International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 10s
DOI: https://doi.org/10.17762/ijritcc.v11i10s.7702
***Article Received:** 07 June 2023 **Revised:** 28 July 2023 **Accepted:** 13 August 2023*

PCO-IB: Churn Analysis P2P Networks Using A Peer Co-Operative Intensive Based Schema

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Abstract: The Peer-to-Peer networks used technology of distributed computing. The P2P network is essential for network communication. P2P networks are utilized in many applications due to these benefits. For example, record sharing, broadcast communications, and media streaming. There are a lot of nodes connected to the P2P network. Peers of network frequently join and leave the network at the same time. In the P2P network, this kind of paradigm is called churn. Numerous new examination works uncovered that stir is the primary issue looked by the present P2P organization. Content availability, data accuracy, and overhead were significantly reduced by the churn process. An Incentive-Based (IB) schema was proposed in this paper in order to circumvent the limitations of the P2P network for multimedia transmission. The IB schema that has been proposed encourages fair communication and cooperation among the nodes. Multimedia transmission efficiency in real-time P2P networks is maximized by the IB schema. In this paper, IB outline for the most part centered around the upgrade of the P2P organizations. The proposed construction is carried out utilizing Organization Test system. In P2P networks, the proposed IB schema improved multimedia transmission performance.

Keywords - Multimedia Data Transmission, Reputation Algorithm, Churn Analysis, Data Availability

I. Introduction

A P2P network is a decentralized system where peers organize themselves as equal entities and fulfill the roles of both receivers and transmitters. P2P networks have witnessed significant advancements alongside the growth of the internet, particularly in large-scale distributed systems. They play a crucial role in information sharing and the transmission of mixed media.

Unlike the conventional client-server model, where a central server handles requests and resources, P2P networks consist of numerous organizations, with each peer contributing its resources to effectively participate in network tasks. The peers in the network have equivalent capacities and resources, promoting a more egalitarian structure. However, a challenge in P2P networks arises from churn, which occurs when peers dynamically join or leave the network. This phenomenon leads to the collapse of the network formation, making it complex to restructure. Designers and evaluators of P2P networks consider the dynamic connection of peers when developing strategies. The main obstacle in managing churn is the need to rebalance data among active peers whenever a peer joins or leaves the network. This process involves redistributing the data and associated responsibilities, which can disrupt the network's performance and result in congestion.

Addressing churn and its impact is crucial for maintaining a stable and efficient P2P network. Various techniques, such as replication, caching, and load balancing, are employed to mitigate the effects of churn and ensure optimal resource sharing among peers.

The P2P networks self-organize with equal entities, enabling efficient information sharing and mixed media transmission. However, the constant joining and leaving of peers, known as churn, pose challenges in maintaining network structure and performance. Overcoming these obstacles requires careful consideration of dynamic peer participation and the implementation of rebalancing techniques.

In P2P networks the nodes join the network and leave the network revoltingly, this peculiarity is called stir. In P2P networks, the churn rate is a major issue because it causes network overhead and delays. Also, disrupt the communication paths and topology of the network. Network performance is harmed by every churn rate event—whether it joins or leaves the network [3]. The churn process has a significant impact on the network efficiency, character, and decentralized nature of the network. In the P2P network, there is no barrier between the peers, who can join or leave the

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network at any time. Nodes join the network when the network user starts the P2P application, and when the user stops the application, nodes go away the network. Therefore, the churn can be defined as the modify in network node structure brought about by friendly joins and departures. The beat rate exceptionally influence on execution P2P network for mixed media transmissions.

Churn analysis is an important task in peer-to-peer (P2P) networks. Churn refers to the rate of peers can join and leave the network, which can have a significant impact on the overall performance and stability of the network. In P2P networks, nodes rely on each other to share resources, such as files or computational power, and if too many nodes leave the network at once, it can result in a loss of functionality or even a complete network failure. To perform churn analysis in P2P networks, there are several approaches that can be taken. One common method is to use statistical models to analyze the behavior of the nodes in the network over time. This can involve analyzing patterns of node arrivals and departures, as well as examining the distribution of node lifetimes within the network. Another approach is to use network simulation tools to model the behavior of nodes in the network and simulate different scenarios to see how they impact the overall performance of the network. This can help network administrators to identify potential issues and develop strategies to mitigate them.

The paper were organized as follows: Section II provided a literature evaluation on the investigation of churn's impact on multimedia transmission in P2P networks. Section III outlined the problem definition and proposed approach. The results of network reconstruction were presented in Section IV, and finally, Section V concluded the paper.

II. Related Work

This section primarily focused on examining churn within P2P networks, particularly in the context of multimedia transmissions. Anas Ahmad Abudaqa et al. [4] introduced a data distribution technique known as Super Generation Network Coding (SGNC) for P2P networks. The objective of SGNC was to improve the transmission of information while minimizing computational burdens.

The experiments conducted in this study revealed that SGNC outperformed other methods in terms of availability, overhead, and decoding data for P2P data distribution. However, it was noted that the proposed framework was more suitable for transmitting data of medium size. When dealing with large amounts of data, the network overhead increased.

Overall, the findings highlighted the advantages of SGNC in P2P data distribution, but also pointed out its limitations when handling substantial data transfers that resulted in increased network overhead.

The P2P network has regular irregularity in information dispersions, its leads use higher data transmission and high asset use. The churn also has a significant impact on the peer-to-peer network, causing resource waste, increased overload, and decreased network capability. Kademlia network high churn impact on data transmission and load balance was proposed by Qi Zhang et al. as a way to circumvent these limitations [5][6].

Ding, et al[7][8]. proposed an original social-based bootstrapping strategy for beat examination in P2P organizations. In the event of uncorrelated churn and failure, the P2P network becomes flexible. The proposed technique accomplished better execution in support of organization steering. However, to send progressively situations the proposed strategy ought to be improved in P2P organizations.

Fei Huang et al[9], proposed a novel agent-based P2P network schema to decrease P2P network churn rate and delay. There are two kinds of churn delays: tributary recovery and channel switch delays. With the network's addition of a queueing model, the agent-based schema reduces churn delays. The novel agent-based peer-to-peer network, on the other hand, reduces delays; however, the schema does not distinguish between normal agents and priority-based agents.

The churn of connections within a communication network poses significant obstacles. B.N. Krishna Sai et al. proposed modeling techniques and predictive analysis to overcome the prediction of churn in communication networks. By selecting the appropriate features and increasing threshold values, the proposed method produced superior results. Yet, this model isn't material all P2P networks[10].

III. Proposed Schema

A. Problem Statement

Dynamic node mobility in P2P networks presents several underlying challenges. The network's unreliability and delays lead to a degradation in the quality of service for multimedia transmission. In P2P networks, the timely transmission of multimedia is crucial, and it is essential to establish delay-free transmission paths that prioritize maintaining QoS within the network. The multimedia data transmission optimization is necessary to enhance QoS. However, the performance of multimedia data transmission is significantly impacted by churn in P2P networks. Dealing with churns becomes a primary concern in maintaining network stability and performance. The motivation behind the proposed approach, referred to as the Intensive Based Schema, stems from the

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need to tackle churn-related challenges and promote equitable communication within P2P networks.

B. Intensive Based Schema

To enhance the performance of multimedia transmission, especially in the presence of churn, the Intensive Based (IB) schema is proposed and implemented in P2P networks. Churns in such networks frequently lead to delays and limited availability of multimedia content. The IB schema is designed to address these issues effectively. To address these limitations, the IB schema introduces a fair communication approach.

In P2P networks, where peers frequently join and leave the network, it becomes essential to establish trusted paths for fair communication. To achieve this, the IB schema incorporates an intensive trust calculation based on the satisfaction and dissatisfaction of a peer's reputation.

The intensive trust calculation function determines the peer cooperation (PCO), which is the difference between the satisfied reputation and the unsatisfied reputation. By leveraging the intensive calculation function alongside reputation, the network can determine the level of peer cooperation. Based on the PCO, the network then establishes fair paths for multimedia transmissions.

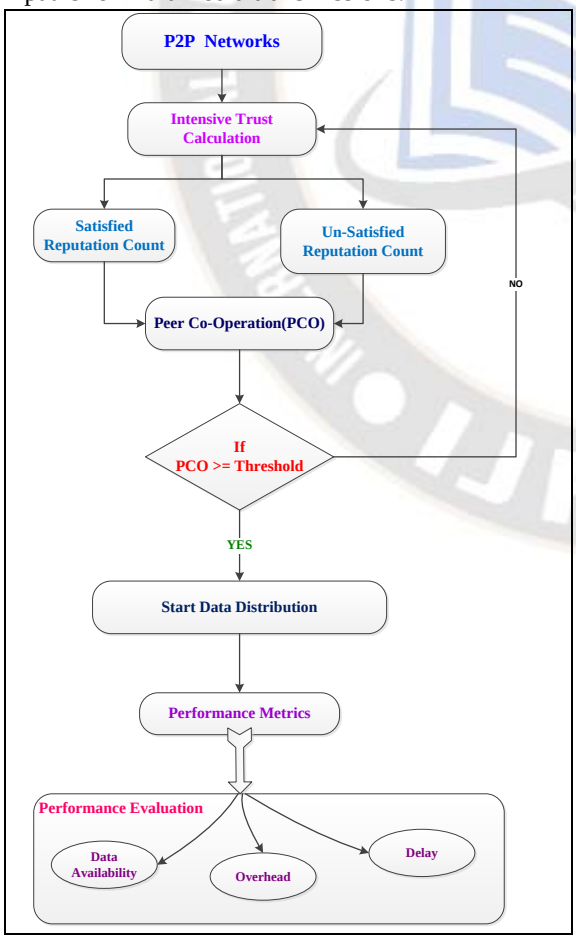

Fig 1 Intensive Based Schema Architecture

The IB Schema is visually represented in Figure 1, showcasing the overall framework and process. It aims to improve the performance of multimedia transmission by considering trust, reputation, and fairness in P2P networks.

The Intensive Based Reputation Algorithm is a method for assessing the quality of service (QoS) metrics in peer-to-peer (P2P) networks. It uses a reputation system that takes into account both satisfied and unsatisfied reputation counts, as well as peer cooperation.

C. Algorithm

Algorithm Name - Reputation for Intensive Schema

Input- Peer Co-operation PCO , Satisfied Reputation Count SRC, Un-Satisfied Reputation Count USRC

Output- Performance Metrics

1. Start
2. Nodes of P2P network
3. Intensive Trust Calculate
4. Reputation Count Satisfied Sum = $\sum_{i=1}^{n}$ SRCi
5. Reputation Count Un-Satisfied Sum = $\sum_{j=1}^{n}$ USRCj
6. PCO = $\sum_{i=1}^{n}$ SRCi - $\sum_{j=1}^{n}$ USRCj
7. If (PCO >= Threshold) {
8. Fair Path Construction
9. Start Data Transmission
10. }
11. else {
12. Line No 3 Repeat
13. }
14. QoS Metrics Evaluation
15. End

The input to the algorithm includes the satisfied reputation count (SRC), the unsatisfied reputation count (USRC), and the peer cooperation (PCO). The SRC and USRC are used to calculate the intensive trust, while the PCO is the difference between the sum of the satisfied reputation count and the sum of the unsatisfied reputation count.

If the PCO is above a certain threshold, the algorithm will constitute a fair path and initiate data transmission. If the PCO is below the threshold, the algorithm will repeat the process from line 3. After data transmission is complete, the algorithm evaluates performance metrics to determine the quality of service.

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The Intensive Based Reputation Algorithm is designed to ensure that data transmission occurs on fair and trustworthy paths in P2P networks, which can ultimately improve the QoS metrics of the network.

IV. Results Analysis

Implemented in Network Simulation version 2.35, the proposed Intensive Based Schema aims to enhance the performance of multimedia transmission in P2P networks. Through simulation results, it has been demonstrated that the IB schema effectively improves multimedia transmission within the P2P network.

The simulation results are presented and discussed in a dedicated subsection. Table 1 provides an overview of the simulated environment used for the network simulation, including the relevant parameters and settings.

A. Parameters of Network Simulation

Table 1: Network Simulation Environment

S No	Network Parameter	Value of Parameter
1	Type of Channel	WirelessChannel
2	Model of Radio-Propagation	Propagation/TwoRayGround
3	Network Interface	WirelessPhy
4	Type of Interface	DropTail
5	Antenna Model	OmniAntenna
6	Size of Queue	50
7	Routing Protocol	AODV
8	No.of Nodes	24
9	RXThresh_	3000
10	CTSThreshold_	2000
11	RTSThreshold_	5000
12	Data Rate	2MB
13	Basic Rate	1MB

Table 1 illustrates the network parameters and their corresponding values employed in the network simulation. The deployment of nodes utilized the two-ray ground radio propagation model. To evaluate the effectiveness of the proposed work, a comparison was conducted based on various performance metrics. These performance metrics will be defined and discussed in the subsequent subsection.

B . Definition of Metrics

This section aims to define each performance metric utilized in evaluating the P2P network, which will be presented in the subsequent empirical simulation results.

Table 2: Performance Metrics

S No	Performance Metric	Definition
1	Availability	The shared data resources ensure a high level of availability among network nodes.
2	Overhead	The utilization of resource percentages facilitates the transmission of fixed-sized data across the network.
3	Delay	The time difference between the receipt and sending of packets.

Table 2 provides the definitions of the performance metrics used in evaluating the proposed schema. These metrics include data availability, overhead, and delay.

C. Results Comparison

The simulation results of data availability, overhead and delay are discussed in below sub section.

i) Content Availability

Figure 2 displays the data availability recorded for different schemas. The multimedia size ranges from 4GB to 32GB, with the size doubling at each interval. As the data size increases, the availability value improves for all the approaches. Notably, the proposed schema demonstrates enhanced performance compared to the BitTorrent [11] and SGNC [4] networks.

ii) Overhead

Figure 3 depicts existing and proposed schemas with overhead performance. The results indicate that the proposed IB schema outperforms the Random, Local, and Global schemas in terms of overhead. Additionally, it demonstrates better performance compared to the Local and Global schemas mentioned in references [4] and [12].

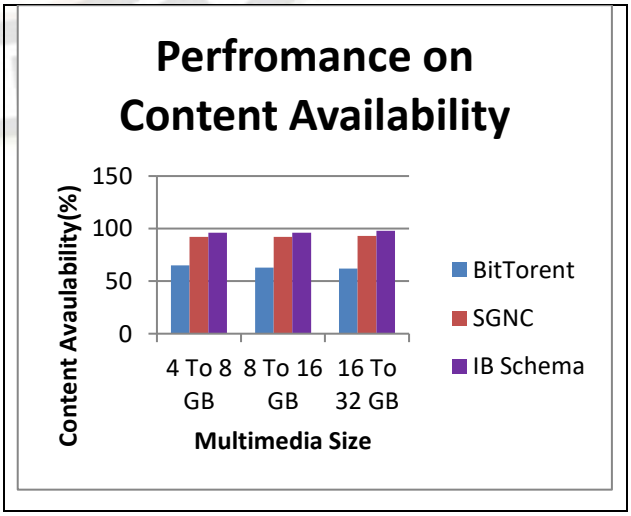

Fig 2 Content Availability Comparison

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iii) Delay

Figure 4 illustrates the relationship between recovery time and delay performance. On X- axis taken recovery time, while the Y-axis taken delay performance. The results highlight two significant observations. Firstly, the Intensive Based Schema outperforms both the General Schema and NAP Schema [4][11] in terms of performance. Secondly, it is observed that as the recovery time increases, both the General Schema and NAP Schema experience an increase in delay performance.

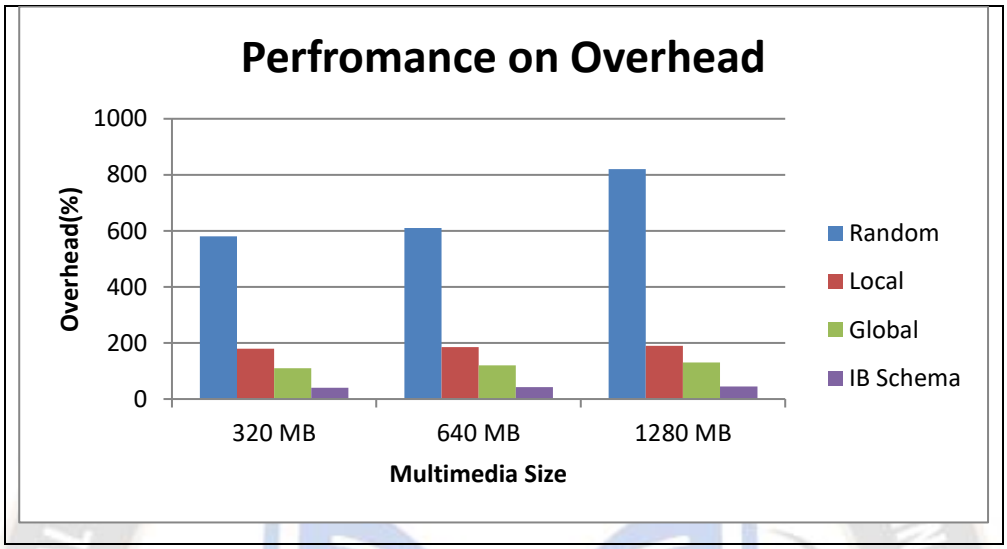

Fig 3 Overhead Performance

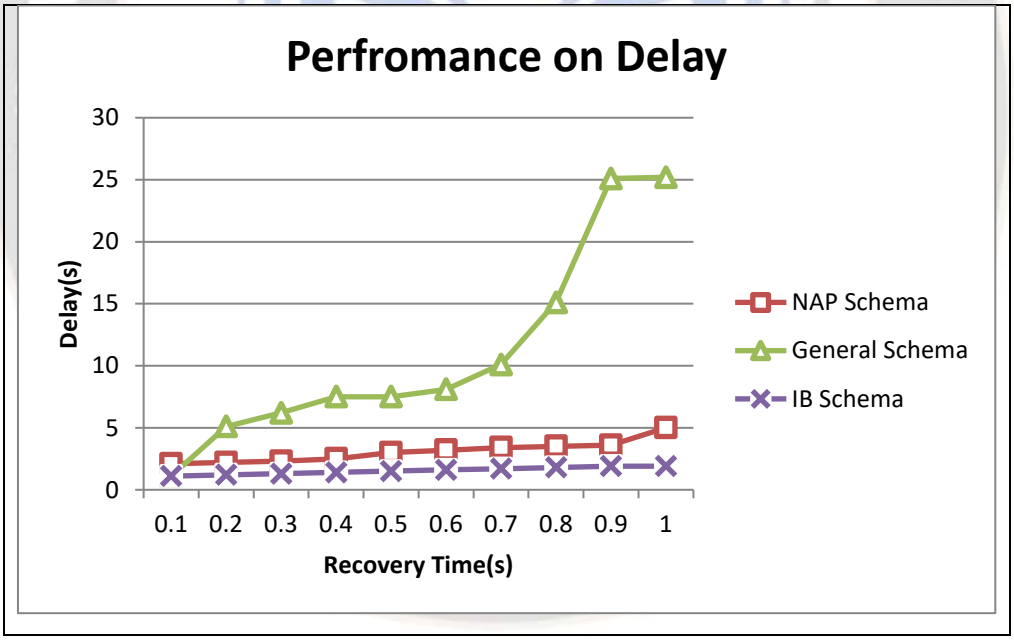

Fig 4 Performance Comparison on Delay

V. Conclusion

In this research work, mainly focused on the improve the quality of service in P2P networks for multimedia data transmission with churn process. Different factors effects on the quality of multimedia transmissions. They include data availability, delay, and reduce overhead. Such parameters are associated churn paradigm in P2P networks. In this paper proposed a intensive based schema. The proposed schema utilize the reputation method and improves the co-operation between the nodes of p2p networks. The proposed schema implementation is made with network simulator. The empirical results shown that the proposed schema has better performance improvement with the present state of the system.

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