij} X_j \tag{4}$$

The coding coefficient $g_{ij} \left(1 \le j \le n \right)$ is a randomly selected value from the specified range F_q .After n coded packets are received at each receiving node, the original packet can be decoded based on the next linear equation as the following.

$$\begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{pmatrix} g_{11} & \cdots & g_{1n} \\ \vdots & \ddots & \vdots \\ g_{n1} & \cdots & g_{nn} \end{pmatrix}^{-1} \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix} \tag{5}$$

Coefficient Matrix Composed of n Coefficient Vectors $G=\{g_{i1},g_{i2},g_{i3},\cdots,g_{in}\}$

The CPAMBBDN algorithm introduced in this paper is divided into two phases: a data broadcasting phase and a data retransmission phase. The following describes the specific steps.

The source node sends N data packets to K receiving nodes, with each packet transmitted at designated time intervals. Following this, a feedback matrix T is created at the source node using the feedback information received in the form of ACK or NAK, which is then maintained and updated as needed.

2) Once the source node has broadcast N data packets, it proceeds to the retransmission phase after the time $M\Delta t$. All the lost data packets consist of a set $D=\{X_1,X_2,X_3,\cdots,X_n\}$, and the largest coefficient $M_{\max}$ in the coefficient vector $G=\{g_{i1},g_{i2},g_{i3},\cdots,g_{in}\}(1\le i\le M_{\max})$ (randomly chosen from a defined range) is utilized to encode all lost data packets and produce $M_{\max}$ number of coded packets. In this context, $M_{\max}$ denotes the highest number of data packets that have been lost among all receiving nodes, determined by the equation (6):

$$M_{\max}=\max_{i\in\{1,2,\cdots,K\}}\left\{\sum_{j=1}^{K}T(i,j)\right\} \tag{6}$$

3) Once the data packet that has been encoded is retransmitted, the configuration of its corresponding encoding vector matrix G is estimated and presented at each receiving node. With regard to $M_{\max}$, if $r_i\neq N$, this indicates that G has not completed the full permutation at node R_i. In this situation, the node R_i will notify the source node about how many coded packets need to be retransmitted for G to achieve the necessary full permutation. In this paper, the necessary coded packets are represented by N_i, and the details of this scenario are outlined in the following equation:

$$N_i=\begin{cases}N-r_i, r_i\le N\\ 0, r_i\ge N\end{cases} \tag{7}$$

In the equation（7）, $i=1,2,\cdots,K$.

If node R_i obtains $M_{\max}$ coded packets during the data retransmission phase, then N_i is 0. If 2 encoded packets are missing at node R_i, then $N_i=2$.

The value $M_{\max}$ at the source node is modified according to the N_i values provided by each receiving node, and $M_{\max}$ coded packets are generated in the new retransmission phase. The relevant algorithm can be found in equation (4) mentioned earlier.

5) Steps 3 and 4 are iterated until the vector matrix of all receiving nodes matches N. That is, $M_{\max} = 0$. If no packets are lost, the original data packet can be decoded at the receiving node using the Gaussian elimination method.

From the steps described above, it can be seen that the differences between the CPAMBBDN algorithm put forward in this paper and the network coding wireless broadcasting retransmission (NCWBR) [21] algorithm are mainly reflected in the aspects as the following.

1)The CPAMBBDN algorithm combines and retransmits lost packets. In the NCWBR algorithm, it is necessary to update the feedback matrix and determine the different types or packets. Based on the CPAMBBDN algorithm, not only are all the lost packets combined and sent again, but the number of encoded packets is also determined based on the $M_{\max}$.

2) The CPMBBDN algorithm is not affected by the distribution of lost packets. The main reason is that the number of coding packets is determined at the receiving node with the highest number of lost packets. Compared with the number of retransmissions based on traditional ARQ mechanisms, the source node needs to retransmit 9 data packets based on the NCWBR algorithm. In the application of the CPMBBDN algorithm, only 3 coding packets are needed. $Y_1 = g_{11}P_1 + g_{12}P_2 + g_{12}P_3 + g_{14}P_4$, $Y_2 = g_{21}P_1 + g_{22}P_2 + g_{22}P_3 + g_{24}P_4$, and $Y_3 = g_{31}P_1 + g_{32}P_2 + g_{32}P_3 + g_{34}P_4$; that is to say, all lost packets can be decoded at the receiving node.

The CPAMBBDN algorithm put forward in this paper has reduced the overhead of feedback information in the retransmission phase. When different packets are received at the receiving node based on the NCWBR algorithm, it is necessary to send the feedback ACK or NAK control packets. In this case, the matrix T is updated at the source node. When the broadcasting system has a high number of users, a substantial amount of feedback information overhead is produced. Based on the proposed CPAMBBDN algorithm, the feedback information is sent at all the receiving nodes only after the retransmission of the coded packet $M_{\max}$ is carried out. In addition, the control overhead is reduced to a certain extent, and there is no need to send the feedback information to the source node frequently. The detailed workflow of the CPAMBBDN algorithm is illustrated in Fig. 4 as follows.

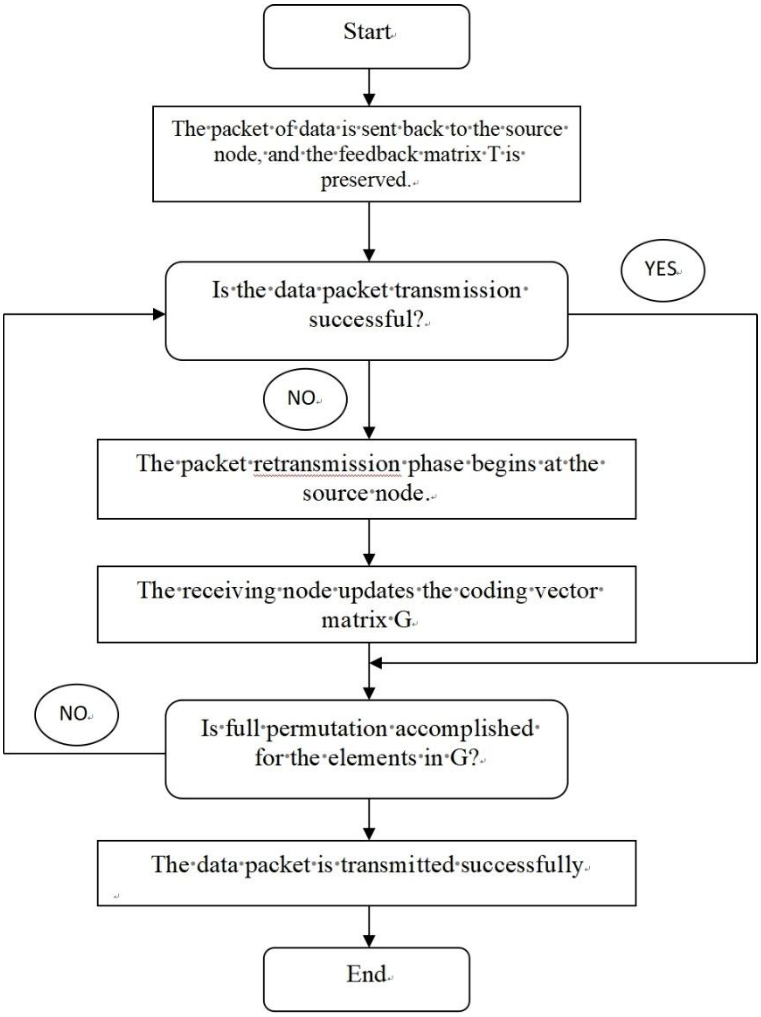


Fig. 4: CPAMBBDN algorithm flow.

5. Simulation and Performance Analysis

To illustrate the advantages of the proposed CPAMBBDN algorithm, the NCWBR algorithm and the conventional ARQ mechanism are taken as the control group. The three algorithms are tested by using the operational packet network testing (OPNET) problem simulation tools. The specific settings of the simulated parameters are shown in Table 1 as follows.

Table 1

Simulation parameter table

Parameter	Numerical Value
Simulation scene	1550m×650m
Network simulation time/s	4000
Nodes Number	200

Number of source nodes	65
Number of destination nodes	43
Node moving velocity/($m \cdot s^{-1}$)	[1,16]
Transmission rate/($Mb \cdot s^{-1}$)	55
Packet loss rate	0.1,0.2,0.3,0.5,0.6
Message interval time/s	[20,30]
Node mobility model	Random site

Fig. 5 shows that various algorithms can affect the average frequency of transmission times in the case of different packet loss rates. In addition, 4 receiving nodes and 20 groups are required in the network for the broadcasting of packets. Fig. 5 illustrates that the mean number of packet transmission times based on the CPAMBBDN algorithm proposed in this paper is the lowest. In addition, if the packet loss rate is extremely small, the mean number of packet retransmission times by group based on the NCWBR algorithm is similar to that based on the proposed CPAMBBDN algorithm. As the loss rate is increased to 0.4, the proposed CPAMBBDN algorithm demonstrates a marked improvement in performance compared to both the NCWBR algorithm and the traditional ARQ mechanism. The main reason is that the proposed CPAMBBDN algorithm requires the combination of the data packets to be retransmitted. The conventional ARQ mechanism is replaced by the proposed CPAMBBDN algorithm. Compared with the NCWBR algorithm, the number of coded packets by group based on the CPAMBBDN algorithm is determined by the receiving node with the highest loss rate. In addition, the NCWBR algorithm is not subject to the influence of the packet loss distribution and the unstable performance as a result.

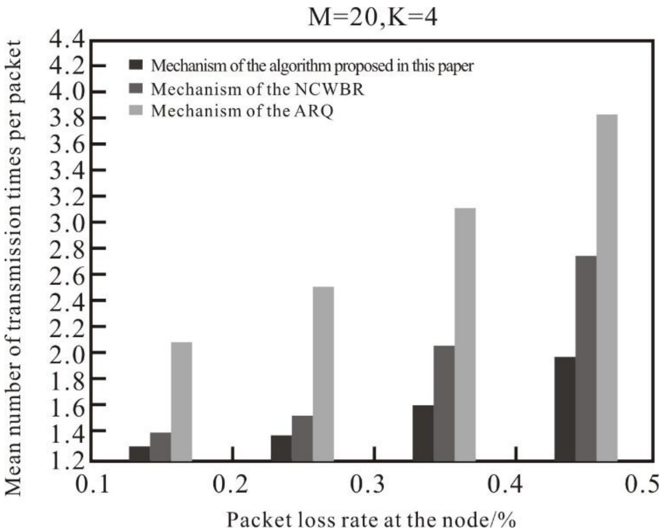


Fig. 5: Influence of the packet loss rate on the mean number of transmissions.

Fig. 6 shows the influence of various algorithms regarding the average number of transmission times when the number of receiving nodes is different. In addition, it is assumed that the packet loss rate at the receiving nodes in the network is 0.2, and 20 packets need to be broadcast. If there are only two receiving nodes for the broadcast, the performance of the CPAMBBDN algorithm proposed in this paper does not show a notable difference when compared to the other algorithms. As the number K of receiving nodes increases, the average packet transmission times per group using the proposed CPAMBBDN algorithm are less than those observed with the other two mechanisms. The reason is that the number of packet transmission times based on the CPAMBBDN algorithm is mainly determined at the node with the maximum packet loss rate. Provided that the group packet loss rate stays the same, it will not lead to a significant increase in the number of transmission times. On the other hand, compared with the CPAMBBDN algorithm put forward in this paper, the distribution of the packet loss based on the NCWBR algorithm becomes more complicated. The different packets received are decoded at the receiving node to reduce the probability of any lost packet. Consequently, the average number of transmission occurrences rises.

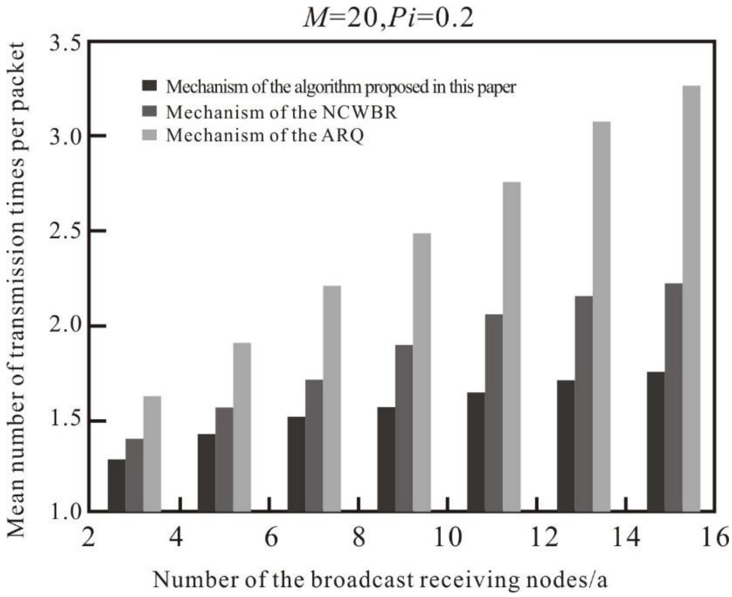
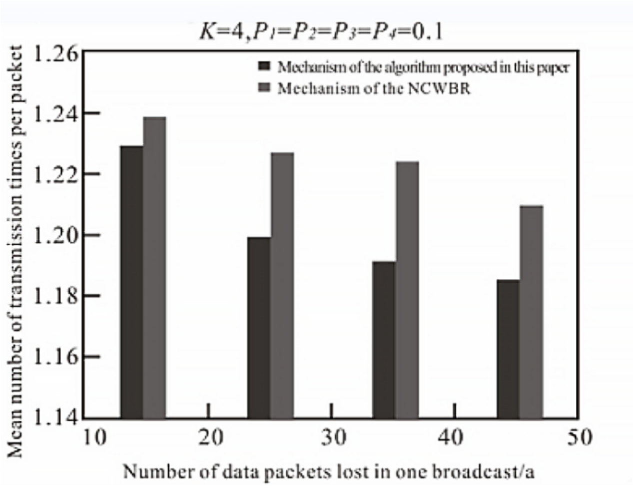
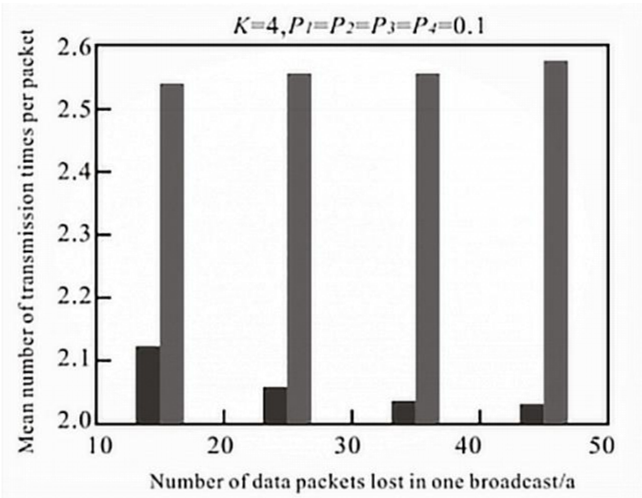


Fig. 6: Influence of number of receiving nodes on average transmission times.

Fig. 7 shows the simulation result of the average number of times each packet is transmitted when four receiving nodes have different numbers of packet losses in one broadcast. With the increase in the number of packets in the broadcast, the mean number of transmission times based on the CPAMBBDN algorithm put forward in this paper has decreased more significantly in the two algorithms. If the number of lost packets is relatively small (as shown in Fig. 7a), the improvement in the performance based on the CPAMBBDN algorithm compared with that based on the NCWBR algorithm is not significant. If the count of dropped packets is relatively large (as shown in Fig. 7b), the proposed CPAMBBDN algorithm is significantly superior to the NCWBR algorithm. The primary cause is that the loss rate is relatively high.



(a) The effect of the low packet loss rate on the average number of transmission attempts.



(b) The effect of a high packet loss rate on the average number of transmission attempts.

Fig. 7: The effect of different packet loss rates on the average number of transmission attempts.

If the high loss rate has relatively little influence on the average number of transmission times, then only a few packets need to be retransmitted, and the probability of grouping based on different types or combinations of packets will not be very high. As the number of packet losses rises, the distribution of these losses becomes irregular, and the probability that the receiving node decodes the lost packets by decoding asynchronous packets will become lower. As a result, the mean number of transmission times will be increased accordingly. Since the comparison algorithm NCWBR can encode the lost packets effectively and the coding complexity is relatively high, the average number of packet transmission attempts per group is considerable.

Fig. 8 illustrates the impact of diverse algorithms on the network-normalised control overhead in the context of varying packet loss rates.

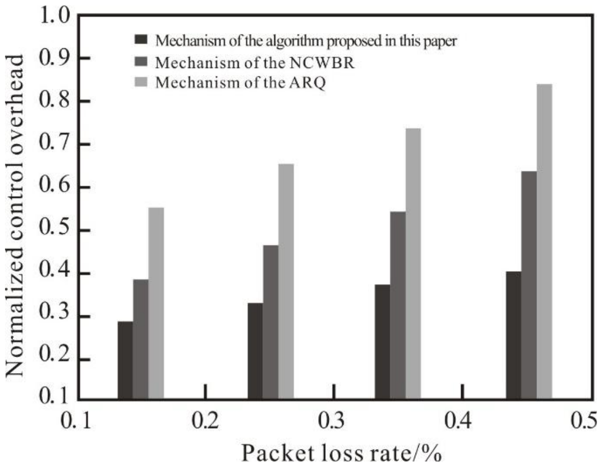


Fig. 8: Influence of the packet loss rate on the normalized control overhead.

Based on the figure, it can be known that the normalized control overhead of the CPAMBBDN algorithm put forward in this paper is lower than that of the mechanism in the control group. The reason is that the proposed CPAMBBDN algorithm has low computational complexity and is not subject to the influence by the distribution of lost packets. The quantity of encoded data packets is primarily influenced by the receiving node that experiences the highest number of lost packets, which has consequently decreased the frequency of data packet retransmissions to some degree. In addition, it is not necessary to feed back the control information at the destination node to the source node. As the comparison mechanism has a higher complexity and the efficiency of selecting the encoded data packets is lower, the normalized control overhead is relatively high.

Based on the above data, the proposed CPAMBBDN algorithm is compared with the reference NCWBR algorithm and traditional ARQ mechanism, as shown in Table 2. From the table, it can be seen that the CPAMBBDN algorithm has advantages in reducing packet transmission times, controlling overhead, and being insensitive to the distribution of lost packets. From the test results, it can be seen that the CPAMBBDN algorithm reduces the number of retransmissions and control overhead by combining lost packets and determining the number of encoded packets based on the node with the most lost packets among the receiving nodes.

Table 2

Comparison of key features of three algorithms

Features/Algorithms	CPAMBBDN	NCWBR	ARQ
Packet retransmission mechanism	Combine and retransmit lost data packets	Update feedback matrix to identify different types of packages	Resend lost packets one by one
Repeating lost packets one by one is affected by the distribution of lost packets	Not affected	affected	Not affected
Determination of the number of unaffected encoded data packets	The determination of the number of unaffected encoded packets is determined by the node with the most lost packets among the receiving nodes	Determine based on feedback matrix and different types of packets	Determine one by one
Cost of feedback information	reduce	higher	higher
control overhead	lower	higher	higher
Lower packet transmission frequency	less	more	more

In contrast, the NCWBR algorithm requires updating the feedback matrix and determining retransmission based on different packet types, while traditional ARQ mechanisms retransmit lost data packets one by one, which may result in higher transmission times and control overhead. In addition, the performance of CPAMBBDN algorithm under different packet loss rates and number of receiving nodes was verified through simulation experiments. The experimental results show that when the packet loss rate is high, the CPAMBBDN algorithm has a significant performance improvement compared to the NCWBR algorithm and traditional ARQ mechanism.

6. Conclusions

The method of big data network processing and analysis of multimedia broadcast with channel interpolation algorithm proposed in this study has important practical significance in the field of network data transmission. First, the experimental verification showed that 5,000 packets were sent through the server between the two points, and no packet was lost in the wireless network. This method solves the multimedia data loss problem caused by high packet loss rate in network transmission effectively through backup and channel interpolation technology and improves the reliability and stability of data transmission. Secondly, the method simplifies the complex network coding process, reduces the computational complexity, and makes the network performance more stable in a specific environment. Finally, experimental verification shows that the proposed method achieves almost no packet loss in wireless networks and does not affect user experience even when a small number of packets are lost at the sending and receiving ends of nodes. This is of great significance for improving the quality of multimedia broadcasting services and user experience. Although this study has made some achievements, there are still some shortcomings. First of all, this study focuses on the calculation method of wireless network data broadcast, and its applicability to other types of network environments (such as wired network, hybrid network, etc.) needs to be further verified. Secondly, although the experimental verification shows that the method can achieve high reliability data transmission under certain conditions, the experimental conditions are relatively ideal, and the actual application may face a more complex and changeable network environment, so the robustness and adaptability of the method need to be further evaluated. In addition, the threshold of packet loss at the sending and receiving end of nodes in this study is between 0.3% and 2.3%, which has little impact on the user experience, but still has the potential to further reduce the packet loss rate. Looking forward to the future, the channel interpolation algorithm proposed in this study has a broad prospect in the field of multimedia broadcast big data network processing and analysis. On the one hand, the application of this method in other types of network environments can be further explored, such as applying it to wired networks, hybrid networks, etc., to verify its universality and versatility. On the other hand, the algorithm can be optimized and improved to improve its robustness and adaptability for the complex network environment that may appear in practical applications. In addition, it can be combined with other advanced technologies, such as artificial intelligence, machine learning, etc., to further improve the reliability and efficiency of data transmission. At the same time, more research on user experience can be carried out to better meet users' needs and expectations for multimedia broadcasting services.

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